Appendix C Additional Monitoring Results

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C. Additional Monitoring Results

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This appendix contains additional information on monitoring results and supplements data summarized in the main body of the report.

Table C.1. Radionuclide Concentrations in FFTF Pond Water

Isotope	2014				2009 - 2013			
	No. of Samples	No. of Detects	Average[a] *pCi/L* [c]	Maximum[b] *pCi/L* [c]	No. of Samples	No. of Detects	Average[a] *pCi/L* [c]	Maximum[b] *pCi/L* [c]
Antimony-125[d]	5	0	-2.5E-00	1.6E+00 ± 6.8E+00	24	0	-4.8E-01 ± 4.9E+00	4.4E+00 ± 5.4E+00
Cesium-134 [d]	5	0	9.3E-02	1.8E+00 ± 1.8E+00	24	0	0.80E+00± 2.2E+00	3.0E+00 ± 3.0E+00
Cesium-137 [d]	5	0	1.5E-01	0.53E+00 ± 1.9E+00	24	0	-1.8E-02 ± 2.2E+00	2.9E+00 ± 2.5E+00
Cobalt-60[c]	5	0	4.4E-01	2.4E+00 ± 2.3E+00	24	0	2.4E-01± 1.6E+00	1.7E+00 ± 2.1E+00
Europium-152 [d]	5	0	1.9E+00	4.9E+00 ± 7.4E+00	24	0	1.45+E00± 5.7E+00	6.9E+00 ± 6.5E+00
Europium-154 [d]	5	0	0.89E+00	2.2E+00 ± 4.9E+00	24	0	-0.36E+00 ± 5.4E+00	6.7E+00 ± 7.0E+00
Europium-155[d]	5	0	-2.4E+00	1.7+00 ± 7.3E+00	24	0	-1.2E+00 ± 9.1E+00	8.5E+00 ± 1.0E+01
Gross Alpha [d]	5	0	0.10E+00	0.58E+00± 0.98E+00	24	2	8.2E-01 ± 1.8E+00	3.1E+00 ± 1.8E+00
Gross Beta	5	5	9.2E+00	11.7E+00 ± 2.6E+00	24	24	8.4E+00 ± 7.6E+00	1.9E+01 ± 3.3E+00
Tritium	5	5	11.9E+02	13.3E+02 ± 3.3E+02	24	24	2.9E+03 ± 6.3E+03	1.2E+04 ± 2.5E+03
Potassium-40[d]	5	0	11.4E+00	24.4E+00 ± 35.8E+00	24	0	6.7E+00 ± 4.8E+01	7.6E+01 ± 3.5E+01
Ruthenium-106[d]	5	0	3.5E+00	22.5E+00 ± 33.1E+00	24	0	2.2E+00 ± 1.4E+01	1.6E+01 ± 1.7E+01

[a] Average ± two standard deviations.
[b] Maximum ± analytical uncertainty.
[c] 1pCi = 0.037 Bq.
[d] Maximum value reported is a non-detect.

Table C.2 Radionuclide Concentrations in West Lake Sediment

Radionuclide	2014		2009-2013		
	No. of Samples	Concentration *pCi/g*[a] Result[b]	No. of Samples	Concentration *pCi/g*[a] Average[c]	Concentration *pCi/g*[a] Maximum[b]
Antimony-125	1	-2.7E-02 ± 7.0E-02[d]	6	1.0E-02 ± 3.0E-02[d]	3.6E-02 ± 4.6E-02[d]
Cesium-134	1	1.2E-02 ± 4.0E-02[d]	6	4.8E-02 ± 5.6E-02 [d]	9.7E-02 ± 5.6E-02 [d]
Cesium-137	1	4.4E-01 ± 7.7E-02	6	1.2E+00 ± 4.5E-01	1.9E+00 ± 1.6E-01
Cobalt-60	1	-2.3E-03 ± 3.2E-02[d]	6	-1.4-03 ± 1.2E-02[d]	8.6E-03 ± 1.7E-02[d]
Europium-152	1	5.4E-02 ± 8.0E-02[d]	6	-6.4E-03 ± 4.2E-02[d]	2.5E-02 ± 5.8E-02[d]
Europium-154	1	-3.8E-02 ± 9.7E-02[d]	6	-1.2E-02 ± 9.2E-02[d]	4.7E-02 ± 6.0E-02[d]
Europium-155	1	-2.5E-02 ± 1.0E-01[d]	6	5.3E-02 ± 4.6E-02 [d]	8.5E-02 ± 8.6E-02 [d]
Gross Alpha	1	9.9E+00± 2.1E+00[d]	6	9.0E+00 ± 7.9E+00	12.2E+00 ± 3.1E+00
Gross Beta	1	20.9E+00 ± 2.6E+00	6	2.3E+01 ± 14E+00	3.1E+01 ± 5.4E+00
Potassium-40	1	6.3E+00 ± 1.0E+00	6	1.6E+01 ± 4.8E+00	1.9E+01 ± 2.0E+00
Ruthenium-106	1	-2.3E-01 ± 3.2E-01[d]	6	7.2E-03 ± 1.6E-01[d]	1.2E-01 ± 1.5E-01[d]
Strontium-90	1	3.1E-02 ± 2.4E-02 [d]	6	3.3E-01 ± 2.4E-01	4.9E-01 ± 9.7E-02
Technetium-99	1	1.2E-02 ± 4.7E-01[d]	6	-1.4E-01 ± 4.0E-01[d]	1.4E-01 ± 4.7E-01[d]
Uranium-234	1	7.6E+00± 1.1E+00	6	2.8E+00 ± 3.9E+00	6.4E+00 ± 8.7E-01
Uranium-235	1	3.2E-01 ± 8.9E-02	6	1.6E-01 ± 2.0E-01	3.6E-01 ± 6.8E-02
Uranium-238	1	6.8E+00 ± 1.0E+00	6	2.7E+00 ± 3.7E+00	6.1E+00 ± 8.3E-01

[a] 1 pCi = 0.037 Bq.
[b] Result and maximum values are ± total propagated analytical uncertainty (2 Sigma).
[c] Averages are ±2 standard deviations of the mean. Average values calculated using reporting limit values for all results at or below minimum detectable concentrations.
[d] Result was below detection limit.
[e] No result available.

