



Appendix G

Radiological Airborne Emissions at Oak Ridge National Laboratory

This appendix presents annual radioactive airborne emissions for ORNL in 2023. All data were determined to be statistically different from zero at the 95 percent confidence level. Any number not statistically different from zero was not included in the emission calculation. Because measuring a radionuclide requires counting random radioactive emissions from a sample, the same result may not be obtained if the sample is analyzed repeatedly. This deviation is referred to as the counting uncertainty. Statistical significance at the 95 percent confidence level means that there is a 5 percent chance that the results could be erroneous.

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
²²⁵ Ac	M	particulate									3.09E-06	3.09E-06
²²⁶ Ac	M	particulate									1.07E-09	1.07E-09
²²⁷ Ac	M	particulate									6.5E-07	6.5E-07
²²⁸ Ac	M	particulate									1.28E-20	1.28E-20
¹⁰⁵ Ag	M	particulate									6.25E-21	6.25E-21
^{106m} Ag	M	particulate									2.05E-25	2.05E-25
¹⁰⁸ Ag	B	unspecified									1.4E-18	1.4E-18
^{108m} Ag	M	particulate									3.17E-14	3.17E-14
¹¹⁰ Ag	B	unspecified									5.39E-12	5.39E-12
^{110m} Ag	M	particulate									6.6E-08	6.6E-08
¹¹¹ Ag	M	particulate									4.66E-08	4.66E-08
¹¹² Ag	M	particulate									1.49E-09	1.49E-09
²⁶ Al	M	particulate									2.99E-09	2.99E-09
²⁴¹ Am	M	particulate	4.49E-06	4.24E-07		4.91E-09			7.54E-07		2.72E-07	5.95E-06
²⁴¹ Am	F	particulate			1.39E-07		6.73E-10	3.08E-07			2.2E-09	4.5E-07
²⁴² Am	M	particulate									2.03E-10	2.03E-10
^{242m} Am	M	particulate									2.04E-10	2.04E-10
²⁴³ Am	M	particulate									3.14E-09	3.14E-09
²⁴⁴ Am	M	particulate									1.23E-20	1.23E-20
²⁴⁵ Am	M	particulate									1.15E-19	1.15E-19
^{246m} Am	M	particulate									7.04E-24	7.04E-24
²⁴⁷ Am	B	unspecified									2.53E-57	2.53E-57
³⁷ Ar	B	unspecified									1.92E-12	1.92E-12
³⁹ Ar	B	unspecified									6.09E-04	6.09E-04
⁴¹ Ar	B	unspecified							9.59E+02	8.15E+01		1.04E+03
⁷¹ As	M	particulate									5.0E-49	5.0E-49
⁷² As	M	particulate									1.91E-38	1.91E-38
⁷³ As	M	particulate									1.8E-16	1.8E-16
⁷⁴ As	M	particulate									1.52E-17	1.52E-17

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹⁹⁵ Au	M	particulate									2.33E-21	2.33E-21
¹²⁸ Ba	M	particulate									4.79E-84	4.79E-84
¹³¹ Ba	M	particulate									2.43E-23	2.43E-23
¹³³ Ba	M	particulate									3.58E-13	3.58E-13
^{137m} Ba	B	unspecified									2.69E-07	2.69E-07
¹³⁹ Ba	M	particulate							6.08E-01		6.08E-01	
¹⁴⁰ Ba	M	particulate							7.52E-04		7.59E-09	7.52E-04
⁷ Be	M	particulate	3.19E-07	2.62E-07		2.98E-06					2.61E-06	6.17E-06
⁷ Be	S	particulate			3.0E-06						1.26E-07	3.13E-06
¹⁰ Be	M	particulate									6.29E-16	6.29E-16
²⁰⁶ Bi	M	particulate									3.21E-09	3.21E-09
²⁰⁷ Bi	M	particulate									9.72E-19	9.72E-19
²⁰⁸ Bi	B	unspecified									1.49E-19	1.49E-19
²¹⁰ Bi	M	particulate									1.27E-18	1.27E-18
^{210m} Bi	M	particulate									8.17E-20	8.17E-20
²¹¹ Bi	B	unspecified									4.14E-08	4.14E-08
²¹² Bi	M	particulate									1.9E-11	1.9E-11
²¹³ Bi	M	particulate									2.08E-18	2.08E-18
²¹⁴ Bi	M	particulate									8.15E-19	8.15E-19
²⁴⁵ Bk	M	particulate									1.49E-44	1.49E-44
²⁴⁷ Bk	M	particulate									1.65E-24	1.65E-24
²⁴⁸ Bk	M	particulate									1.21E-20	1.21E-20
²⁴⁹ Bk	M	particulate									1.39E-11	1.39E-11
²⁵⁰ Bk	M	particulate									5.14E-21	5.14E-21
²⁵¹ Bk	B	unspecified									1.37E-23	1.37E-23
⁷⁷ Br	M	particulate									1.46E-46	1.46E-46
⁸² Br	M	particulate									6.58E-10	6.58E-10
¹¹ C	G	dioxide								9.97E+03		9.97E+03
¹⁴ C	M	particulate									3.3E-09	3.3E-09
⁴¹ Ca	M	particulate									7.07E-12	7.07E-12

