



Appendix G

Radiological Airborne Emissions at Oak Ridge National Laboratory

This appendix presents annual radioactive airborne emissions for ORNL in 2022. 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.

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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										9.58E-08	9.58E-08
²²⁶ Ac	M	particulate										1.07E-09	1.07E-09
²²⁷ Ac	M	particulate										1.07E-08	1.07E-08
¹⁰⁵ Ag	M	particulate										2.46E-28	2.46E-28
^{106m} Ag	M	particulate										5.24E-50	5.24E-50
¹⁰⁸ Ag	B	unspecified										4.95E-18	4.95E-18
^{108m} Ag	M	particulate										2.76E-10	2.76E-10
¹¹⁰ Ag	B	unspecified										1.79E-11	1.79E-11
^{110m} Ag	M	particulate										3.65E-08	3.65E-08
¹¹¹ Ag	M	particulate										4.23E-08	4.23E-08
¹¹² Ag	M	particulate										5.62E-10	5.62E-10
²⁶ Al	M	particulate										2.99E-09	2.99E-09
²⁴¹ Am	M	particulate	4.19E-08	1.21E-06		1.54E-09				1.21E-09		2.79E-07	1.53E-06
²⁴¹ Am	F	particulate			1.48E-07		1.42E-08	1.64E-07				9.84E-10	3.27E-07
²⁴² Am	M	particulate										4.24E-11	4.24E-11
^{242m} Am	M	particulate										4.29E-11	4.29E-11
²⁴³ Am	M	particulate										4.05E-09	4.05E-09
³⁷ Ar	B	unspecified										2.14E-07	2.14E-07
³⁹ Ar	B	unspecified										3.7E-04	3.7E-04
⁴¹ Ar	B	unspecified							3.94E+02	1.04E+02			4.98E+02
⁷³ As	M	particulate										1.67E-21	1.67E-21
⁷⁴ As	M	particulate										1.75E-26	1.75E-26
¹⁹⁵ Au	M	particulate										9.07E-21	9.07E-21
¹³¹ Ba	M	particulate										7.63E-31	7.63E-31
¹³³ Ba	M	particulate										5.67E-15	5.67E-15
^{137m} Ba	B	unspecified										9.54E-07	9.54E-07
¹³⁹ Ba	M	particulate							3.62E-01				3.62E-01
¹⁴⁰ Ba	M	particulate							5.08E-04			1.85E-08	5.08E-04

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
⁷ Be	M	particulate	3.78E-07	4.81E-07							2.68E-06	3.54E-06
⁷ Be	S	particulate			3.75E-06		1.59E-07				7.03E-07	4.61E-06
¹⁰ Be	M	particulate									6.01E-16	6.01E-16
²⁰⁶ Bi	M	particulate									3.21E-09	3.21E-09
²⁰⁷ Bi	M	particulate									5.86E-17	5.86E-17
²⁰⁸ Bi	B	unspecified									8.67E-20	8.67E-20
²¹⁰ Bi	M	particulate									3.38E-21	3.38E-21
^{210m} Bi	M	particulate									4.04E-20	4.04E-20
²¹¹ Bi	B	unspecified									4.14E-11	4.14E-11
²¹² Bi	M	particulate									1.89E-11	1.89E-11
²⁴⁵ Bk	M	particulate									2.5E-84	2.5E-84
²⁴⁷ Bk	M	particulate									1.77E-27	1.77E-27
²⁴⁹ Bk	M	particulate									1.23E-11	1.23E-11
⁸² Br	M	particulate									6.58E-10	6.58E-10
¹¹ C	G	dioxide								1.3E+04		1.3E+04
¹⁴ C	M	particulate									2.26E-05	2.26E-05
⁴¹ Ca	M	particulate									7.05E-12	7.05E-12
⁴⁵ Ca	M	particulate									2.58E-12	2.58E-12
⁴⁷ Ca	M	particulate									2.94E-77	2.94E-77
¹⁰⁹ Cd	M	particulate									1.28E-14	1.28E-14
¹¹³ Cd	M	particulate									3.46E-27	3.46E-27
^{113m} Cd	M	particulate									2.55E-10	2.55E-10
¹¹⁵ Cd	M	particulate									1.16E-08	1.16E-08
^{115m} Cd	M	particulate									5.86E-11	5.86E-11
¹³⁴ Ce	M	particulate									3.4E-69	3.4E-69
¹³⁹ Ce	M	particulate									1.58E-09	1.58E-09
¹⁴¹ Ce	M	particulate									3.48E-08	3.48E-08
¹⁴³ Ce	M	particulate									8.44E-10	8.44E-10
¹⁴⁴ Ce	M	particulate									1.53E-06	1.53E-06
²⁴⁸ Cf	M	particulate									1.01E-23	1.01E-23

Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
²⁴⁹ Cf	M	particulate									5.56E-19	5.56E-19
²⁵⁰ Cf	M	particulate									7.07E-18	7.07E-18
²⁵¹ Cf	M	particulate									3.36E-20	3.36E-20
²⁵² Cf	M	particulate									3.45E-08	3.45E-08
²⁵² Cf	F	particulate									6.87E-11	6.87E-11
²⁵³ Cf	M	particulate									1.2E-34	1.2E-34
²⁵⁴ Cf	M	particulate									9.2E-28	9.2E-28
³⁶ Cl	M	particulate									4.08E-09	4.08E-09
²⁴⁰ Cm	M	particulate									3.24E-29	3.24E-29
²⁴¹ Cm	M	particulate									5.7E-23	5.7E-23
²⁴² Cm	M	particulate									6.59E-09	6.59E-09
²⁴³ Cm	M	particulate	1.03E-07	3.32E-08					2.06E-09		2.32E-10	1.38E-07
²⁴³ Cm	F	particulate			4.23E-09		3.1E-08	6.8E-09			2.41E-10	4.22E-08
²⁴⁴ Cm	M	particulate	1.03E-07	3.32E-08					2.06E-09		3.63E-06	3.77E-06
²⁴⁴ Cm	F	particulate			4.23E-09		3.1E-08	6.8E-09			2.41E-10	4.22E-08
²⁴⁵ Cm	M	particulate									3.5E-09	3.5E-09
²⁴⁶ Cm	M	particulate									6.06E-13	6.06E-13
²⁴⁷ Cm	M	particulate									1.2E-09	1.2E-09
²⁴⁸ Cm	M	particulate									1.45E-11	1.45E-11
²⁵⁰ Cm	M	particulate									4.18E-26	4.18E-26
⁵⁶ Co	M	particulate									5.1E-14	5.1E-14
⁵⁷ Co	M	particulate									7.02E-09	7.02E-09
⁵⁸ Co	M	particulate									4.14E-08	4.14E-08
⁶⁰ Co	M	particulate									3.94E-06	3.94E-06
⁵¹ Cr	M	particulate									3.96E-12	3.96E-12
¹³¹ Cs	F	particulate									9.2E-43	9.2E-43
¹³² Cs	F	particulate									1.11E-51	1.11E-51
¹³⁴ Cs	F	particulate									7.03E-07	7.03E-07
¹³⁵ Cs	F	particulate									3.2E-09	3.2E-09
¹³⁶ Cs	F	particulate									4.06E-09	4.06E-09