Table C.3. Radionuclide Concentrations in West Lake Seep Water (2014 and 2012, 2013)

Radionuclide	2014			2012 and 2013			DOE-Derived Concentration Guides/Standards	Washington State Ambient Surface Water Quality Standard[d]
	No. of Samples	Concentration[a] Average[b] pCi/L	Concentration[a] Maximum[c] pCi/L	No. of Samples	Concentration[a] Average[b] pCi/L	Concentration[a] Maximum[c] pCi/L		
Tritium	1	[f]	17.7E+01 ± 14.5E+01	1	[f]	6.9E+02 ± 21.0+01	2,000,000	20,000[d,e]
Uranium-234	1	[f]	6.2E+01 ± 11E+00	2	26.0E+01 ± 7.0E+01	26.3E+01 ± 38.1E+00	500	—
Uranium-235	1	[f]	3.1E+00 ± 0.68E+00	2	13.0E+00 ± 1.5E+00	13.8E+00 ± 4.3E+00	600	—
Uranium-238	1	[f]	5.8E+01 ± 10E+00	2	24.4E+01 ± 13E+00	23.7E+01 ± 34.4E+00	600	—

[a] 1 pCi = 0.037 Bq.
b Averages are ±2 standard deviations of the mean. Average values calculated using reporting limit values for all results at or below minimum detectable concentrations.
c Maximum values are ± total propagated analytical uncertainty.
d WAC 246-290, 40 CFR 141. Dashes indicate no concentration guides available.
e WAC 173-201A-250 and EPA-570/9-76-003.
f Average values are not calculated when only one sample was analyzed; 2012 West Lake Seep Water did not have tritium analyses performed.

Table C.4. Radionuclide Concentrations in West Lake Surface Water (2014 and 2012, 2013)

Radionuclide	2014			2012 and 2013			DOE-Derived Concentration Guides/Standards	Washington State Ambient Surface Water Quality Standard[d]
	No. of Samples	Concentration[a] Average[b] *pCi/L*	Concentration[a] Maximum[c] *pCi/L*	No. of Samples	Concentration[a] Average[b] *pCi/L*	Concentration[a] Maximum[c] *pCi/L*		
Tritium	1	---[f]	9.6E+01 ± 15.0E+01	2	23.7E+00 ± 1.2E+00	24.3E+00 ± 13.5E+01	2,000,000	20,000[d,e]
Uranium-234	1	---[f]	65.8E+02 ± 10.7E+01	2	19.3E+02 ± 38.3E+02	38.5E+02 ± 52.5E+01	500	—
Uranium-235	1	---[f]	24.8E+01 ± 93.7E+00	2	73.8E+00 ± 14.6E+01	14.7E+01 ± 4.7E+01	600	—
Uranium-238	1	---[f]	63.8E+02 ± 10.4E+01	2	18.3E+02 ± 36.4E+02	36.5E+02 ± 5.0E+02	600	—

[a] 1 pCi = 0.037 Bq.
[b] Averages are ±2 standard deviations of the mean. Average values calculated using reporting limit values for all results at or below minimum detectable concentrations.
[c] Maximum values are ± total propagated analytical uncertainty.
[d] WAC 246-290, 40 CFR 141. Dashes indicate no concentration guides available.
[e] WAC 173-201A-250 and EPA-570/9-76-003.
[f] Average values are not calculated when only one sample was analyzed.

Table C.5. Concentrations of Selected Radionuclides (pCi/m^3)[a] in Onsite Air Samples, 2014 Compared to Previous Years