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
⁴⁵ Ca	M	particulate									1.41E-12	1.41E-12
⁴⁷ Ca	M	particulate									2.13E-19	2.13E-19
¹⁰⁹ Cd	M	particulate									3.57E-12	3.57E-12
^{111m} Cd	B	unspecified									7.57E-44	7.57E-44
¹¹³ Cd	M	particulate									4.06E-16	4.06E-16
^{113m} Cd	M	particulate									9.47E-11	9.47E-11
¹¹⁵ Cd	M	particulate									1.16E-08	1.16E-08
^{115m} Cd	M	particulate									1.41E-09	1.41E-09
¹³⁴ Ce	M	particulate									1.28E-05	1.28E-05
¹³⁹ Ce	M	particulate									1.36E-06	1.36E-06
¹⁴¹ Ce	M	particulate									2.38E-05	2.38E-05
¹⁴³ Ce	M	particulate									6.73E-09	6.73E-09
¹⁴⁴ Ce	M	particulate									6.41E-05	6.41E-05
²⁴⁸ Cf	M	particulate									3.29E-20	3.29E-20
²⁴⁹ Cf	M	particulate									1.76E-17	1.76E-17
²⁵⁰ Cf	M	particulate									3.23E-16	3.23E-16
²⁵¹ Cf	M	particulate									1.97E-18	1.97E-18
²⁵² Cf	M	particulate							9.05E-10		1.29E-08	1.38E-08
²⁵² Cf	F	particulate									6.87E-11	6.87E-11
²⁵³ Cf	M	particulate									1.82E-21	1.82E-21
²⁵⁴ Cf	M	particulate									8.69E-22	8.69E-22
³⁶ Cl	M	particulate									3.01E-13	3.01E-13
²⁴⁰ Cm	M	particulate									1.64E-19	1.64E-19
²⁴¹ Cm	M	particulate									1.87E-14	1.87E-14
²⁴² Cm	M	particulate									5.09E-07	5.09E-07
²⁴³ Cm	M	particulate	5.0E-08	1.33E-08		1.0E-08			1.35E-08		4.49E-10	8.72E-08
²⁴³ Cm	F	particulate			6.32E-09		1.1E-09				4.28E-10	7.85E-09
²⁴⁴ Cm	M	particulate	5.0E-08	1.33E-08		1.0E-08			1.35E-08		3.08E-06	3.16E-06
²⁴⁴ Cm	F	particulate			6.32E-09		1.1E-09				4.28E-10	7.85E-09
²⁴⁵ Cm	M	particulate									4.47E-11	4.47E-11

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
²⁴⁶ Cm	M	particulate									1.18E-12	1.18E-12
²⁴⁷ Cm	M	particulate									1.3E-09	1.3E-09
²⁴⁸ Cm	M	particulate									3.79E-11	3.79E-11
²⁴⁹ Cm	M	particulate									5.67E-24	5.67E-24
²⁵⁰ Cm	M	particulate									1.52E-22	1.52E-22
⁵⁶ Co	M	particulate									2.17E-15	2.17E-15
⁵⁷ Co	M	particulate									8.71E-12	8.71E-12
⁵⁸ Co	M	particulate									2.94E-11	2.94E-11
⁶⁰ Co	M	particulate									6.93E-07	6.93E-07
⁶⁰ Co	S	particulate			3.3E-07				1.0E-07			4.3E-07
^{60m} Co	M	particulate									1.05E-18	1.05E-18
⁵¹ Cr	M	particulate									2.1E-08	2.1E-08
¹³¹ Cs	F	particulate									5.0E-21	5.0E-21
¹³² Cs	F	particulate									1.25E-20	1.25E-20
¹³⁴ Cs	F	particulate									7.2E-06	7.2E-06
¹³⁵ Cs	F	particulate									2.09E-11	2.09E-11
¹³⁶ Cs	F	particulate									3.85E-09	3.85E-09
¹³⁷ Cs	F	particulate	3.56E-07	3.9E-06					6.36E-06		2.44E-04	2.55E-04
¹³⁷ Cs	S	particulate			1.0E-04			1.81E-07			6.05E-08	1.0E-04
¹³⁸ Cs	F	particulate							2.19E+03			2.19E+03
⁶⁷ Cu	M	particulate									1.7E-19	1.7E-19
¹⁵⁹ Dy	M	particulate									4.72E-15	4.72E-15
¹⁶⁶ Dy	M	particulate									6.7E-31	6.7E-31
¹⁶⁹ Er	M	particulate									2.25E-18	2.25E-18
²⁵³ Es	M	particulate									3.14E-20	3.14E-20
²⁵⁴ Es	M	particulate									5.13E-21	5.13E-21
²⁵⁵ Es	B	unspecified									1.73E-22	1.73E-22
¹⁴⁷ Eu	M	particulate									4.26E-24	4.26E-24
¹⁴⁸ Eu	M	particulate									9.97E-91	9.97E-91
¹⁴⁹ Eu	M	particulate									1.98E-18	1.98E-18

