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DETERMINATION OF FTF SITE SPECIFIC FACTORS FOR WASTE CLASSIFICATION

Attached is the evaluation (SRR-CWDA-2010-00122) that determined site specific factors for use in FTF waste classification.

If you have any questions please contact me at 557-9336.

Attachment.

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Determination of FTF Site Specific Factors for Waste Classification
(SRR-CWDA-2010-00122)

Introduction

To determine compliance to the Class C Concentration limits for the closure of the FTF, allowance is made in NUREG 1854, NRC Staff Guidance for Activities Related to U. S. Department of Energy Waste Determinations, to develop site specific factors for comparison to the Class C concentration limits set out in 10 CFR 61.55 Tables 1 and 2.

Methodology

The FTF PA provides the estimated dose to an intruder who resides within the boundary of the FTF after the period of institutional control (100 years). The intruder is assumed to be exposed via various pathways from water used at a 1 meter well and from drill cuttings. The 1 meter well is contaminated from all the sources within the FTF (tanks, transfer lines, and other ancillary equipment). In addition, drill cuttings that pull up contamination from striking a transfer line are deposited on the ground surface. The Base Case in the PA assumes that a three inch transfer line is penetrated by a driller and the cuttings are spread among the garden – thus an additional source is added to the contaminated well source. The impact of drilling into a four inch transfer line has also been presented in the PA to the chronic intruder. The impact of drilling into a waste tank (Tank 18) was also considered in the PA with respect to the acute intruder – the well driller, not to a chronic intruder, since the likelihood of penetrating a waste tank is very remote due to drilling practices that would terminate the drilling once significant resistance is encountered.

To ascertain site specific factors the GoldSim dose calculator was utilized to determine the dose to the chronic intruder assuming the 1 meter well contaminated source and one of three drill cutting sources – a three inch or a four inch transfer line or a waste tank (Tank 18). The peak doses were determined and site specific factors were determined based on the assumed concentrations at closure from the drill cutting source.

Because the performance objective to the intruder is 500 mrem/year, the site specific factor is based on the following equation:

$$SiteFactor_i = \frac{TableValue_i}{C_i} x \frac{Dose_i}{500 mrem/yr}$$

Where
Site Factor $_i$ = site specific factor, for radionuclide i at closure
Table Value $_i$ = Class C concentration limit from 10 CFR 61.55 Table 1 or Table 2, for radionuclide i
C $_i$ = concentration of the drilled source, for radionuclide i at closure
Dose $_i$ = peak dose that occurs 100 years (for transfer lines) or 500 years (for Tank 18) after closure, for radionuclide i

Site Specific Factors of Drilled Source

Three Inch Transfer Line

For the three inch transfer line, the concentration of the radionuclides of interest in curies/ft^2 is provided in Table 1. The inventory of the drilled mass is based on an eight inch long segment of transfer line that is penetrated by the drill. The three inch line is assumed to be schedule 40 with an inside diameter of 3.068 inches and an outside diameter of 3.5 inches. The volume of the drilled source is assumed to be only the volume of piping material associated with the eight inch long pipe segment, and the mass is based on a density of 7.85 g/cc. With these parameters the following has been determined:
Inside surface area per foot of pipe (surface area contaminated) = 0.803 ft^2
Volume of consumed piping material = 17.8 cubic inches (= 0.000292 cubic meters)
Mass of consumed piping material = 2,293 grams

Using the above data, the peak dose obtained from GoldSim, and the equation developed above, the site specific factors from the three inch transfer line at closure are provided in Table 1.

Because of the in-growth of Pu-238 from Am-242m, the site specific factor shown in Table 1 has been increased by a factor of 30 for Am-242m. The appendix presents the input and results of the GoldSim runs.