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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			
¹³⁷ Cs	F	particulate	3.19E-07	3.44E-06						4.26E-06		2.32E-04	2.4E-04
¹³⁷ Cs	S	particulate			4.6E-05							1.26E-05	5.86E-05
¹³⁸ Cs	F	particulate								1.11E+03			1.11E+03
¹⁵⁹ Dy	M	particulate										2.78E-19	2.78E-19
¹⁶⁶ Dy	M	particulate										2.38E-87	2.38E-87
¹⁶⁹ Er	M	particulate										6.76E-41	6.76E-41
²⁵³ Es	M	particulate										4.4E-32	4.4E-32
²⁵⁴ Es	M	particulate										8.84E-25	8.84E-25
²⁵⁵ Es	B	unspecified										4.98E-30	4.98E-30
¹⁴⁷ Eu	M	particulate										1.22E-34	1.22E-34
¹⁴⁸ Eu	M	particulate										4.92E-97	4.92E-97
¹⁴⁹ Eu	M	particulate										2.36E-23	2.36E-23
¹⁵⁰ Eu	M	particulate										3.29E-18	3.29E-18
¹⁵² Eu	M	particulate										1.89E-07	1.89E-07
¹⁵⁴ Eu	M	particulate										1.92E-07	1.92E-07
¹⁵⁵ Eu	M	particulate										4.37E-08	4.37E-08
¹⁵⁶ Eu	M	particulate										2.97E-11	2.97E-11
⁵⁵ Fe	M	particulate										2.4E-07	2.4E-07
⁵⁹ Fe	M	particulate										2.76E-10	2.76E-10
⁶⁰ Fe	M	particulate										1.16E-15	1.16E-15
⁶⁷ Ga	M	particulate										1.62E-101	1.62E-101
¹⁴⁸ Gd	M	particulate										1.07E-10	1.07E-10
¹⁴⁹ Gd	M	particulate										4.16E-52	4.16E-52
¹⁵⁰ Gd	B	unspecified										3.18E-90	3.18E-90
¹⁵¹ Gd	M	particulate										2.13E-19	2.13E-19
¹⁵² Gd	M	particulate										2.16E-26	2.16E-26
¹⁵³ Gd	M	particulate										3.39E-10	3.39E-10
⁶⁸ Ge	M	particulate										3.1E-16	3.1E-16
⁷¹ Ge	M	particulate										3.14E-31	3.14E-31
³ H	V	vapor	3.18E-02		3.39E-01	2.99E-03	7.37E-01			7.93E+01	1.16E+03	9.32E-01	1.24E+03

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
¹⁷² Hf	M	particulate									6.47E-12	6.47E-12
¹⁷⁵ Hf	M	particulate									6.93E-14	6.93E-14
^{178m} Hf	M	particulate									3.22E-11	3.22E-11
^{179m} Hf	M	particulate									5.64E-20	5.64E-20
¹⁸¹ Hf	M	particulate									1.62E-14	1.62E-14
¹⁸² Hf	M	particulate									2.77E-15	2.77E-15
²⁰³ Hg	M	inorganic									8.53E-24	8.53E-24
¹⁶³ Ho	B	unspecified									1.49E-21	1.49E-21
^{166m} Ho	M	particulate									2.78E-13	2.78E-13
¹²⁴ I	F	particulate									1.82E-82	1.82E-82
¹²⁵ I	F	particulate									3.98E-23	3.98E-23
¹²⁶ I	F	particulate			6.94E-03	4.97E-03					1.57E-09	1.19E-02
¹²⁹ I	F	particulate									1.09E-05	1.09E-05
¹³¹ I	F	particulate	3.12E-08		8.43E-04	2.64E-02			4.22E-02		1.68E-08	6.94E-02
¹³¹ I	S	particulate						1.73E-06				1.73E-06
¹³² I	F	particulate				8.01E-03			4.36E-01			4.44E-01
¹³³ I	F	particulate							2.32E-01			2.32E-01
¹³⁴ I	F	particulate							3.94E-01			3.94E-01
¹³⁵ I	F	particulate							7.75E-01			7.75E-01
¹¹¹ In	M	particulate									8.78E-107	8.78E-107
¹¹⁴ In	B	unspecified									2.6E-17	2.6E-17
^{114m} In	M	particulate									1.8E-11	1.8E-11
¹¹⁵ In	M	particulate									8.88E-25	8.88E-25
¹⁹² Ir	M	particulate									1.47E-14	1.47E-14
^{192m} Ir	B	unspecified									2.33E-20	2.33E-20
^{194m} Ir	M	particulate									1.71E-14	1.71E-14
⁴⁰ K	M	particulate									3.15E-07	3.15E-07
⁸¹ Kr	B	unspecified									1.09E-07	1.09E-07
^{83m} Kr	B	unspecified									4.E-08	4.E-08
⁸⁵ Kr	B	unspecified							1.51E+02		2.53E+02	4.04E+02

Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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			
^{85m} Kr	B	unspecified								1.21E+01	1.17E+02		1.29E+02
⁸⁷ Kr	B	unspecified								5.77E+01	2.61E+02		3.19E+02
⁸⁸ Kr	B	unspecified								5.33E+01	9.13E+01		1.45E+02
⁸⁹ Kr	B	unspecified								2.88E+01			2.88E+01
¹³⁷ La	M	particulate										3.42E-19	3.42E-19
¹³⁸ La	M	particulate										1.94E-23	1.94E-23
¹⁴⁰ La	M	particulate								5.12E-02		8.14E-09	5.12E-02
¹⁷¹ Lu	M	particulate										3.65E-17	3.65E-17
¹⁷² Lu	M	particulate										1.97E-18	1.97E-18
¹⁷³ Lu	M	particulate										5.08E-13	5.08E-13
¹⁷⁴ Lu	M	particulate										5.61E-12	5.61E-12
^{174m} Lu	M	particulate										1.16E-17	1.16E-17
¹⁷⁶ Lu	M	particulate										3.29E-21	3.29E-21
^{177m} Lu	M	particulate										3.89E-11	3.89E-11
⁵² Mn	M	particulate										4.04E-65	4.04E-65
⁵³ Mn	M	particulate										1.31E-15	1.31E-15
⁵⁴ Mn	M	particulate										1.99E-07	1.99E-07
⁹³ Mo	M	particulate										1.75E-09	1.75E-09
⁹⁹ Mo	M	particulate										1.74E-08	1.74E-08
²² Na	M	particulate										2.3E-11	2.3E-11
⁹¹ Nb	B	unspecified										9.31E-11	9.31E-11
^{91m} Nb	B	unspecified										1.08E-15	1.08E-15
⁹² Nb	B	unspecified										4.48E-15	4.48E-15
^{92m} Nb	B	unspecified										9.14E-29	9.14E-29
^{93m} Nb	M	particulate										1.47E-09	1.47E-09
⁹⁴ Nb	M	particulate										1.82E-08	1.82E-08
⁹⁵ Nb	M	particulate										2.1E-08	2.1E-08
^{95m} Nb	M	particulate										6.62E-61	6.62E-61
⁹⁶ Nb	M	particulate										9.67E-11	9.67E-11
⁹⁷ Nb	M	particulate										5.95E-11	5.95E-11

Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
¹⁴⁰ Nd	B	unspecified									5.94E-95	5.94E-95
¹⁴⁴ Nd	B	unspecified									1.25E-20	1.25E-20
¹⁴⁷ Nd	M	particulate									1.13E-08	1.13E-08
⁵⁶ Ni	M	particulate									1.08E-89	1.08E-89
⁵⁹ Ni	M	particulate									3.03E-10	3.03E-10
⁶³ Ni	M	particulate									1.37E-07	1.37E-07
²³⁴ Np	M	particulate									1.62E-79	1.62E-79
²³⁵ Np	M	particulate									7.29E-15	7.29E-15
²³⁶ Np	M	particulate									1.45E-18	1.45E-18
²³⁷ Np	M	particulate									9.12E-08	9.12E-08
²³⁸ Np	M	particulate									1.22E-101	1.22E-101
²³⁹ Np	M	particulate									1.37E-09	1.37E-09
¹⁸⁵ Os	M	particulate									4.2E-19	4.2E-19
¹⁹¹ Os	M	particulate				1.06E-02						1.06E-02
¹⁹⁴ Os	M	particulate									2.24E-13	2.24E-13
³² P	M	particulate									7.13E-17	7.13E-17
³³ P	M	particulate									6.66E-18	6.66E-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									1.54E-16	1.54E-16
²³² Pa	M	particulate									1.4E-10	1.4E-10
²³³ Pa	M	particulate									5.9E-08	5.9E-08
²⁰⁵ Pb	M	particulate									1.83E-20	1.83E-20
²¹⁰ Pb	M	particulate									4.67E-21	4.67E-21
²¹¹ Pb	M	particulate									3.42E-11	3.42E-11
²¹² Pb	M	particulate	2.87E-01	3.5E-01		3.77E-02			3.22E-02		4.85E-08	7.07E-01
²¹² Pb	S	particulate			6.37E+00		1.15E+00				1.16E-01	7.64E+00
²¹⁴ Pb	S	particulate			6.81E-01							6.81E-01
²¹⁴ Pb	M	particulate				4.9E-03						4.9E-03
¹⁰³ Pd	M	particulate									3.26E-28	3.26E-28