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total	
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915			
¹⁵² Eu	M	particulate										1.88E-07	1.88E-07
¹⁵² Eu	F	particulate			9.25E-07								9.25E-07
¹⁵⁴ Eu	M	particulate										4.86E-07	4.86E-07
¹⁵⁵ Eu	M	particulate										2.2E-07	2.2E-07
¹⁵⁶ Eu	M	particulate										2.98E-10	2.98E-10
⁵⁵ Fe	M	particulate										3.11E-07	3.11E-07
⁵⁹ Fe	M	particulate										7.95E-11	7.95E-11
⁶⁰ Fe	M	particulate										1.18E-15	1.18E-15
²²² Fr	M	particulate										1.18E-28	1.18E-28
²²³ Fr	M	particulate										3.19E-19	3.19E-19
⁶⁷ Ga	M	particulate										8.69E-43	8.69E-43
⁶⁸ Ga	M	particulate										4.08E-26	4.08E-26
¹⁴⁸ Gd	M	particulate										1.06E-10	1.06E-10
¹⁴⁹ Gd	M	particulate										8.53E-30	8.53E-30
¹⁵⁰ Gd	B	unspecified										2.97E-87	2.97E-87
¹⁵¹ Gd	M	particulate										5.13E-15	5.13E-15
¹⁵² Gd	M	particulate										2.03E-23	2.03E-23
¹⁵³ Gd	M	particulate										1.05E-10	1.05E-10
⁶⁸ Ge	M	particulate										7.05E-15	7.05E-15
⁷¹ Ge	M	particulate										5.9E-19	5.9E-19
³ H	V	vapor			9.01E-01	3.81E-02	6.99E-01		6.55E+01	1.25E+03		1.85E+00	1.32E+03
¹⁷² Hf	M	particulate										4.49E-12	4.49E-12
¹⁷⁵ Hf	M	particulate										8.95E-12	8.95E-12
^{178m} Hf	M	particulate										3.15E-11	3.15E-11
^{179m} Hf	M	particulate										2.8E-24	2.8E-24
¹⁸¹ Hf	M	particulate										6.53E-12	6.53E-12
¹⁸² Hf	M	particulate										2.9E-15	2.9E-15
²⁰³ Hg	M	inorganic										2.24E-21	2.24E-21
¹⁶³ Ho	B	unspecified										1.18E-16	1.18E-16
¹⁶⁶ Ho	M	particulate										1.01E-30	1.01E-30