Four Inch Transfer Line

For the four inch transfer line, the concentration of the radionuclides of interest in curies/ft^2 is provided in Table 2. The inventory of the drilled mass is based on an eight inch long segment of transfer line that is penetrated by the drill. The four inch line is assumed to be schedule 40 with an inside diameter of 4.026 inches and an outside diameter of 4.5 inches. The volume of the drilled source is assumed to be only the volume of piping material associated with the eight inch long pipe segment, and the mass is based on a density of 7.85 g/cc. With these parameters the following has been determined:
Inside surface area per foot of pipe (surface area contaminated) = 1.054 ft^2
Volume of consumed piping material = 25.4 cubic inches (= 0.000416 cubic meters)
Mass of consumed piping material = 3,266 grams

Using the above data, the peak dose obtained from GoldSim, and the equation developed above, the site specific factors from the four inch transfer line at closure are provided in Table 2. As was the case for the three-inch transfer line, the site specific factor for Am-242m was increased by a factor of 30. The appendix presents the input and results of the GoldSim runs.

Table 1 Proposed Site Specific Factors Based on Three Inch Transfer Line

Radio-nuclide	Peak Dose (mrem/yr)	Piping Source Ci/ft^2	Source Drilled (Curies)	10 CFR 61.55 Class C Concentration Limits			Site Specific Factors	
				Table 1		Table 2	Table 1	Table 2
				(nCi/gram)	(Ci/m^3)	(Ci/m^3)	(unitless)	(unitless)
C-14	1.5E+00	4.3E-08	2.3E-08	n a	8.0E+00	n a	3.0E+02	n a
Ni-59	3.7E-02	1.7E-06	9.0E-07	n a	2.2E+02	n a	5.2E+00	n a
Nb-94	1.2E-01	3.8E-08	2.0E-08	n a	2.0E-01	n a	6.9E-01	n a
Tc-99	1.6E+00	1.5E-05	8.0E-06	n a	3.0E+00	n a	3.6E-01	n a
I-129	6.5E-01	7.1E-11	3.8E-11	n a	8.0E-02	n a	7.9E+02	n a
Np-237	3.4E+01	7.9E-08	4.2E-08	1.0E+02	n a	n a	3.6E+02	n a
Pu-238	7.8E-02	1.8E-04	9.9E-05	1.0E+02	n a	n a	3.6E-04	n a
Pu-239	7.2E+00	7.2E-05	3.9E-05	1.0E+02	n a	n a	8.6E-02	n a
Pu-240	8.0E+00	2.7E-05	1.4E-05	1.0E+02	n a	n a	2.6E-01	n a
Pu-241	2.8E-01	1.3E-04	6.7E-05	3.5E+03	n a	n a	6.7E-02	n a
Pu-242	1.7E-01	2.2E-07	1.2E-07	1.0E+02	n a	n a	6.5E-01	n a
Pu-244	4.3E-04	1.0E-10	5.5E-11	1.0E+02	n a	n a	3.5E+00	n a
Am-241	3.0E+00	5.9E-04	3.1E-04	1.0E+02	n a	n a	4.4E-03	n a
Am-242m	3.7E-04	8.4E-07	4.5E-07	1.0E+02	n a	n a	1.1E-02	n a
Am-243	2.2E-01	9.6E-08	5.1E-08	1.0E+02	n a	n a	2.0E+00	n a
Cm-242	0.0E+00	0.0E+00	0.0E+00	2.0E+04	n a	n a	n a	n a
Cm-243	8.1E-07	1.4E-08	7.6E-09	1.0E+02	n a	n a	4.9E-05	n a
Cm-244	2.6E-04	2.7E-05	1.4E-05	1.0E+02	n a	n a	8.3E-06	n a
Cm-245	3.0E+00	3.5E-10	1.9E-10	1.0E+02	n a	n a	7.4E+03	n a
Cm-247	1.3E-02	1.3E-22	6.9E-23	1.0E+02	n a	n a	8.8E+13	n a
Cm-248	5.1E-02	3.0E-23	1.6E-23	1.0E+02	n a	n a	1.5E+15	n a
Cf-249	1.6E-09	8.1E-25	4.3E-25	1.0E+02	n a	n a	1.7E+09	n a
H-3	5.1E-06	2.9E-06	1.6E-06	n a	n a	n a	n a	n a
Co-60	5.1E-07	2.3E-05	1.2E-05	n a	n a	n a	n a	n a
Ni-63	5.7E-04	1.4E-04	7.4E-05	n a	n a	7.0E+02	n a	3.1E-03
Sr-90	4.0E+01	3.1E-02	1.7E-02	n a	n a	7.0E+03	n a	9.8E+00
Cs-137	3.2E+01	5.9E-03	3.1E-03	n a	n a	4.6E+03	n a	2.7E+01