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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									8.16E-13	8.16E-13
¹⁴³ Pm	M	particulate									1.11E-23	1.11E-23
¹⁴⁴ Pm	M	particulate									2.06E-21	2.06E-21
¹⁴⁵ Pm	M	particulate									2.53E-11	2.53E-11
¹⁴⁶ Pm	M	particulate									1.59E-11	1.59E-11
¹⁴⁷ Pm	M	particulate									2.75E-06	2.75E-06
¹⁴⁸ Pm	M	particulate									1.13E-08	1.13E-08
^{148m} Pm	M	particulate									1.04E-08	1.04E-08
²⁰⁸ Po	B	unspecified									3.8E-32	3.8E-32
²⁰⁹ Po	B	unspecified									1.95E-29	1.95E-29
²¹⁰ Po	B	inorganic									5.31E-16	5.31E-16
¹⁴³ Pr	M	particulate									1.63E-15	1.63E-15
¹⁴⁴ Pr	M	particulate									1.25E-06	1.25E-06
¹⁹³ Pt	M	particulate									3.4E-12	3.4E-12
²³⁶ Pu	M	particulate									1.43E-09	1.43E-09
²³⁷ Pu	M	particulate									3.54E-12	3.54E-12
²³⁸ Pu	M	particulate	1.23E-08	7.89E-08		3.01E-10			1.34E-08		7.09E-07	8.14E-07
²³⁸ Pu	F	particulate			8.32E-08		8.49E-09	1.21E-07			1.39E-09	2.14E-07
²³⁹ Pu	M	particulate	1.94E-08	5.35E-07		3.21E-10			3.37E-09		1.4E-06	1.96E-06
²³⁹ Pu	F	particulate			3.29E-07		9.5E-09	2.47E-08			1.29E-06	1.65E-06
²⁴⁰ Pu	M	particulate	1.94E-08	5.35E-07		3.21E-10			3.37E-09		1.96E-07	7.54E-07
²⁴⁰ Pu	F	particulate			3.29E-07		9.5E-09	2.47E-08			5.68E-10	3.64E-07
²⁴¹ Pu	M	particulate									5.55E-07	5.55E-07
²⁴² Pu	M	particulate									5.69E-10	5.69E-10
²⁴³ Pu	M	particulate									3.87E-20	3.87E-20
²⁴⁴ Pu	M	particulate									3.13E-10	3.13E-10
²⁴⁶ Pu	M	particulate									1.32E-43	1.32E-43
²²³ Ra	M	particulate									2.34E-08	2.34E-08
²²⁴ Ra	M	particulate									4.98E-09	4.98E-09
²²⁵ Ra	M	particulate									1.09E-09	1.09E-09