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
^{166m} Ho	M	particulate									2.81E-13	2.81E-13
¹²⁴ I	F	particulate				3.05E-05					5.38E-36	3.05E-05
¹²⁵ I	F	particulate				5.64E-05					3.91E-17	5.64E-05
¹²⁶ I	F	particulate			5.31E-03	4.81E-03					1.57E-09	1.01E-02
¹²⁹ I	F	particulate				1.21E-05			5.55E-04		9.66E-06	5.77E-04
¹³¹ I	F	particulate				1.21E-02			1.61E-01		1.68E-08	1.73E-01
¹³² I	F	particulate				1.85E-03			5.53E-01		4.17E-27	5.55E-01
¹³³ I	F	particulate							4.59E-01			4.59E-01
¹³⁴ I	F	particulate							6.15E-01			6.15E-01
¹³⁵ I	F	particulate							1.4E+00			1.4E+00
¹¹¹ In	M	particulate									1.45E-39	1.45E-39
^{113m} In	M	particulate									1.54E-08	1.54E-08
¹¹⁴ In	B	unspecified									7.8E-18	7.8E-18
^{114m} In	M	particulate									1.41E-10	1.41E-10
¹¹⁵ In	M	particulate									8.27E-22	8.27E-22
^{115m} In	M	particulate									1.49E-13	1.49E-13
¹⁹² Ir	M	particulate									3.05E-11	3.05E-11
^{192m} Ir	B	unspecified									2.32E-20	2.32E-20
¹⁹⁴ Ir	M	particulate									2.78E-19	2.78E-19
^{194m} Ir	M	particulate									4.66E-18	4.66E-18
⁴⁰ K	M	particulate									3.06E-07	3.06E-07
⁴² K	M	particulate									2.47E-26	2.47E-26
⁸¹ Kr	B	unspecified									2.0E-07	2.0E-07
^{83m} Kr	B	unspecified									1.78E-09	1.78E-09
⁸⁵ Kr	B	unspecified							6.49E+02		1.5E+02	7.99E+02
^{85m} Kr	B	unspecified							7.94E+00	9.26E+01		1.01E+02
⁸⁷ Kr	B	unspecified							2.87E+01	1.98E+02		2.27E+02
⁸⁸ Kr	B	unspecified							4.06E+01	7.19E+01		1.13E+02
⁸⁹ Kr	B	unspecified							3.54E+01			3.54E+01
¹³⁷ La	M	particulate									3.2E-16	3.2E-16

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹³⁸ La	M	particulate									1.81E-20	1.81E-20
¹⁴⁰ La	M	particulate								8.72E-04	3.88E-07	8.72E-04
¹⁷¹ Lu	M	particulate									1.33E-29	1.33E-29
¹⁷² Lu	M	particulate									1.45E-30	1.45E-30
¹⁷³ Lu	M	particulate									3.1E-13	3.1E-13
¹⁷⁴ Lu	M	particulate									4.56E-12	4.56E-12
^{174m} Lu	M	particulate									5.79E-17	5.79E-17
¹⁷⁶ Lu	M	particulate									3.29E-21	3.29E-21
¹⁷⁷ Lu	M	particulate									2.58E-16	2.58E-16
^{177m} Lu	M	particulate									3.89E-08	3.89E-08
⁵² Mn	M	particulate									7.6E-20	7.6E-20
⁵³ Mn	M	particulate									3.49E-15	3.49E-15
⁵⁴ Mn	M	particulate									5.83E-09	5.83E-09
⁹³ Mo	M	particulate									1.79E-09	1.79E-09
⁹⁹ Mo	M	particulate									1.74E-08	1.74E-08
²² Na	M	particulate									2.69E-11	2.69E-11
⁹¹ Nb	B	unspecified									9.89E-11	9.89E-11
^{91m} Nb	B	unspecified									1.93E-15	1.93E-15
⁹² Nb	B	unspecified									4.63E-15	4.63E-15
^{92m} Nb	B	unspecified									1.97E-16	1.97E-16
^{93m} Nb	M	particulate									6.67E-09	6.67E-09
⁹⁴ Nb	M	particulate									8.16E-10	8.16E-10
⁹⁵ Nb	M	particulate									2.74E-05	2.74E-05
^{95m} Nb	M	particulate									1.51E-07	1.51E-07
⁹⁶ Nb	M	particulate									9.67E-11	9.67E-11
⁹⁷ Nb	M	particulate									5.95E-11	5.95E-11
¹⁴⁰ Nd	B	unspecified									4.96E-38	4.96E-38
¹⁴⁴ Nd	B	unspecified									6.26E-20	6.26E-20
¹⁴⁷ Nd	M	particulate									2.3E-06	2.3E-06
⁵⁶ Ni	M	particulate									6.49E-57	6.49E-57