Radionuclide	Site	2014					2009 – 2013				EPA Table 2[e,f]
		No. of Samples	Detections[b]	Average[c]	Maximum[d]	Sampler	No of Samples	Detections[b]	Average[c]	Maximum[d]	
Gross alpha	100-K Area	187	181	1.7E-03 ± 2.7E-03	7.8E-03 ± 1.3E-03	N534	E	1094	1.2E-03 ± 2.0E-03	2.0E-02 ± 2.5E-03	2.0E-02
	100-N D4	14	14	3.1E-03 ± 5.8E-03	9.3E-03 ± 6.6E-03	N106	381	360	1.2E-03 ± 1.5E-03	5.5E-03 ± 1.4E-03	
	200-East	555	550	1.8E-03 ± 2.5E-03	6.8E-03 ± 1.1E-03	N480	2734	2607	1.2E-03 ± 1.3E-03	6.6E-03 ± 1.1E-03	
	200-West	597	595	1.8E-03 ± 2.5E-03	9.2E-03 ± 1.6E-03	N304	3126	2947	1.2E-03 ± 1.5E-03	1.4E-02 ± 2.0E-03	
	300 D4	162	149	1.1E-03 ± 1.5E-03	4.1E-03 ± 8.0E-04	N903	771	706	8.3E-04 ± 1.1E-03	3.9E-03 ± 1.5E-03	
	618-10 BG	103	103	1.5E-03 ± 1.5E-03	6.0E-03 ± 1.3E-03	N548	331	304	1.1E-03 ± 2.5E-03	1.6E-02 ± 2.3E-03	
	ERDF	133	133	1.4E-03 ± 2.0E-03	5.6E-03 ± 9.7E-04	N168	652	601	1.0E-03 ± 1.2E-03	5.1E-03 ± 1.1E-03	
Gross beta	100-K Area	189	189	1.9E-02 ± 2.2E-02	6.1E-02 ± 4.8E-03	N900	1168	1167	2.4E-02 ± 1.1E-01	1.2E+00 ± 8.4E-02	9.0E+00
	100-N D4	14	14	2.8E-02 ± 5.7E-02	1.2E-01 ± 1.7E-02	N106	381	381	1.7E-02 ± 2.0E-02	6.9E-02 ± 6.4E-03	
	200-East	555	554	1.8E-02 ± 2.1E-02	6.0E-02 ± 4.9E-03	N499	2734	2734	1.7E-02 ± 2.2E-02	1.2E-01 ± 9.0E-03	
	200-West	597	597	1.8E-02 ± 2.1E-02	7.5E-02 ± 6.2E-03	N304	3126	3124	1.7E-02 ± 2.1E-02	1.0E-01 ± 2.3E-02	
	300 D4	162	162	2.2E-02 ± 2.6E-02	7.3E-02 ± 6.3E-03	N903	776	776	2.0E-02 ± 2.6E-02	1.1E-01 ± 1.2E-02	
	618-10 BG	103	103	1.9E-02 ± 2.0E-02	5.1E-02 ± 8.6E-03	N580	331	330	1.6E-02 ± 2.6E-02	1.1E-01 ± 9.0E-03	
	ERDF	133	133	1.6E-02 ± 2.0E-02	5.6E-02 ± 4.7E-03	N963	652	651	1.5E-02 ± 2.0E-02	7.6E-02 ± 5.8E-03	
Strontium-90	100-K Area	14	0	1.9E-05 ± 3.8E-04	3.6E-04 ± 2.9E-04	N476	102	20	6.3E-04 ± 4.9E-03	1.5E-02 ± 4.4E-03	1.9E-02
	100-N D4	3	0	2.4E-03 ± 3.5E-03	4.3E-03 ± 5.8E-03	N106	30	4	7.4E-06 ± 4.3E-04	5.7E-04 ± 2.3E-04	
	200-East	42	0	5.2E-05 ± 3.2E-04	3.9E-04 ± 4.5E-04	N984	210	37	-7.4E-06 ± 4.3E-04	1.7E-03 ± 5.7E-04	
	200-West	46	0	2.7E-05 ± 3.5E-04	5.5E-04 ± 4.7E-04	N964	243	25	-6.2E-05 ± 3.5E-04	5.0E-04 ± 3.9E-04	
	300 D4	10	0	1.2E-05 ± 3.3E-04	4.1E-04 ± 3.0E-04	N557	43	2	-8.8E-05 ± 4.8E-04	3.4E-04 ± 2.7E-04	
	618-10 BG	8	0	8.9E-05 ± 1.0E-04	1.9E-04 ± 1.6E-04	N579	32	4	-2.9E-05 ± 5.5E-04	3.7E-04 ± 3.2E-04	
	ERDF	10	0	1.1E-04 ± 2.7E-04	3.3E-04 ± 3.6E-04	N517	50	5	-5.1E-05 ± 3.1E-04	3.1E-04 ± 1.1E-04	
Cesium-134	100-K Area	14	0	4.7E-05 ± 4.0E-04	5.0E-04 ± 4.1E-04	N900	102	7	9.6E-06 ± 3.4E-04	3.3E-04 ± 1.7E-04	2.7E-02
	100-N D4	3	0	-2.1E-03 ± 1.3E-02	5.0E-03 ± 9.2E-03	N106	30	3	-2.6E-05 ± 2.9E-04	3.3E-04 ± 1.5E-04	
	200-East	42	0	-2.0E-05 ± 4.3E-04	6.8E-04 ± 6.4E-04	N978	210	19	3.3E-06 ± 2.8E-04	5.2E-04 ± 2.1E-04	
	200-West	46	0	3.9E-05 ± 5.0E-04	6.2E-04 ± 5.5E-04	N155	244	23	-9.0E-06 ± 3.1E-04	5.2E-04 ± 4.0E-04	
	300 D4	10	0	4.6E-05 ± 1.8E-04	2.1E-04 ± 3.2E-04	N904	44	0	4.6E-05 ± 3.8E-04	4.8E-04 ± 1.5E-03	
	618-10 BG	8	0	1.2E-05 ± 2.0E-04	2.3E-04 ± 2.1E-04	N548	32	3	-5.6E-05 ± 4.5E-04	6.8E-04 ± 2.3E-04	
	ERDF	10	0	2.5E-05 ± 1.8E-04	1.6E-04 ± 3.2E-04	N963	50	2	1.9E-05 ± 2.9E-04	5.8E-04 ± 4.5E-04	
Cesium-137	100-K Area	14	0	9.4E-05 ± 3.5E-04	4.1E-04 ± 3.7E-04	N534	102	44	5.1E-03 ± 3.7E-02	1.2E-01 ± 3.9E-02	1.9E-02
	100-N D4	3	0	-3.0E-04 ± 7.1E-03	3.8E-03 ± 8.2E-03	N102	30	12	3.1E-04 ± 9.5E-04	1.9E-03 ± 6.5E-04	
	200-East	42	1	9.7E-05 ± 4.1E-04	6.9E-04 ± 3.8E-04	N999	210	49	2.6E-04 ± 2.7E-03	1.9E-02 ± 6.2E-03	
	200-West	45	0	5.7E-05 ± 3.3E-04	4.0E-04 ± 4.5E-04	N168	244	32	5.5E-05 ± 2.8E-04	7.6E-04 ± 3.8E-04	
	300 D4	10	1	1.0E-04 ± 4.8E-04	6.5E-04 ± 5.1E-04	N904	44	2	1.0E-04 ± 3.1E-04	5.3E-04 ± 2.7E-04	
	618-10 BG	8	0	1.6E-05 ± 2.1E-04	1.8E-04 ± 1.9E-04	N548	32	4	8.1E-05 ± 5.1E-04	1.2E-03 ± 4.0E-04	
	ERDF	10	0	9.1E-05 ± 2.6E-04	4.0E-04 ± 4.5E-04	N168	50	7	6.6E-05 ± 2.1E-04	3.8E-04 ± 1.5E-04	
Plutonium-238	100-K Area	13	0	4.0E-07 ± 3.0E-06	5.0E-06 ± 4.6E-06	N534	99	5	7.0E-06 ± 4.5E-05	1.5E-04 ± 7.1E-05	2.1E-03
	100-N D4	2	0	-3.4E-05 ± 2.2E-05	-2.3E-05 ± 2.3E-04	N106	30	0	2.1E-06 ± 1.1E-05	1.9E-05 ± 1.8E-05	
	200-East	36	0	-2.1E-08 ± 1.9E-06	1.6E-06 ± 3.0E-06	N968	210	3	1.4E-06 ± 9.5E-06	3.6E-05 ± 3.0E-05	
	200-West	35	0	-1.1E-07 ± 2.0E-06	2.4E-06 ± 2.9E-06	N165	244	9	1.5E-06 ± 1.1E-05	3.7E-05 ± 1.9E-05	

Table C.5. Concentrations of Selected Radionuclides (pCi/m^3)[a] in Onsite Air Samples, 2014 Compared to Previous Years