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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									1.06E-08	1.06E-08
²²⁸ Ra	M	particulate									5.5E-14	5.5E-14
⁸³ Rb	M	particulate									2.01E-16	2.01E-16
⁸⁴ Rb	M	particulate									1.41E-21	1.41E-21
⁸⁶ Rb	M	particulate									6.26E-23	6.26E-23
⁸⁷ Rb	M	particulate									2.48E-16	2.48E-16
¹⁸³ Re	B	unspecified									1.53E-25	1.53E-25
¹⁸⁴ Re	M	particulate									5.45E-27	5.45E-27
^{184m} Re	M	particulate									5.74E-16	5.74E-16
^{186m} Re	M	particulate									2.48E-15	2.48E-15
¹⁸⁷ Re	M	particulate									1.68E-21	1.68E-21
⁹⁹ Rh	M	particulate									1.73E-39	1.73E-39
¹⁰¹ Rh	M	particulate									4.96E-19	4.96E-19
^{101m} Rh	M	particulate									2.56E-76	2.56E-76
¹⁰² Rh	M	particulate									5.31E-12	5.31E-12
^{102m} Rh	M	particulate									3.42E-15	3.42E-15
^{103m} Rh	M	particulate									1.4E-12	1.4E-12
¹⁰⁵ Rh	M	particulate									5.57E-09	5.57E-09
¹⁰⁶ Rh	B	unspecified									7.02E-07	7.02E-07
²¹⁹ Rn	B	unspecified									5.43E-07	5.43E-07
²²² Rn	B	unspecified									1.7E-05	1.7E-05
¹⁰³ Ru	M	particulate									3.64E-08	3.64E-08
¹⁰⁶ Ru	M	particulate									9.37E-07	9.37E-07
³⁵ S	M	particulate									2.78E-13	2.78E-13
^{120m} Sb	M	particulate									1.46E-09	1.46E-09
¹²² Sb	M	particulate				1.81E-03					3.E-09	1.81E-03
¹²⁴ Sb	M	particulate				4.33E-03					1.99E-09	4.33E-03
¹²⁵ Sb	M	particulate				4.7E-04					5.35E-08	4.7E-04
¹²⁶ Sb	M	particulate				8.25E-03					5.45E-09	8.25E-03
^{126m} Sb	M	particulate									2.4E-12	2.4E-12

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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 Sb	M	particulate									4.54E-09	4.54E-09
⁴⁶ Sc	M	particulate									1.16E-13	1.16E-13
⁴⁷ Sc	M	particulate									1.05E-90	1.05E-90
⁷² Se	B	unspecified									4.02E-63	4.02E-63
⁷⁵ Se	F	particulate				1.88E-07					3.51E-15	1.88E-07
⁷⁹ Se	F	particulate									9.35E-13	9.35E-13
³² Si	M	particulate									1.81E-13	1.81E-13
¹⁴⁵ Sm	M	particulate									5.56E-16	5.56E-16
¹⁴⁶ Sm	M	particulate									9.79E-19	9.79E-19
¹⁴⁷ Sm	M	particulate									2.61E-17	2.61E-17
¹⁴⁸ Sm	B	unspecified									2.18E-24	2.18E-24
¹⁵¹ Sm	M	particulate									1.86E-09	1.86E-09
¹¹³ Sn	M	particulate									8.78E-09	8.78E-09
^{117m} Sn	M	particulate									1.58E-06	1.58E-06
^{119m} Sn	M	particulate									8.08E-10	8.08E-10
¹²¹ Sn	M	particulate									1.48E-12	1.48E-12
^{121m} Sn	M	particulate									1.11E-11	1.11E-11
¹²³ Sn	M	particulate									1.59E-10	1.59E-10
¹²⁵ Sn	M	particulate									3.63E-09	3.63E-09
¹²⁶ Sn	M	particulate									2.42E-12	2.42E-12
⁸² Sr	M	particulate									1.49E-52	1.49E-52
⁸⁵ Sr	M	particulate									5.87E-16	5.87E-16
⁸⁹ Sr	S	particulate			5.15E-06		1.66E-08				9.35E-08	5.26E-06
⁸⁹ Sr	M	particulate	5.1E-08	1.54E-06		1.38E-08			7.E-06		7.18E-07	9.32E-06
⁹⁰ Sr	M	particulate	5.1E-08	1.54E-06		1.38E-08			7.E-06		9.92E-05	1.08E-04
⁹⁰ Sr	S	particulate			5.15E-06		1.66E-08	1.38E-06			9.83E-08	6.64E-06
⁹¹ Sr	M	particulate									1.19E-13	1.19E-13
¹⁷⁹ Ta	M	particulate									1.07E-11	1.07E-11
¹⁸² Ta	M	particulate									2.64E-05	2.64E-05
¹⁵⁵ Tb	M	particulate									2.48E-67	2.48E-67