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
⁵⁹ Ni	M	particulate									5.81E-10	5.81E-10
⁶³ Ni	M	particulate									1.71E-07	1.71E-07
⁶⁶ Ni	M	particulate									5.18E-43	5.18E-43
²³⁴ Np	M	particulate									3.19E-35	3.19E-35
²³⁵ Np	M	particulate									5.18E-14	5.18E-14
²³⁷ Np	M	particulate									2.9E-05	2.9E-05
²³⁸ Np	M	particulate									8.78E-13	8.78E-13
²³⁹ Np	M	particulate									1.32E-09	1.32E-09
²⁴⁰ Np	M	particulate									1.69E-20	1.69E-20
¹⁸⁵ Os	M	particulate									4.92E-15	4.92E-15
¹⁹¹ Os	M	particulate				2.55E-02						2.55E-02
¹⁹⁴ Os	M	particulate									2.03E-13	2.03E-13
³² P	M	particulate									4.24E-16	4.24E-16
³³ P	M	particulate									3.26E-18	3.26E-18
²²⁸ Pa	M	particulate									5.5E-11	5.5E-11
²³⁰ Pa	M	particulate									3.72E-09	3.72E-09
²³¹ Pa	M	particulate									7.54E-16	7.54E-16
²³² Pa	M	particulate									1.4E-10	1.4E-10
²³³ Pa	M	particulate									4.49E-08	4.49E-08
²³⁴ Pa	M	particulate									2.99E-14	2.99E-14
²⁰⁵ Pb	M	particulate									3.71E-20	3.71E-20
²⁰⁹ Pb	M	particulate									2.09E-18	2.09E-18
²¹⁰ Pb	M	particulate									2.0E-09	2.0E-09
²¹¹ Pb	M	particulate									3.42E-08	3.42E-08
²¹² Pb	M	particulate	1.08E+00	3.38E-01		1.51E-02			2.93E-02		5.79E-08	1.46E+00
²¹² Pb	S	particulate			3.37E+00		3.89E-01				8.49E-02	3.84E+00
²¹⁴ Pb	M	particulate				4.4E-03			3.68E-02		8.07E-19	4.12E-02
²¹⁴ Pb	S	particulate			1.13E+00		1.42E-01				1.09E-04	1.27E+00
¹⁰⁰ Pd	M	particulate									5.88E-59	5.88E-59
¹⁰³ Pd	M	particulate									1.6E-14	1.6E-14

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹⁰⁷ Pd	M	particulate									5.4E-12	5.4E-12
¹⁴³ Pm	M	particulate									5.05E-20	5.05E-20
¹⁴⁴ Pm	M	particulate									6.09E-18	6.09E-18
¹⁴⁵ Pm	M	particulate									2.43E-11	2.43E-11
¹⁴⁶ Pm	M	particulate									9.68E-12	9.68E-12
¹⁴⁷ Pm	M	particulate									1.18E-05	1.18E-05
¹⁴⁸ Pm	M	particulate									5.07E-09	5.07E-09
^{148m} Pm	M	particulate									3.42E-07	3.42E-07
²⁰⁸ Po	B	unspecified									2.49E-13	2.49E-13
²⁰⁹ Po	B	unspecified									7.8E-10	7.8E-10
²¹⁰ Po	B	inorganic									3.58E-13	3.58E-13
¹⁴³ Pr	M	particulate									8.19E-10	8.19E-10
¹⁴⁴ Pr	M	particulate									6.13E-05	6.13E-05
¹⁹³ Pt	M	particulate									3.47E-12	3.47E-12
²³⁶ Pu	M	particulate									3.01E-11	3.01E-11
²³⁷ Pu	M	particulate									7.81E-13	7.81E-13
²³⁸ Pu	M	particulate	7.75E-09	3.04E-08		1.13E-09			1.2E-08		6.36E-07	6.87E-07
²³⁸ Pu	F	particulate			6.46E-07		3.09E-09	5.49E-08			1.42E-09	7.05E-07
²³⁹ Pu	M	particulate	1.26E-08	2.05E-07		5.25E-10			1.1E-08		1.98E-05	2.01E-05
²³⁹ Pu	F	particulate			2.31E-07		6.22E-09	1.09E-08			3.42E-10	2.48E-07
²⁴⁰ Pu	M	particulate	1.26E-08	2.05E-07		5.25E-10			1.1E-08		5.8E-06	6.02E-06
²⁴⁰ Pu	F	particulate			2.31E-07		6.22E-09	1.09E-08			3.42E-10	2.48E-07
²⁴¹ Pu	M	particulate									1.11E-05	1.11E-05
²⁴² Pu	M	particulate									3.27E-05	3.27E-05
²⁴³ Pu	M	particulate									1.86E-18	1.86E-18
²⁴⁴ Pu	M	particulate									7.83E-08	7.83E-08
²⁴⁶ Pu	M	particulate									7.04E-24	7.04E-24
²²³ Ra	M	particulate									7.3E-08	7.3E-08
²²⁴ Ra	M	particulate									4.98E-09	4.98E-09
²²⁵ Ra	M	particulate									1.09E-09	1.09E-09