Table 2 Proposed Site Specific Factors Based on Four Inch Transfer Line

Radio-nuclide	Peak Dose (mrem/yr)	Piping Source Ci/ft^2	Source Drilled (Curies)	10 CFR 61.55 Class C Concentration Limits			Site Specific Factors	
				Table 1		Table 2	Table 1	Table 2
				(nCi/gram)	(Ci/m^3)	(Ci/m^3)	(unitless)	(unitless)
C-14	1.5E+00	5.6E-08	3.9E-08	n a	8.0E+00	n a	2.5E+02	n a
Ni-59	3.7E-02	2.2E-06	1.5E-06	n a	2.2E+02	n a	4.3E+00	n a
Nb-94	1.2E-01	4.9E-08	3.5E-08	n a	2.0E-01	n a	5.7E-01	n a
Tc-99	1.6E+00	2.0E-05	1.4E-05	n a	3.0E+00	n a	3.0E-01	n a
I-129	6.5E-01	9.3E-11	6.5E-11	n a	8.0E-02	n a	6.6E+02	n a
Np-237	3.4E+01	1.0E-07	7.2E-08	1.0E+02	n a	n a	3.0E+02	n a
Pu-238	1.3E-01	2.4E-04	1.7E-04	1.0E+02	n a	n a	5.1E-04	n a
Pu-239	7.2E+00	9.4E-05	6.6E-05	1.0E+02	n a	n a	7.1E-02	n a
Pu-240	8.0E+00	3.5E-05	2.4E-05	1.0E+02	n a	n a	2.1E-01	n a
Pu-241	2.8E-01	1.6E-04	1.1E-04	3.5E+03	n a	n a	5.6E-02	n a
Pu-242	1.7E-01	2.9E-07	2.0E-07	1.0E+02	n a	n a	5.4E-01	n a
Pu-244	4.3E-04	1.3E-10	9.4E-11	1.0E+02	n a	n a	3.0E+00	n a
Am-241	3.0E+00	7.7E-04	5.4E-04	1.0E+02	n a	n a	3.7E-03	n a
Am-242m	6.3E-04	1.1E-06	7.7E-07	1.0E+02	n a	n a	1.6E-02	n a
Am-243	2.2E-01	1.3E-07	8.8E-08	1.0E+02	n a	n a	1.6E+00	n a
Cm-242	0.00E+00	0.0E+00	0.0E+00	2.0E+04	n a	n a	n a	n a
Cm-243	1.4E-06	1.8E-08	1.3E-08	1.0E+02	n a	n a	7.0E-05	n a
Cm-244	4.5E-04	3.5E-05	2.5E-05	1.0E+02	n a	n a	1.2E-05	n a
Cm-245	3.0E+00	4.5E-10	3.2E-10	1.0E+02	n a	n a	6.1E+03	n a
Cm-247	1.3E-02	1.7E-22	1.2E-22	1.0E+02	n a	n a	7.3E+13	n a
Cm-248	5.1E-02	3.9E-23	2.7E-23	1.0E+02	n a	n a	1.2E+15	n a
Cf-249	1.6E-09	1.1E-24	7.4E-25	1.0E+02	n a	n a	1.4E+09	n a
H-3	7.2E-06	3.2E-06	2.2E-06	n a	n a	n a	n a	n a
Co-60	8.7E-07	3.1E-05	2.1E-05	n a	n a	n a	n a	n a
Ni-63	9.8E-04	1.8E-04	1.3E-04	n a	n a	7.0E+02	n a	4.5E-03
Sr-90	6.9E+01	4.1E-02	2.9E-02	n a	n a	7.0E+03	n a	1.4E+01
Cs-137	5.5E+01	7.7E-03	5.4E-03	n a	n a	4.6E+03	n a	3.9E+01

Recognizing that the peak dose for a specific radionuclide may be dominated by the contaminated groundwater source and not the drilling source, Table 3 provides the limiting (i.e., maximum) site specific factor based on either the three inch transfer line (Table 1) or the four inch transfer line (Table 2).