Radionuclide	Site	2014					2009 – 2013				EPA Table 2[e,f]
		No. of Samples	Detections[b]	Average[c]	Maximum[d]	Sampler	No of Samples	Detections[b]	Average[c]	Maximum[d]	
	300 D4	10	0	1.4E-06 ± 6.7E-06	1.0E-05 ± 1.5E-05	N557	40	3	1.8E-06 ± 1.3E-05	2.3E-05 ± 2.8E-05	
	618-10 BG	8	0	3.6E-06 ± 9.8E-06	1.2E-05 ± 1.7E-05	N548	32	2	3.1E-06 ± 1.8E-05	4.6E-05 ± 2.2E-05	
	ERDF	10	0	4.9E-07 ± 4.0E-06	4.4E-06 ± 1.8E-05	N517	50	1	1.3E-06 ± 8.5E-06	1.6E-05 ± 8.3E-06	
Plutonium-239/240u	100-K Area	12	0	1.3E-06 ± 2.4E-06	3.3E-06 ± 3.2E-06	N576	102	46	5.0E-05 ± 3.3E-04	1.2E-03 ± 4.7E-04	2.0E-03
	100-N D4	2	0	2.4E-04 ± 5.0E-06	2.4E-04 ± 5.8E-04	N106	30	13	7.6E-06 ± 1.8E-05	3.9E-05 ± 1.8E-05	
	200-East	36	0	1.9E-07 ± 2.2E-06	2.6E-06 ± 3.7E-06	N532	210	20	1.9E-06 ± 6.3E-06	3.1E-05 ± 1.5E-05	
	200-West	43	4	3.5E-06 ± 2.2E-05	6.3E-05 ± 2.1E-05	N165	244	85	1.8E-05 ± 1.1E-04	4.5E-04 ± 1.6E-04	
	300 D4	10	0	7.9E-07 ± 3.0E-06	4.4E-06 ± 4.1E-06	N902	41	3	2.2E-06 ± 1.1E-05	2.9E-05 ± 1.7E-05	
	618-10 BG	8	6	9.9E-05 ± 2.9E-04	4.6E-04 ± 1.7E-04	N548	32	16	6.2E-05 ± 2.6E-04	6.8E-04 ± 2.6E-04	
	ERDF	10	0	2.0E-06 ± 6.8E-06	1.0E-05 ± 1.8E-05	N517	50	22	6.8E-06 ± 2.1E-05	6.1E-05 ± 2.4E-05	
Uranium-234	100-K Area	12	2	3.2E-06 ± 7.4E-06	1.1E-05 ± 7.7E-06	N576	84	61	1.1E-05 ± 1.3E-05	4.7E-05 ± 3.0E-05	7.7E-03
	100-N D4	3	0	-1.2E-04 ± 5.6E-04	1.5E-04 ± 5.0E-04	N102	30	25	9.0E-06 ± 1.1E-05	1.9E-05 ± 1.2E-05	
	200-East	42	11	4.0E-06 ± 4.7E-06	9.7E-06 ± 6.1E-06	N999	210	156	9.6E-06 ± 9.6E-06	4.4E-05 ± 2.0E-05	
	200-West	45	9	3.6E-06 ± 3.5E-06	8.6E-06 ± 7.5E-06	N994	244	186	2.4E-05 ± 2.8E-04	2.2E-03 ± 7.4E-04	
	300 D4	10	8	4.1E-05 ± 3.9E-05	6.1E-05 ± 2.2E-05	N905	43	34	3.6E-05 ± 4.4E-05	8.8E-05 ± 2.1E-05	
	618-10 BG	8	1	9.5E-06 ± 1.7E-05	2.9E-05 ± 2.4E-05	N548	32	21	1.3E-05 ± 1.5E-05	3.0E-05 ± 1.5E-05	
	ERDF	10	2	1.0E-05 ± 1.2E-05	1.9E-05 ± 2.7E-05	N517	50	42	2.6E-05 ± 1.2E-04	4.3E-04 ± 1.7E-04	
Uranium-235	100-K Area	8	0	3.8E-07 ± 2.3E-06	2.4E-06 ± 3.8E-06	N476	83	8	2.1E-06 ± 7.6E-06	2.6E-05 ± 2.1E-05	7.1E-03
	100-N D4	3	0	1.1E-04 ± 2.0E-04	2.5E-04 ± 5.0E-04	N102	30	2	1.6E-06 ± 4.6E-06	7.2E-06 ± 5.5E-06	
	200-East	33	0	3.8E-07 ± 2.1E-06	2.3E-06 ± 2.9E-06	N984	210	16	1.7E-06 ± 3.7E-06	7.3E-06 ± 7.4E-06	
	200-West	37	0	4.3E-07 ± 2.1E-06	3.0E-06 ± 4.2E-06	N956	243	31	3.7E-06 ± 3.0E-05	2.1E-04 ± 7.8E-05	
	300 D4	9	1	1.7E-06 ± 5.5E-06	5.8E-06 ± 5.9E-06	N918	39	5	4.0E-06 ± 4.8E-06	1.2E-05 ± 4.9E-06	
	618-10 BG	3	0	2.7E-07 ± 1.8E-06	1.5E-06 ± 8.9E-06	N549	32	2	1.9E-06 ± 7.7E-06	1.0E-05 ± 1.1E-05	
	ERDF	6	0	1.3E-06 ± 3.6E-06	4.9E-06 ± 1.1E-05	N517	50	7	3.0E-06 ± 1.5E-05	5.3E-05 ± 2.3E-05	
Uranium-238	100-K Area	12	2	2.3E-06 ± 2.4E-06	5.4E-06 ± 5.1E-06	N535	84	55	8.3E-06 ± 9.7E-06	2.5E-05 ± 2.1E-05	8.3E-03
	100-N D4	3	0	2.8E-04 ± 5.4E-04	6.5E-04 ± 1.2E-03	N106	30	25	7.5E-06 ± 7.4E-06	1.6E-05 ± 9.2E-06	
	200-East	42	14	3.5E-06 ± 4.4E-06	1.2E-05 ± 1.0E-05	N976	210	154	7.6E-06 ± 7.2E-06	2.3E-05 ± 1.1E-05	
	200-West	45	14	3.3E-06 ± 3.4E-06	8.0E-06 ± 6.1E-06	N554	244	182	2.1E-05 ± 2.5E-04	1.9E-03 ± 6.6E-04	
	300 D4	10	9	3.8E-05 ± 2.8E-05	5.3E-05 ± 2.2E-05	N905	43	37	3.2E-05 ± 4.2E-05	8.1E-05 ± 1.9E-05	
	618-10 BG	8	5	5.3E-05 ± 9.6E-05	1.6E-04 ± 7.1E-05	N548	32	22	1.3E-05 ± 1.7E-05	4.3E-05 ± 1.9E-05	
	ERDF	9	0	6.7E-06 ± 1.6E-05	2.1E-05 ± 2.2E-05	N517	50	44	2.4E-05 ± 1.0E-04	3.7E-04 ± 1.4E-04	
Americium-241	100-K Area	13	0	4.3E-05 ± 4.1E-04	7.3E-04 ± 7.3E-04	N900	95	39	2.9E-05 ± 4.8E-04	1.1E-03 ± 3.9E-04	1.9E-03
	100-N D4	3	0	-5.7E-05 ± 7.7E-05	-5.7E-06 ± 1.7E-05	N103	30	18	1.1E-05 ± 2.0E-05	3.9E-05 ± 1.7E-05	
	200-East	42	0	-4.2E-05 ± 1.3E-03	1.0E-03 ± 2.8E-03	N967	20	2	3.1E-06 ± 5.9E-06	9.5E-06 ± 6.0E-06	
	200-West	46	0	-2.2E-04 ± 1.9E-03	2.4E-03 ± 2.3E-03	N965	10	10	4.0E-05 ± 2.9E-05	6.4E-05 ± 2.8E-05	
	300 D4	8	0	1.5E-06 ± 2.4E-06	3.1E-06 ± 3.9E-06	N918	23	3	-2.1E-06 ± 1.7E-03	1.9E-03 ± 2.7E-03	
	618-10 BG	8	3	4.1E-05 ± 9.5E-05	1.6E-04 ± 7.5E-05	N548	24	16	3.7E-05 ± 1.1E-04	2.4E-04 ± 9.4E-05	
Plutonium-241	100-K Area	12	0	-8.7E-05 ± 4.7E-04	2.9E-04 ± 6.9E-04	N534	78	11	6.6E-04 ± 3.0E-03	9.2E-03 ± 2.9E-03	
	200-East	4	0	2.2E-04 ± 4.0E-04	5.4E-04 ± 7.4E-04	N481	20	0	3.9E-05 ± 6.1E-04	7.7E-04 ± 1.1E-03	1.9E-03