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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			
¹⁵⁶ Tb	M	particulate										1.19E-65	1.19E-65
¹⁵⁷ Tb	M	particulate										3.5E-19	3.5E-19
¹⁵⁸ Tb	M	particulate										6.38E-16	6.38E-16
¹⁶⁰ Tb	M	particulate										7.29E-13	7.29E-13
¹⁶¹ Tb	M	particulate										1.75E-47	1.75E-47
^{95m} Tc	M	particulate										5.92E-27	5.92E-27
⁹⁶ Tc	M	particulate										1.97E-10	1.97E-10
⁹⁷ Tc	M	particulate										4.75E-18	4.75E-18
^{97m} Tc	M	particulate										2.14E-16	2.14E-16
⁹⁸ Tc	M	particulate										3.55E-17	3.55E-17
⁹⁹ Tc	M	particulate										7.96E-10	7.96E-10
⁹⁹ Tc	S	particulate							2.19E-06				2.19E-06
¹¹⁸ Te	B	unspecified										2.22E-72	2.22E-72
^{119m} Te	B	unspecified										5.82E-82	5.82E-82
¹²¹ Te	M	particulate										4.05E-10	4.05E-10
^{121m} Te	M	particulate										5.41E-11	5.41E-11
^{123m} Te	M	particulate										8.16E-07	8.16E-07
^{125m} Te	M	particulate										1.6E-07	1.6E-07
¹²⁷ Te	M	particulate										1.08E-10	1.08E-10
^{127m} Te	M	particulate				3.22E-06						1.13E-10	3.22E-06
¹²⁹ Te	M	particulate										1.84E-15	1.84E-15
^{129m} Te	M	particulate				3.71E-06						6.73E-08	3.78E-06
^{131m} Te	M	particulate										9.13E-10	9.13E-10
¹³² Te	M	particulate										3.03E-09	3.03E-09
²²⁷ Th	S	particulate										1.56E-08	1.56E-08
²²⁸ Th	S	particulate	6.32E-10	5.08E-08	2.85E-08	4.15E-09	5.04E-09		2.53E-08			7.07E-06	7.18E-06
²²⁹ Th	S	particulate										5.31E-10	5.31E-10
²³⁰ Th	S	particulate	1.43E-09	1.88E-09		4.77E-10			3.86E-09			3.4E-09	1.1E-08
²³⁰ Th	F	particulate			1.18E-08		4.34E-10					9.97E-10	1.32E-08
²³¹ Th	S	particulate										3.58E-14	3.58E-14