Table 3 Proposed Site Specific Factors Based on a Transfer Line Source

Radionuclide	Site Specific Factors	
	Table 1	Table 2
C-14	3.0E+02	n a
Ni-59	5.2E+00	n a
Nb-94	6.9E-01	n a
Tc-99	3.6E-01	n a
I-129	7.9E+02	n a
Np-237	3.6E+02	n a
Pu-238	5.1E-04	n a
Pu-239	8.6E-02	n a
Pu-240	2.6E-01	n a
Pu-241	6.7E-02	n a
Pu-242	6.5E-01	n a
Pu-244	3.5E+00	n a
Am-241	4.4E-03	n a
Am-242m	1.6E-02	n a
Am-243	2.0E+00	n a
Cm-242	n a	n a
Cm-243	7.0E-05	n a
Cm-244	1.2E-05	n a
Cm-245	7.4E+03	n a
Cm-247	8.8E+13	n a
Cm-248	1.5E+15	n a
Cf-249	1.7E+09	n a
H-3	n a	n a
Co-60	n a	n a
Ni-63	n a	4.5E-03
Sr-90	n a	1.4E+01
Cs-137	n a	3.9E+01

Waste Tank (Tank 18)

Using the Tank 18 inventory at closure and assuming that this inventory is uniformly distributed along the floor of Tank 18, the inventory is determined by the ratio of the area of an eight-inch diameter drill to the area of the tank floor. The area of the floor in Tank 18 is approximately 5,675 ft^2 and the area of eight inch drill is 0.35 ft^2; thus the ratio is 0.0000615. Assuming that the volume of waste remaining in the tank is 5,000 gallons, the volume of waste pulled up by the drilling is 0.308 gallons (= 0.00116 M^3). The mass of the waste volume consumed by the drilling is assumed to be that of grout with a density of 2.06 g/cc. Thus, the mass is estimated to be 2,400 grams.

Using the above data, the peak dose obtained from GoldSim, and the equation developed above, the site specific factors from the waste tank at closure are provided in Table 4.

Included in Table 4 are adjustments which had to be made to account for in-growth of some of the radionuclides. The adjustments made are identified below.

In-growth of Pu-238 from Am-242m caused an increase of 30 to Am-242m.
In-growth of Am-241 from Pu-241 caused an increase of 3 to Am-241.
In-growth of Pu-239 from Cm-243 caused an increase of 40,000 to Cm-243.
In-growth of Pu-240 from Cm-244 caused an increase of 8,000,000 to Cm-244.

The appendix presents the input and results from the GoldSim runs.