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
²²⁶ Ra	M	particulate									5.06E-08	5.06E-08
²²⁸ Ra	M	particulate									7.45E-12	7.45E-12
⁸³ Rb	M	particulate									6.79E-14	6.79E-14
⁸⁴ Rb	M	particulate									2.86E-13	2.86E-13
⁸⁶ Rb	M	particulate									2.34E-11	2.34E-11
⁸⁷ Rb	M	particulate									1.38E-15	1.38E-15
¹⁸³ Re	B	unspecified									3.2E-16	3.2E-16
¹⁸⁴ Re	M	particulate									5.23E-19	5.23E-19
^{184m} Re	M	particulate									7.94E-16	7.94E-16
¹⁸⁶ Re	M	particulate									5.02E-19	5.02E-19
^{186m} Re	M	particulate									2.48E-15	2.48E-15
¹⁸⁷ Re	M	particulate									2.47E-21	2.47E-21
¹⁸⁸ Re	M	particulate									4.48E-16	4.48E-16
⁹⁹ Rh	M	particulate									3.74E-25	3.74E-25
¹⁰⁰ Rh	M	particulate									7.73E-59	7.73E-59
¹⁰¹ Rh	M	particulate									6.62E-16	6.62E-16
^{101m} Rh	M	particulate									1.88E-31	1.88E-31
¹⁰² Rh	M	particulate									9.87E-11	9.87E-11
^{102m} Rh	M	particulate									2.42E-11	2.42E-11
^{103m} Rh	M	particulate									2.16E-06	2.16E-06
¹⁰⁵ Rh	M	particulate									1.41E-07	1.41E-07
¹⁰⁶ Rh	B	unspecified									2.11E-07	2.11E-07
²¹⁹ Rn	B	unspecified									3.5E-03	3.5E-03
²²² Rn	B	unspecified									8.13E-09	8.13E-09
⁹⁷ Ru	M	particulate									2.43E-44	2.43E-44
¹⁰³ Ru	M	particulate									2.21E-06	2.21E-06
¹⁰⁶ Ru	M	particulate									2.24E-05	2.24E-05
³⁵ S	M	particulate									6.05E-12	6.05E-12
¹¹⁹ Sb	M	particulate									4.0E-40	4.0E-40
^{120m} Sb	M	particulate									1.46E-09	1.46E-09

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹²² Sb	M	particulate									3.0E-09	3.0E-09
¹²⁴ Sb	M	particulate				1.08E-03					5.57E-09	1.08E-03
¹²⁵ Sb	M	particulate				1.45E-04					5.44E-07	1.46E-04
¹²⁶ Sb	M	particulate				1.23E-03					2.01E-07	1.23E-03
^{126m} Sb	M	particulate									1.38E-11	1.38E-11
¹²⁷ Sb	M	particulate									8.53E-09	8.53E-09
⁴⁴ Sc	M	particulate									1.41E-33	1.41E-33
^{44m} Sc	M	particulate									1.97E-53	1.97E-53
⁴⁶ Sc	M	particulate									2.19E-14	2.19E-14
⁴⁷ Sc	M	particulate									1.97E-17	1.97E-17
⁷² Se	B	unspecified									1.65E-38	1.65E-38
⁷⁵ Se	F	particulate									3.94E-14	3.94E-14
⁷⁹ Se	F	particulate									4.72E-12	4.72E-12
³² Si	M	particulate									3.69E-13	3.69E-13
¹⁴⁵ Sm	M	particulate									1.85E-15	1.85E-15
¹⁴⁶ Sm	M	particulate									1.46E-18	1.46E-18
¹⁴⁷ Sm	M	particulate									1.18E-16	1.18E-16
¹⁴⁸ Sm	B	unspecified									2.04E-21	2.04E-21
¹⁵¹ Sm	M	particulate									2.32E-08	2.32E-08
¹¹³ Sn	M	particulate									1.52E-08	1.52E-08
^{117m} Sn	M	particulate									9.76E-10	9.76E-10
^{119m} Sn	M	particulate									1.28E-08	1.28E-08
¹²¹ Sn	M	particulate									1.04E-09	1.04E-09
^{121m} Sn	M	particulate									1.35E-09	1.35E-09
¹²³ Sn	M	particulate									3.46E-08	3.46E-08
¹²⁵ Sn	M	particulate									3.63E-09	3.63E-09
¹²⁶ Sn	M	particulate									1.4E-11	1.4E-11
⁸² Sr	M	particulate									2.62E-42	2.62E-42
⁸⁵ Sr	M	particulate									1.41E-14	1.41E-14
^{87m} Sr	M	particulate									6.46E-36	6.46E-36