Table C.5. Concentrations of Selected Radionuclides (pCi/m^3)[a] in Onsite Air Samples, 2014 Compared to Previous Years

Radionuclide	Site	2014					2009 – 2013				EPA Table 2[e,f]
		No. of Samples	Detections[b]	Average[c]	Maximum[d]	Sampler	No of Samples	Detections[b]	Average[c]	Maximum[d]	

[a] 1 pCi = 0.037 Bq.
[b] Number of samples with measurable concentrations of contaminant.
[c] Average ± two standard deviations of all samples analyzed.
[d] Maximum ± analytical uncertainty
[e] DOE derived concentration guides are shown for gross alpha and gross beta
[f] EPA values are based on an effective dose equivalent of 10 millirem/year (100 micro Sievert) (40 CFR 61, Appendix E, Table 2).
BG = Burial Ground project.
D4 = Deactivation, decontamination, decommissioning, and demolition.
DOE = U.S. Department of Energy.
EPA = Environmental Protection Agency.
ERDF = Environmental Restoration Disposal Facility.

Table C.6. Concentrations of Selected Radionuclides (pCi/m³)[a] in Offsite Air Samples, 2014 Compared to Previous Years

Radionuclide	Location	2014				2009- 2013				EPA Table 2[e,f]
		No. of Samples	No. of Detects[b]	Average[c] pCi/m³	Maximum[d] pCi/m³	No. of Samples	No. of Detects[b]	Average[c] pCi/m³	Maximum[d] pCi/m³	
Gross alpha	Onsite	552	491	1.1E-03 ± 1.8E-03	7.9E-03 ± 1.1E-03	2586	2322	7.6E-04 ± 1.0E-03	4.7E-03 ± 5.0E-04	2.0E-02
	Perimeter	296	263	1.1E-03 ± 2.3E-03	7.7E-03 ± 1.2E-03	1399	1248	7.5E-04 ± 1.1E-03	8.2E-03 ± 1.6E-03	
	Nearby communities	86	81	1.3E-03 ± 2.1E-03	6.0E-03 ± 9.2E-04	386	351	7.4E-04 ± 1.1E-03	4.2E-03 ± 8.3E-04	
	Distant community	27	21	9.2E-04 ± 1.7E-03	4.2E-03 ± 8.5E-04	128	108	6.7E-04 ± 1.0E-03	3.6E-03 ± 7.9E-04	
Gross beta	Onsite	554	554	2.3E-02 ± 2.8E-02	8.4E-02 ± 7.7E-03	2591	2591	2.0E-02 ± 2.6E-02	1.3E-01 ± 1.0E-02	9.0E+00
	Perimeter	296	296	2.3E-02 ± 2.8E-02	8.0E-02 ± 6.4E-03	1400	1400	1.9E-02 ± 2.5E-02	9.5E-02 ± 8.8E-03	
	Nearby communities	188	188	2.3E-02 ± 3.3E-02	1.6E-01 ± 1.6E-02	879	879	1.9E-02 ± 2.5E-02	9.9E-02 ± 9.2E-03	
	Distant community	27	27	2.0E-02 ± 2.2E-02	5.6E-02 ± 4.6E-03	128	128	1.7E-02 ± 2.3E-02	9.5E-02 ± 7.4E-03	
Cesium-137	Onsite	40	1	5.9E-05 ± 3.2E-04	6.5E-04 ± 5.1E-04	203	2	8.9E-05 ± 6.0E-04	1.2E-03 ± 1.0E-03	1.9E-02
	Perimeter	22	0	-7.7E-05 ± 3.5E-04	2.4E-04 ± 5.3E-04	153	3	1.1E-04 ± 1.4E-03	6.9E-03 ± 2.0E-03	
	Nearby communities	14	0	5.2E-05 ± 4.2E-04	3.4E-04 ± 2.6E-04	114	1	7.5E-05 ± 8.2E-04	1.2E-03 ± 7.0E-04	
	Distant community	2	0	9.2E-05 ± 1.8E-04	1.8E-04 ± 3.1E-04	18	0	8.6E-05 ± 7.5E-04	7.7E-04 ± 9.1E-04	
Plutonium-239/240	Onsite	34	0	2.4E-07 ± 2.8E-06	4.4E-06 ± 4.2E-06	184	21	1.6E-06 ± 2.4E-05	1.6E-04 ± 5.2E-05	2.0E-03
	Perimeter	17	1	3.2E-07 ± 3.9E-06	5.3E-06 ± 3.8E-06	109	6	8.4E-07 ± 1.1E-05	5.5E-05 ± 1.3E-05	
	Nearby communities	9	1	1.2E-06 ± 4.3E-06	5.9E-06 ± 4.0E-06	54	6	6.9E-07 ± 5.4E-06	1.6E-05 ± 4.6E-06	
	Distant community	2	0	-1.3E-06 ± 7.1E-07	-9.9E-07 ± 1.5E-06	16	0	1.7E-07 ± 2.3E-06	2.7E-06 ± 2.6E-06	
Strontium-90	Onsite	32	0	-3.9E-06 ± 2.8E-04	3.1E-04 ± 2.7E-04	127	2	1.9E-05 ± 1.4E-04	3.8E-04 ± 2.8E-04	1.9E-02
	Perimeter	18	0	-1.5E-05 ± 2.9E-04	3.7E-04 ± 3.0E-04	116	2	1.6E-05 ± 1.7E-04	4.2E-04 ± 3.3E-04	
	Nearby communities	7	0	-9.0E-06 ± 1.8E-04	8.7E-05 ± 1.7E-04	41	1	3.8E-05 ± 3.1E-04	7.2E-04 ± 1.9E-04	
	Distant community	2	0	1.6E-04 ± 9.9E-05	2.1E-04 ± 2.9E-04	17	0	5.6E-05 ± 3.5E-04	6.7E-04 ± 8.0E-04	
Hydrogen-3	Onsite	126	82	9.9E+00 ± 2.7E+01	8.8E+01 ± 1.8E+01	503	347	8.4E+00 ± 2.5E+01	1.1E+02 ± 1.1E+01	1.5E+03