Table 4 Proposed Site Specific Factors Based on Waste Tank 18

Radio-nuclide	Peak Dose (mrem/yr)	Source Drilled (Curies)	10 CFR 61.55 Class C Concentration Limits			Site Specific Factors	
			Table 1		Table 2	Table 1	Table 2
			(nCi/gram)	(Ci/m^3)	(Ci/m^3)	(unitless)	(unitless)
C-14	1.5E+00	6.3E-05	n a	8.0E+00	n a	4.4E-01	n a
Ni-59	3.7E-02	6.3E-05	n a	2.2E+02	n a	3.0E-01	n a
Nb-94	1.2E-01	6.3E-08	n a	2.0E-01	n a	8.8E-01	n a
Tc-99	1.6E+00	6.3E-05	n a	3.0E+00	n a	1.8E-01	n a
I-129	6.5E-01	6.3E-08	n a	8.0E-02	n a	1.9E+00	n a
Np-237	3.4E+01	1.5E-05	1.0E+02	n a	n a	1.1E+00	n a
Pu-238	1.6E-01	4.2E-03	1.0E+02	n a	n a	1.8E-05	n a
Pu-239	1.8E+01	9.8E-03	1.0E+02	n a	n a	9.0E-04	n a
Pu-240	9.4E+00	3.0E-03	1.0E+02	n a	n a	1.5E-03	n a
Pu-241	2.8E-01	8.0E-03	3.5E+03	n a	n a	5.9E-04	n a
Pu-242	2.8E-01	6.3E-05	1.0E+02	n a	n a	2.1E-03	n a
Pu-244	5.9E-04	6.3E-08	1.0E+02	n a	n a	4.5E-03	n a
Am-241	3.0E+00	4.9E-03	1.0E+02	n a	n a	8.9E-04	n a
Am-242m	8.3E-03	6.3E-05	1.0E+02	n a	n a	1.9E-03	n a
Am-243	2.2E-01	6.3E-06	1.0E+02	n a	n a	1.7E-02	n a
Cm-242	0.0E+00	0.0E+00	2.0E+04	n a	n a	n a	n a
Cm-243	5.0E-07	6.3E-05	1.0E+02	n a	n a	1.5E-04	n a
Cm-244	4.4E-08	6.3E-03	1.0E+02	n a	n a	2.7E-05	n a
Cm-245	3.0E+00	6.3E-05	1.0E+02	n a	n a	2.3E-02	n a
Cm-247	1.3E-02	6.3E-08	1.0E+02	n a	n a	1.0E-01	n a
Cm-248	5.2E-02	6.3E-08	1.0E+02	n a	n a	3.9E-01	n a
Cf-249	6.9E-02	6.3E-05	1.0E+02	n a	n a	5.2E-04	n a
H-3	6.7E-11	6.3E-05	n a	n a	n a	n a	n a
Co-60	5.5E-11	6.3E-05	n a	n a	n a	n a	n a
Ni-63	2.1E-03	4.9E-03	n a	n a	7.0E+02	n a	7.1E-04
Sr-90	1.4E-02	6.6E-02	n a	n a	7.0E+03	n a	3.3E-03
Cs-137	7.2E-01	5.9E-01	n a	n a	4.6E+03	n a	1.3E-02

Appendix

Provided in the following tables are the pertinent input and output of the GoldSim runs that were made to support this evaluation.

The GoldSim dose calculator model was developed for the F Area Tank Farm Performance Assessment.

The following tables are presented as follows for each source considered, i.e., three inch transfer line, four inch transfer line and Tank 18.

1. Initial source term in the base case and the resulting peak dose, the ratio of the 500 rem/year limit to the peak dose and factors to account for in-growth
2. Final source term and resulting peak doses and the year of the peak dose

Table A.1
Initial Source Term and Dose Ratio for Three Inch Transfer Line

Radio-nuclide	Initial Source (Ci/ft^2)	Peak Dose (mrem/yr)	Year of Peak Dose	500 / Peak Dose	In-growth Factor
Am241	5.85E-04	3.02E+00	19,632	1.7E+02	1
Am242m	8.41E-07	3.66E-04	100	1.4E+06	30
Am243	9.55E-08	2.20E-01	19,666	2.3E+03	1
C14	4.26E-08	1.46E+00	4,024	3.4E+02	1
Cf249	8.08E-25	1.60E-09	8,498	3.1E+11	1
Cm243	1.41E-08	8.06E-07	100	6.2E+08	1
Cm244	2.70E-05	2.60E-04	100	1.9E+06	1
Cm245	3.47E-10	2.99E+00	19,670	1.7E+02	1
Cm247	1.29E-22	1.33E-02	19,998	3.8E+04	1
Cm248	2.98E-23	5.13E-02	19,998	9.7E+03	1
Co60	2.33E-05	5.07E-07	100	9.9E+08	4.2
Cs137	5.85E-03	3.20E+01	100	1.6E+01	1
H3	2.93E-06	5.08E-06	100	9.8E+07	1
I129	7.10E-11	6.46E-01	12,818	7.7E+02	1
Nb94	3.77E-08	1.18E-01	16,128	4.2E+03	1
Ni59	1.68E-06	3.67E-02	20,000	1.4E+04	1
Ni63	1.39E-04	5.72E-04	100	8.7E+05	1
Np237	7.89E-08	3.35E+01	10,854	1.5E+01	1
Pu238	1.84E-04	7.75E-02	100	6.4E+03	1
Pu239	7.21E-05	7.21E+00	20,000	6.9E+01	1
Pu240	2.65E-05	8.02E+00	13,420	6.2E+01	1
Pu241	1.25E-04	2.80E-01	19,534	1.8E+03	1
Pu242	2.18E-07	1.66E-01	13,372	3.0E+03	1
Pu244	1.03E-10	4.27E-04	14,058	1.2E+06	1
Sr90	3.14E-02	4.02E+01	100	1.2E+01	1
Tc99	1.50E-05	1.63E+00	678	3.1E+02	1