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
⁸⁹ Sr	M	particulate	4.75E-08	2.56E-06		1.45E-09				8.52E-06	3.79E-06	1.49E-05
⁸⁹ Sr	S	particulate			5.56E-06		1.45E-08				1.51E-08	5.59E-06
⁹⁰ Sr	M	particulate	4.75E-08	2.56E-06		1.45E-09				8.52E-06	1.01E-04	1.12E-04
⁹⁰ Sr	S	particulate			5.56E-06		1.45E-08	1.34E-06			1.66E-08	6.93E-06
⁹¹ Sr	M	particulate									1.19E-13	1.19E-13
¹⁷⁹ Ta	M	particulate									7.33E-12	7.33E-12
¹⁸² Ta	M	particulate									1.61E-10	1.61E-10
¹⁵³ Tb	M	particulate									1.99E-50	1.99E-50
¹⁵⁵ Tb	M	particulate									3.48E-30	3.48E-30
¹⁵⁶ Tb	M	particulate									1.24E-28	1.24E-28
¹⁵⁷ Tb	M	particulate									3.29E-16	3.29E-16
¹⁵⁸ Tb	M	particulate									9.16E-15	9.16E-15
¹⁶⁰ Tb	M	particulate									4.51E-09	4.51E-09
¹⁶¹ Tb	M	particulate									3.36E-18	3.36E-18
⁹⁵ Tc	M	particulate									2.09E-22	2.09E-22
^{95m} Tc	M	particulate									5.3E-21	5.3E-21
⁹⁶ Tc	M	particulate									1.97E-10	1.97E-10
⁹⁷ Tc	M	particulate									4.78E-18	4.78E-18
^{97m} Tc	M	particulate									1.14E-14	1.14E-14
⁹⁸ Tc	M	particulate									2.14E-16	2.14E-16
⁹⁹ Tc	M	particulate									2.21E-09	2.21E-09
⁹⁹ Tc	S	particulate						3.15E-06				3.15E-06
^{99m} Tc	M	particulate									3.67E-18	3.67E-18
¹¹⁸ Te	B	unspecified									4.18E-39	4.18E-39
^{119m} Te	B	unspecified									2.64E-40	2.64E-40
¹²¹ Te	M	particulate									4.05E-10	4.05E-10
^{121m} Te	M	particulate									5.41E-11	5.41E-11
¹²³ Te	M	particulate									1.7E-13	1.7E-13
^{123m} Te	M	particulate									8.17E-11	8.17E-11
^{125m} Te	M	particulate									1.3E-07	1.3E-07

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹²⁷ Te	M	particulate									1.28E-07	1.28E-07
^{127m} Te	M	particulate									1.31E-07	1.31E-07
¹²⁹ Te	M	particulate									2.01E-08	2.01E-08
^{129m} Te	M	particulate									3.2E-08	3.2E-08
^{131m} Te	M	particulate									9.13E-10	9.13E-10
¹³² Te	M	particulate									3.03E-09	3.03E-09
²²⁶ Th	S	particulate									1.07E-19	1.07E-19
²²⁷ Th	S	particulate									1.61E-07	1.61E-07
²²⁸ Th	S	particulate	6.48E-09	2.04E-08	1.45E-07	4.84E-09	5.58E-09		1.74E-08		1.07E-06	1.27E-06
²²⁹ Th	S	particulate									5.31E-10	5.31E-10
²³⁰ Th	S	particulate	2.11E-10	6.12E-09		4.74E-09			2.66E-07		3.31E-09	2.8E-07
²³⁰ Th	F	particulate			8.75E-09		2.36E-09				1.96E-09	1.31E-08
²³¹ Th	S	particulate									2.24E-12	2.24E-12
²³² Th	S	particulate	4.74E-10	3.37E-09		9.11E-10			4.01E-09		1.9E-07	1.98E-07
²³² Th	F	particulate			1.27E-08		8.2E-10				2.15E-09	1.57E-08
²³⁴ Th	S	particulate									1.2E-09	1.2E-09
⁴⁴ Ti	M	particulate									7.63E-12	7.63E-12
²⁰⁴ Tl	M	particulate									2.29E-16	2.29E-16
²⁰⁸ Tl	B	unspecified									7.02E-09	7.02E-09
¹⁶⁶ Tm	M	particulate									1.44E-60	1.44E-60
¹⁶⁷ Tm	M	particulate									6.95E-26	6.95E-26
¹⁶⁸ Tm	B	unspecified									1.52E-16	1.52E-16
¹⁷⁰ Tm	M	particulate									9.68E-12	9.68E-12
¹⁷¹ Tm	M	particulate									1.88E-09	1.88E-09
¹⁷² Tm	M	particulate									7.36E-38	7.36E-38
²³⁰ U	M	particulate									1.06E-19	1.06E-19
²³¹ U	M	particulate									7.73E-33	7.73E-33
²³² U	M	particulate	4.26E-10	3.04E-10							5.38E-13	7.31E-10
²³³ U	M	particulate	2.44E-08	1.34E-07		1.76E-09			9.67E-09		3.12E-07	4.82E-07
²³³ U	S	particulate			2.88E-05		6.02E-09				1.3E-09	2.88E-05