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
²³² Th	S	particulate	1.02E-09	1.12E-08		6.12E-10				6.81E-09	1.28E-08	3.24E-08
²³² Th	F	particulate			2.14E-08		1.64E-09				1.53E-09	2.46E-08
²³⁴ Th	S	particulate									3.11E-13	3.11E-13
⁴⁴ Ti	M	particulate									3.87E-12	3.87E-12
²⁰⁴ Tl	M	particulate									4.56E-18	4.56E-18
²⁰⁸ Tl	B	unspecified									7.02E-12	7.02E-12
¹⁶⁷ Tm	M	particulate									1.56E-48	1.56E-48
¹⁶⁸ Tm	B	unspecified									1.82E-21	1.82E-21
¹⁷⁰ Tm	M	particulate									2.39E-14	2.39E-14
¹⁷¹ Tm	M	particulate									2.67E-09	2.67E-09
²³⁰ U	M	particulate									2.06E-31	2.06E-31
²³¹ U	M	particulate									4.24E-79	4.24E-79
²³² U	M	particulate									6.84E-14	6.84E-14
²³³ U	M	particulate	3.01E-08	4.5E-07		4.59E-10				5.4E-09	3.4E-07	8.25E-07
²³³ U	S	particulate			1.03E-06		9.52E-09				1.47E-08	1.05E-06
²³⁴ U	M	particulate	3.01E-08	4.5E-07		4.59E-10				5.4E-09	7.42E-05	7.47E-05
²³⁴ U	S	particulate			1.03E-06		9.52E-09				1.47E-08	1.05E-06
²³⁵ U	M	particulate		1.27E-08						5.45E-10	1.94E-05	1.94E-05
²³⁵ U	S	particulate			8.44E-09						8.92E-11	8.53E-09
²³⁶ U	M	particulate									2.77E-12	2.77E-12
²³⁷ U	M	particulate									1.38E-16	1.38E-16
²³⁸ U	M	particulate	3.E-09	5.82E-08		2.23E-09				1.42E-08	4.45E-04	4.45E-04
²³⁸ U	S	particulate			2.62E-08		1.94E-09				3.58E-09	3.17E-08
²⁴⁰ U	M	particulate									4.6E-19	4.6E-19
⁴⁸ V	M	particulate									2.5E-23	2.5E-23
⁴⁹ V	M	particulate									1.05E-11	1.05E-11
⁵⁰ V	B	unspecified									7.84E-28	7.84E-28
¹⁸¹ W	M	particulate									2.15E-13	2.15E-13
¹⁸⁵ W	M	particulate									1.77E-11	1.77E-11
¹⁸⁸ W	M	particulate									7.41E-14	7.41E-14

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Table G.1. Radiological airborne emissions from all sources at ORNL, 2022 (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		
¹²³ Xe	B	unspecified									1.57E+02	1.57E+02
¹²⁵ Xe	B	unspecified									9.13E+01	9.13E+01
¹²⁷ Xe	B	unspecified									3.63E-03	3.63E-03
^{131m} Xe	B	unspecified							1.59E+02		1.64E-05	1.59E+02
¹³³ Xe	B	unspecified				3.27E-02			8.43E+00		4.52E-09	8.46E+00
^{133m} Xe	B	unspecified							2.61E+01			2.61E+01
¹³⁵ Xe	B	unspecified							6.17E+01			6.17E+01
^{135m} Xe	B	unspecified							4.5E+01			4.5E+01
¹³⁷ Xe	B	unspecified							9.1E+01			9.1E+01
¹³⁸ Xe	B	unspecified							2.16E+02			2.16E+02
⁸⁷ Y	M	particulate									2.98E-93	2.98E-93
⁸⁸ Y	M	particulate									1.E-10	1.E-10
⁹⁰ Y	M	particulate									8.22E-07	8.22E-07
⁹¹ Y	M	particulate									2.91E-10	2.91E-10
¹⁶⁹ Yb	M	particulate									2.77E-09	2.77E-09
⁶⁵ Zn	M	particulate									1.31E-06	1.31E-06
⁸⁸ Zr	M	particulate									2.1E-15	2.1E-15
⁸⁹ Zr	M	particulate									2.9E-89	2.9E-89
⁹³ Zr	M	particulate									2.28E-11	2.28E-11
⁹⁵ Zr	M	particulate									1.52E-08	1.52E-08
⁹⁷ Zr	M	particulate									3.72E-11	3.72E-11
Totals			3.19E-01	3.50E-01	7.40E+00	1.43E-01	1.89E+00	5.65E-06	2.50E+03	1.50E+04	2.54E+02	1.77E+04

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

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