Table C.6. Concentrations of Selected Radionuclides (pCi/m³)[a] in Offsite Air Samples, 2014 Compared to Previous Years

Radionuclide	Location	2014				2009- 2013				EPA Table 2[e,f]
		No. of Samples	No. of Detects[b]	Average[c] pCi/m³	Maximum[d] pCi/m³	No. of Samples	No. of Detects[b]	Average[c] pCi/m³	Maximum[d] pCi/m³	
	Perimeter	97	50	5.4E+00 ± 9.8E+00	2.2E+01 ± 5.2E+00	441	248	6.4E+00 ± 2.1E+01	9.4E+01 ± 8.9E+00	
	Nearby communities	28	13	6.0E+00 ± 1.3E+01	2.2E+01 ± 4.9E+00	128	77	6.3E+00 ± 1.5E+01	4.8E+01 ± 1.1E+01	
	Distant community	14	4	4.8E+00 ± 1.8E+01	2.9E+01 ± 6.5E+00	65	28	2.3E+00 ± 4.9E+01	7.1E+01 ± 1.2E+01	
Uranium-234	Onsite	26	26	4.0E-05 ± 1.8E-05	6.1E-05 ± 2.2E-05	153	137	4.0E-05 ± 3.2E-05	8.8E-05 ± 2.1E-05	7.7E-03
	Perimeter	8	8	4.8E-05 ± 1.4E-05	5.8E-05 ± 2.0E-05	74	67	4.8E-05 ± 4.0E-05	8.9E-05 ± 2.1E-05	
	Nearby communities	11	11	4.7E-05 ± 1.7E-05	5.9E-05 ± 2.7E-05	77	68	4.6E-05 ± 3.0E-05	8.7E-05 ± 1.9E-05	
	Distant community	2	2	3.3E-05 ± 6.7E-06	3.7E-05 ± 1.4E-05	17	15	3.8E-05 ± 2.9E-05	7.2E-05 ± 3.5E-05	
Uranium-238	Onsite	26	26	3.7E-05 ± 1.6E-05	5.3E-05 ± 2.2E-05	153	146	4.3E-05 ± 2.6E-05	8.7E-05 ± 5.8E-05	8.3E-03
	Perimeter	8	8	5.2E-05 ± 9.6E-06	5.9E-05 ± 2.1E-05	74	70	5.1E-05 ± 3.7E-05	1.2E-04 ± 6.4E-05	
	Nearby communities	11	11	4.8E-05 ± 1.4E-05	6.1E-05 ± 2.7E-05	77	75	5.1E-05 ± 2.8E-05	9.5E-05 ± 3.2E-05	
	Distant community	2	2	3.0E-05 ± 1.5E-05	3.8E-05 ± 1.4E-05	17	16	3.9E-05 ± 1.8E-05	6.0E-05 ± 2.5E-05	
Americium-241	Onsite	40	0	1.6E-04 ± 1.9E-03	4.0E-03 ± 3.2E-03	188	3	-1.0E-04 ± 2.1E-03	3.0E-03 ± 6.0E-03	1.9E-03
	Perimeter	22	0	4.8E-05 ± 1.6E-03	2.1E-03 ± 2.1E-03	140	0	-2.6E-04 ± 2.4E-03	3.3E-03 ± 4.1E-03	
	Nearby communities	14	0	1.3E-04 ± 7.7E-04	9.4E-04 ± 2.2E-03	104	0	-4.2E-04 ± 3.2E-03	5.1E-03 ± 5.3E-03	
	Distant community	2	0	-2.0E-06 ± 1.9E-04	9.3E-05 ± 3.1E-04	17	0	-8.9E-04 ± 3.0E-03	1.8E-03 ± 2.1E-03	

[a] 1 pCi = 0.037 Bq.
[b] Number of samples with measurable concentrations of contaminant. Detection is defined as a value. reported above the minimum detectable activity and above the total propagated analytical uncertainty.
[c] Average ± two standard deviations of all samples analyzed.
[d] Maximum ± analytical uncertainty.
[e] DOE derived concentration guides are shown for gross alpha and gross beta.
[F] EPA values are based on an effective dose equivalent of 10 millirem/year (100 micro Sievert) (40 CFR 61, Appendix E, Table 2).