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
²³⁴ U	M	particulate	2.44E-08	1.34E-07		1.76E-09				9.67E-09	9.59E-04	9.59E-04
²³⁴ U	S	particulate			2.88E-05		6.02E-09				1.3E-09	2.88E-05
²³⁵ U	M	particulate	1.76E-10	2.6E-09		4.0E-10				2.24E-09	2.65E-05	2.65E-05
²³⁵ U	S	particulate			1.72E-08						9.47E-11	1.73E-08
²³⁶ U	M	particulate									4.69E-11	4.69E-11
²³⁷ U	M	particulate									1.81E-10	1.81E-10
²³⁸ U	M	particulate	1.2E-09	2.37E-08		1.21E-09				1.22E-08	2.27E-03	2.27E-03
²³⁸ U	S	particulate			2.22E-07		1.45E-09				2.37E-09	2.26E-07
²⁴⁰ U	M	particulate									1.49E-17	1.49E-17
⁴⁸ V	M	particulate									6.51E-18	6.51E-18
⁴⁹ V	M	particulate									9.37E-11	9.37E-11
⁵⁰ V	B	unspecified									7.32E-25	7.32E-25
¹⁸¹ W	M	particulate									1.45E-11	1.45E-11
¹⁸⁵ W	M	particulate									8.41E-10	8.41E-10
¹⁸⁸ W	M	particulate									3.54E-08	3.54E-08
¹²³ Xe	B	unspecified								1.23E+02		1.23E+02
¹²⁵ Xe	B	unspecified								6.63E+01		6.63E+01
¹²⁷ Xe	B	unspecified								2.77E-03		2.77E-03
^{131m} Xe	B	unspecified								1.72E+02	1.97E-07	1.72E+02
¹³³ Xe	B	unspecified								1.11E+01		1.11E+01
^{133m} Xe	B	unspecified								2.81E+01		2.81E+01
¹³⁵ Xe	B	unspecified								8.86E+01		8.86E+01
^{135m} Xe	B	unspecified								6.65E+01		6.65E+01
¹³⁷ Xe	B	unspecified								2.01E+02		2.01E+02
¹³⁸ Xe	B	unspecified								3.99E+02		3.99E+02
⁸⁷ Y	M	particulate									6.13E-36	6.13E-36
⁸⁸ Y	M	particulate									9.34E-08	9.34E-08
⁹⁰ Y	M	particulate									5.03E-06	5.03E-06
⁹¹ Y	M	particulate									7.81E-06	7.81E-06
¹⁶⁶ Yb	M	particulate									1.25E-60	1.25E-60

Table G.1. Radiological airborne emissions from all sources at ORNL, 2023 (Ci)^a (continued)

Isotope	Inhalation Form ^b	Chemical Form	Stack								Total Minor Sources	ORNL Total
			X-2026	X-3020	X-3039	X-4501	X-7503	X-7880	X-7911	X-8915		
¹⁶⁹ Yb	M	particulate									1.0E-08	1.0E-08
⁶⁵ Zn	M	particulate									8.65E-10	8.65E-10
⁸⁸ Zr	M	particulate									1.43E-16	1.43E-16
⁸⁹ Zr	M	particulate									1.18E-30	1.18E-30
⁹³ Zr	M	particulate									1.26E-10	1.26E-10
⁹⁵ Zr	M	particulate									1.32E-05	1.32E-05
⁹⁷ Zr	M	particulate									3.72E-11	3.72E-11
Totals			1.08E+00	3.38E-01	5.41E+00	1.04E-01	1.23E+00	5.16E-06	4.95E+03	1.19E+04	1.52E+02	1.7E+04

^a Emissions given in curies (Ci). 1 Ci = 3.7E+10 Bq

^b The designations of F, M, and S refer to the lung clearance type: fast (F), moderate (M), or slow (S) for the given radionuclide. G stands for gaseous, V stands for vapor, and B stands for blank, unspecified form.