Table A.2
Final Source Term and Dose Results for Three Inch Transfer Line

Radio-nuclide	Final Source (Ci/ft^2) (a)	Peak Dose to Chronic Intruder (mrem/yr)	Year of Peak Dose	Dose to Acute Intruder at Year 100 (mrem)
Am241	9.7E-02	6.1E+01	100	1.1E+01
Am242m	3.8E-02	1.7E+01	100	3.3E+01
Am243	2.2E-04	2.5E-01	18,856	1.6E-01
C14	1.5E-05	1.5E+00	4,024	1.1E-06
Cf249	2.5E-13	1.6E-09	8,498	3.1E-10
Cm243	8.8E+00	5.0E+02	100	4.1E+02
Cm244	5.2E+01	5.0E+02	100	7.1E+01
Cm245	5.8E-08	3.0E+00	19,670	2.0E-05
Cm247	4.9E-18	1.3E-02	19,998	6.9E-15
Cm248	2.9E-19	5.1E-02	19,998	9.2E-17
Co60	5.5E+03	1.2E+02	100	4.9E+02
Cs137	9.1E-02	5.0E+02	100	2.2E+01
H3	2.9E+02	5.0E+02	100	2.7E-03
I129	5.5E-08	6.5E-01	12,818	1.2E-06
Nb94	1.6E-04	3.1E-01	556	1.0E+00
Ni59	2.3E-02	1.1E-01	20,000	1.5E-04
Ni63	1.2E+02	5.0E+02	100	9.7E-01
Np237	1.2E-06	3.4E+01	10,854	3.6E-03
Pu238	1.2E+00	5.1E+02	100	5.4E+01
Pu239	5.0E-03	1.6E+01	20,000	1.5E+00
Pu240	1.7E-03	1.4E+02	152	1.5E+01
Pu241	2.2E-01	2.8E-01	19,534	4.2E-03
Pu242	6.6E-04	7.9E-01	13,372	6.6E-02
Pu244	1.2E-04	1.7E-01	13,946	1.8E-01
Sr90	3.9E-01	5.0E+02	100	8.0E-01
Tc99	4.6E-03	2.3E+00	678	7.8E-04

(a) Final source is computed by multiplying the initial source from Table A.1 by the dose ratio from Table A.1 and dividing by the in-growth factor from Table A.1.