Table C.7. Radionuclide Concentrations in Columbia River Water (Richland, Washington)

Radionuclide [b]		2014				2009-2013				WA Ambient Surface Water Quality Standard
		Number of		Concentration [a]		Number of		Concentration [a]		
		Samples	Detects	Maximum (pCi/L) [c]	Average (pCi/L) [c]	Samples	Detects	Maximum (pCi/L) [c]	Average (pCi/L) [c]	
Strontium-90		13	0	5.6E-02 ± 3.7E-02	2.3E-03 ± 4.6E-02	60	0	5.6E-02 ± 3.8E-02	1.8E-02 ± 4.4E-02	8
Technetium-99		13	0	4.0E-01 ± 3.7E-01	1.3E-01 ± 2.8E-01	60	0	6.2E-01 ± 4.5E-01	1.0E-02 ± 5.0E-01	900
Tritium		13	13	6.3E+01 ± 9.7E+01	2.7E+01 ± 2.5E+01	61	59	1.4E+02 ± 3.2E+01	4.3E+01 ± 4.8E+01	20,000[d]
Uranium-234		13	13	3.4E-01 ± 7.5E-02	2.7E-01 ± 9.0E-02	60	60	3.5E-01 ± 7.3E-02	2.6E-01 ± 6.7E-02	--[g]
Uranium-235		13	4	2.8E-02 ± 2.2E-02	2.5E-02 ± 3.5E-03	60	16	3.7E-02 ± 2.4E-02	1.3E-02 ± 1.9E-02	--[g]
Uranium-238		13	13	2.8E-01 ± 6.3E-02	2.2E-01 ± 6.1E-02	60	60	3.0E-01 ± 1.2E-01	2.1E-01 ± 6.9E-02	--[g]
Cesium-137	P[b]	12	0	6.0E-03 ± 4.7E-03	1.9E-03 ± 4.4E-03	20	0	2.0E-03 ± 1.6E-03	-2.9E-05 ± 2.3E-03	200[c]
	D[b]	12	0	1.6E-03 ± 1.6E-03	1.3-04 ± 1.4E-03	20	0	4.1E-03 ± 4.4E-03	5.1E-04 ± 3.5E-03	
Plutonium-238	P[b]	4	0	8.7E-05 ± 7.4E-05	2.9E-05 ± 6.7E-05	7	0	6.3E-05 ± 1.2E-04	1.1E-05 ± 4.4E-05	600[c]
	D[b]	4	0	1.5E-04 ± 1.4E-04	4.5E-05 ± 1.3E-04	7	1	3.6E-04 ± 1.6E-04	7.7E-05 ± 2.4E-04	
Plutonium-239/240	P[b]	4	0	1.8E-05 ± 4.3E-05	4.7E-06 ± 2.1E-05	7	0	3.1E-05 ± 1.1E-04	6.8E-06 ± 3.3E-05	
	D[b]	4	0	6.1E-05 ± 1.2E-04	-4.7E-06 ± 8.5E-05	7	0	1.4E-04 ± 1.3E-04	5.6E-05 ± 9.6E-05	

a Maximum values are ± total propagated analytical uncertainty (2 sigma). Averages are ±2 standard deviations of the mean.
b Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately. Other radionuclides are based on unfiltered water samples collected by the composite system (see Section 7.2); Cesium-137, plutonium-238, and plutonium-239/240 data is only available from 2012 through 2014 as historical sampling took place by analyses of water and not the dissolved or fraction concentrations.
c 1 pCi = 0.037 Bq.
d WAC 173-201A-250 and EPA-570/9-76-003.
e WAC 246-290.
f 40 CFR 141.
g Dashes indicate no concentration guides available.
h Average values are not calculated when only one sample was analyzed.
WA = Washington State.

Table C.8. Radionuclide Concentrations in Columbia River Water (Priest Rapids Dam, Washington)

Radionuclide [b]		2014				2009-2013				WA Ambient Surface Water Quality Standard
		Number of		Concentration [a]		Number of		Concentration [a]		
		Samples	Detects	Maximum *(pCi/L)* [c]	Average *(pCi/L)* [c]	Samples	Detects	Maximum *(pCi/L)* [c]	Average *(pCi/L)* [c]	
Composite System										
Strontium-90		13	0	4.0E-02 ± 3.6E-02	1.5E-02 ± 4.2E-02	63	3	1.3E-01 ± 5.0E-02	2.1E-02 ± 5.1E-02	8 [e, f]
Technetium-99		13	0	2.9E-01 ± 4.8E-01	7.3E-03 ± 4.0E-01	59	0	4.8E-01 ± 4.6E-01	-2.2E-02 ± 4.7E-01	900[d]
Tritium		13	13	2.5E+01 ± 6.4E+00	1.7E+01 ± 8.0E+00	61	58	3.0E+01 ± 8.8E+00	1.9E+01 ± 9.5E+00	20,000[d]
Uranium-234		13	13	3.2E-01 ± 7.2E-02	2.3E-01 ± 9.3E-02	58	58	2.8E-01 ± 6.5E-02	2.2E-01 ± 6.1E-02	-- [g]
Uranium-235		13	3	2.2E-02 ± 5.9E-02	9.3E-03 ± 1.5E-02	60	12	3.0E-02 ± 3.2E-02	9.9E-03 ± 1.7E-02	-- [g]
Uranium-238		13	13	2.4E-01 ± 5.3E-02	1.9E-01 ± 7.2E-02	60	60	2.3E-01 ± 8.3E-02	1.8E-01 ± 5.2E-02	-- [g]
Continuous System										
Cesium-137	P[b]	13	0	3.7E-03± 5.0E-03	8.5E-04 ± 3.5E-03	21	0	4.0E-03 ± 2.7E-03	5.7E-04 ± 2.0E-03	200[c]
	D[b]	12	0	2.2E-03 ± 3.0E-03	3.6E-04 ± 1.6E-03	21	0	3.8E-03 ± 4.0E-03	5.4E-04 ± 4.3E-03	
Plutonium-238	P[b]	4	0	7.1E-06 ± 4.2E-05	-8.23.0E-07 ± 2.0E-05	7	0	4.5E-05 ± 7.4E-05	1.2E-05 ± 3.2E-05	-- [g]
	D[b]	4	0	1.9E-04 ± 1.5E-04	5.2E-05 ± 1.6E-04	7	0	5.3E-05 ± 9.8E-05	1.7E-05 ± 6.4E-04	
Plutonium-239/240	P[b]	4	0	1.9E-05 ± 7.0E-05	-5.6E-06 ± 4.1E-05	7	4	6.8E-05 ± 1.2E-04	1.1E-05 ± 6.8E-05	-- [g]
	D[b]	4	0	5.6E-05 ± 9.7E-05	6.9E-06 ± 9.3E-05	7	1	2.5E-05 ± 3.6E-05	7.1E-06 ± 2.9E-05	