Table A.3
Initial Source Term and Dose Ratio for Four Inch Transfer Line

Radio-nuclide	Initial Source (Ci/ft^2)	Peak Dose (mrem/yr)	Year of Peak Dose	500 / Peak Dose	In-growth Factor
Am241	7.66E-04	3.02E+00	19,632	1.7E+02	1
Am242m	1.10E-06	6.29E-04	100	8.0E+05	30
Am243	1.25E-07	2.20E-01	19,666	2.3E+03	1
C14	5.58E-08	1.46E+00	4,024	3.4E+02	1
Cf249	1.06E-24	1.60E-09	8,498	3.1E+11	1
Cm243	1.84E-08	1.38E-06	100	3.6E+08	1
Cm244	3.53E-05	4.47E-04	100	1.1E+06	1
Cm245	4.54E-10	2.99E+00	19,670	1.7E+02	1
Cm247	1.69E-22	1.33E-02	19,998	3.8E+04	1
Cm248	3.90E-23	5.13E-02	19,998	9.7E+03	1
Co60	3.05E-05	8.72E-07	100	5.7E+08	4.2
Cs137	7.66E-03	5.50E+01	100	9.1E+00	1
H3	3.18E-06	7.24E-06	100	6.9E+07	1
I129	9.30E-11	6.46E-01	12,818	7.7E+02	1
Nb94	4.94E-08	1.19E-01	16,128	4.2E+03	1
Ni59	2.20E-06	3.67E-02	20,000	1.4E+04	1
Ni63	1.82E-04	9.84E-04	100	5.1E+05	1
Np237	1.03E-07	3.35E+01	10,858	1.5E+01	1
Pu238	2.40E-04	1.33E-01	100	3.8E+03	1
Pu239	9.44E-05	7.24E+00	20,000	6.9E+01	1
Pu240	3.47E-05	8.02E+00	13,420	6.2E+01	1
Pu241	1.63E-04	2.80E-01	19,534	1.8E+03	1
Pu242	2.85E-07	1.66E-01	13,372	3.0E+03	1
Pu244	1.34E-10	4.27E-04	14,058	1.2E+06	1
Sr90	4.10E-02	6.89E+01	100	7.3E+00	1
Tc99	1.96E-05	1.64E+00	678	3.1E+02	1

Table A.4
Final Source Term and Dose Results for Four Inch Transfer Line

Radio-nuclide	Final Source (Ci/ft^2) (a)	Peak Dose to Chronic Intruder (mrem/yr)	Year of Peak Dose	Dose to Acute Intruder at Year 100 (mrem)
Am241	1.27E-01	1.0E+02	100	1.9E+01
Am242m	8.75E-01	1.7E+01	100	3.3E+00
Am243	2.85E-04	3.2E-01	100	2.8E-01
C14	1.91E-05	1.5E+00	4,024	1.8E-06
Cf249	3.32E-13	1.6E-09	8,498	5.3E-10
Cm243	6.66E+00	5.0E+02	100	4.1E+02
Cm244	3.95E+01	5.0E+02	100	7.1E+01
Cm245	7.60E-08	3.0E+00	19,668	3.5E-05
Cm247	6.37E-18	1.3E-02	19,998	1.2E-14
Cm248	3.80E-19	5.1E-02	19,998	1.6E-16
Co60	1.75E+04	1.2E+02	100	4.9E+02
Cs137	6.97E-02	5.0E+02	100	2.3E+01
H3	2.20E+02	5.0E+02	100	2.7E-03
I129	7.20E-08	6.5E-01	12,818	2.0E-06
Nb94	2.08E-04	5.3E-01	100	1.8E+00
Ni59	3.00E-02	1.5E-01	11,430	2.7E-04
Ni63	9.25E+01	5.0E+02	100	9.7E-01
Np237	1.54E-06	3.4E+01	10,856	6.3E-03
Pu238	9.04E-01	5.1E+02	100	5.4E+01
Pu239	6.52E-03	1.9E+01	248	1.9E+00
Pu240	2.16E-03	1.5E+02	154	1.5E+01
Pu241	2.91E-01	2.8E-01	19,534	7.2E-03
Pu242	8.58E-04	1.2E+00	13,344	1.1E-01
Pu244	1.57E-04	2.8E-01	13,710	3.1E-01
Sr90	2.97E-01	5.0E+02	100	8.0E-01
Tc99	5.99E-03	2.7E+00	678	1.3E-03

(a) Final source is computed by multiplying the initial source from Table A.3 by the dose ratio from Table A.3 and dividing by the in-growth factor from Table A.3.

Table A.5
Initial Source Term and Dose Ratio for Tank 18

Radio-nuclide	Initial Source (Ci/ft^2)	Peak Dose (mrem/yr)	Year of Peak Dose	500 / Peak Dose	In-growth Factor
Am241	1.40E-02	3.0E+00	19,632	1.6E+02	3
Am242m	1.80E-04	8.3E-03	500	6.0E+04	30
Am243	1.80E-05	2.2E-01	19,658	2.3E+03	1
C14	1.80E-04	1.5E+00	4,024	3.4E+02	1
Cf249	1.80E-04	6.9E-02	500	7.3E+03	1
Cm243	1.80E-04	5.0E-07	500	9.9E+08	4.0E+04
Cm244	1.80E-02	4.4E-08	500	1.1E+10	8.0E+06
Cm245	1.80E-04	3.0E+00	19,670	1.7E+02	1
Cm247	1.80E-07	1.3E-02	19,998	3.7E+04	1
Cm248	1.80E-07	5.2E-02	19,998	9.7E+03	1
Co60	1.80E-04	5.5E-11	500	9.1E+12	1
Cs137	1.70E+00	7.2E-01	500	6.9E+02	1
H3	1.80E-04	6.7E-11	548	7.5E+12	1
I129	1.80E-07	6.5E-01	12,818	7.7E+02	1
Nb94	1.80E-07	1.2E-01	16,128	4.2E+03	1
Ni59	1.80E-04	3.7E-02	20,000	1.4E+04	1
Ni63	1.40E-02	2.1E-03	500	2.3E+05	1
Np237	4.20E-05	3.4E+01	10,856	1.5E+01	1
Pu238	1.20E-02	1.6E-01	500	3.1E+03	1
Pu239	2.80E-02	1.8E+01	500	2.7E+01	1
Pu240	8.60E-03	9.4E+00	13,374	5.3E+01	1
Pu241	2.30E-02	2.8E-01	19,532	1.8E+03	1
Pu242	1.80E-04	2.8E-01	13,372	1.8E+03	1
Pu244	1.80E-07	5.9E-04	14,054	8.5E+05	1
Sr90	1.90E-01	1.4E-02	500	3.7E+04	1
Tc99	1.80E-04	1.6E+00	678	3.0E+02	1

Table A.6
Final Source Term and Dose Results for Tank 18

Radio-nuclide	Final Source (Ci/ft^2) (a)	Peak Dose to Chronic Intruder (mrem/yr)	Year of Peak Dose	Dose to Acute Intruder at Year 500 (mrem)
Am241	7.7E-01	4.5E+02	500	7.9E+01
Am242m	3.6E-01	1.7E+02	500	3.3E+01
Am243	4.1E-02	2.2E+01	500	2.0E+01
C14	6.0E-02	1.4E+01	500	2.7E-03
Cf249	1.3E+00	5.0E+02	500	4.7E+02
Cm243	4.5E+00	1.2E-02	500	1.0E-02
Cm244	2.6E+01	6.2E-05	500	8.9E-06
Cm245	3.0E-02	3.8E+01	1,450	1.4E+01
Cm247	6.7E-03	4.6E+00	19,872	6.3E+00
Cm248	1.7E-03	3.0E+00	500	3.6E-01
Co60	1.6E+09	6.6E-11	500	2.1E-10
Cs137	1.2E+03	5.0E+02	500	2.3E+01
H3	1.3E+09	8.3E-01	500	4.5E-06
I129	1.4E-04	1.0E+00	12,816	2.0E-03
Nb94	7.6E-04	9.5E-01	554	3.2E+00
Ni59	2.4E+00	5.7E+00	500	1.1E-02
Ni63	3.3E+03	5.0E+02	500	9.7E-01
Np237	6.3E-04	3.5E+01	10,856	4.8E-01
Pu238	3.7E+01	4.8E+02	500	5.0E+01
Pu239	7.7E-01	5.0E+02	500	5.2E+01
Pu240	4.6E-01	3.4E+02	500	3.5E+01
Pu241	4.1E+01	9.3E-01	1,470	7.7E-02
Pu242	3.3E-01	2.1E+02	500	2.1E+01
Pu244	1.5E-01	1.4E+02	500	1.5E+02
Sr90	7.0E+03	5.0E+02	500	8.0E-01
Tc99	5.5E-02	6.6E+00	678	6.1E-03

(a) Final source is computed by multiplying the initial source from Table A.5 by the dose ratio from Table A.5 and dividing by the in-growth factor from Table A.5.