[a] Maximum values are ± total propagated analytical uncertainty (2 sigma). Averages are ±2 standard deviations of the mean.
b Radionuclides measured using the continuous system show the particulate (P) and dissolved (D) fractions separately. Other radionuclides are based on unfiltered water samples collected by the composite system (see Section 7.2); Cesium-137, plutonium-238, and plutonium-239/240 data is only available from 2012 through 2014 as historical sampling took place by analyses of water and not the dissolved or fraction concentrations.
c 1 pCi = 0.037 Bq.
d WAC 173-201A-250 and EPA-570/9-76-003.
e WAC 246-290.
f 40 CFR 141.
g Dashes indicate no concentration guides available.
h Average values are not calculated when only one sample was analyzed.
WA = Washington State.

Table C.9. Radionuclide Concentrations in Columbia River Water (Hanford Reach)

Transect/Radionuclide	No. of Detections	No. of Samples	Concentration[b]					
			Maximum (*pCi/L*[a])			Minimum (*pCi/L*[a])		
Vernita Bridge (HRM 0.3)								
Strontium-90	0	4	0.031	±	0.035	-0.019	±	0.031
Tritium	4	4	26	±	7.2	15	±	6.0
Uranium-234	4	4	0.24	±	0.07	0.15	±	0.06
Uranium-235	0	4	0.018	±	0.022	0.006	±	0.012
Uranium-238	4	4	0.18	±	0.06	0.11	±	0.04
100-N Area (HRM 9.5)								
Strontium-90	0	5	0.037	±	0.036	-0.001	±	0.032
Tritium	5	5	33	±	13	14	±	6.6
Uranium-234	5	5	0.27	±	0.06	0.19	±	0.044
Uranium-235	2	5	0.023	±	0.017	0.006	±	0.018
Uranium-238	5	5	0.19	±	0.044	0.15	±	0.038
Hanford Townsite (HRM 28.7)								
Strontium-90	0	5	0.054	±	0.038	0.001	±	0.03
Tritium	5	5	196	±	67	14	±	8.2
Uranium-234	5	5	0.26	±	0.06	0.16	±	0.05
Uranium-235	0	5	0.010	±	0.019	0	±	0.012
Uranium-238	5	5	0.17	±	0.05	0.13	±	0.04
300 Area (HRM 43.1)								
Strontium-90	0	5	0.029	±	0.03	-0.02	±	0.023
Tritium	5	5	65	±	11	18	±	5.2
Uranium-234	5	5	0.55	±	0.11	0.21	±	0.06
Uranium-235	0	5	0.019	±	0.022	0.007	±	0.013
Uranium-238	5	5	0.44	±	0.09	0.17	±	0.05
Richland (HRM 46.4)								
Strontium-90	0	5	0.039	±	0.036	-0.0005	±	0.031
Tritium	5	5	29	±	7.2	16	±	6.3
Uranium-234	5	5	0.29	±	0.074	0.18	±	0.05
Uranium-235	0	5	0.016	±	0.019	0.018	±	0.02
Uranium-238	5	5	0.23	±	0.06	0.16	±	0.05

[a] 1 pCi = 0.037 Bq.
[b] Maximum and minimum values are ± total propagated analytical uncertainty (2 sigma).
[c] Less than the laboratory—reported detection limit.
[d] Result listed as the maximum value when only one sample is analyzed.
HRM = Hanford river marker.

Table C.10. Dissolved Metal Concentrations in Columbia River Transect Water Near Hanford Site

Metal	No. of Samples	No. of Detections	Maximum (µg/L)[a]	Minimum (µg/L)[a]	Average (±2 SD) (µg/L)[a]		Minimum Detectable Concentrations	Washington State Ambient Surface Water Quality Chronic Toxicity Level[b]
Vernita Bridge								
Antimony	8	0	—	—	—	—	1.0	—
Arsenic	8	0					1.7	190
Beryllium	8	0	—	—	—	—	0.2	—
Cadmium	8	0	—	—	—	—	0.11	—
Chromium	8	0	—	—	—	—	2	10
Copper	8	8	0.79	0.53	0.63	0.16	0.35	6
Lead	8	0	—	—	—	—	0.5	1.1
Nickel	8	8	0.74	0.50	0.59	0.13	0.5	83
Selenium	8	0	—	—	—	—	1.5	5
Silver	8	0	—	—	—	—	0.2	—
Thallium	8	0	—	—	—	—	0.45	—
Uranium	8	8	0.45	0.42	0.43	0.02	0.67	—
Zinc	8	2	5.8	3.5	3.8	1.5	3.5	55
100-N Area								
Antimony	10	0	—	—	—	—	1	—
Arsenic	10	0					1.7	190
Beryllium	10	0	—	—	—	—	0.2	—
Cadmium	10	0	—	—	—	—	0.11	—
Chromium	10	0	—	—	—	—	2	10
Copper	10	10	0.94	0.63	0.73	0.18	0.35	6
Lead	10	0	—	—	—	—	0.5	1.1
Nickel	10	10	1.11	0.52	0.63	0.33	0.5	83
Selenium	10	0	—	—	—	—	1.5	5
Silver	10	0	—	—	—	—	0.2	—
Thallium	10	0	—	—	—	—	0.45	—
Uranium	10	10	0.61	0.52	0.56	0.05	0.67	—
Zinc[c]	10	1	3.53	3.53			3.5	55
Hanford Townsite								
Antimony	12	0	—	—	—	—	1.0	—
Arsenic	12	0	—	—	—	—	1.7	190
Beryllium	12	0	—	—	—	—	0.2	—
Cadmium	12	0	—	—	—	—	0.11	—
Chromium	12	0	—	—	—	—	2	10
Copper	12	12	1.7	0.66	0.79	0.53	0.35	6
Lead	12	0	—	—	—	—	0.5	1.1
Nickel	12	12	0.63	0.51	0.58	0.08	0.5	83
Selenium	12	0	—	—	—	—	1.5	5
Silver	12	0	—	—	—	—	0.2	—
Thallium	12	0	—	—	—	—	0.45	—
Uranium	12	12	0.58	0.47	0.52	0.06	0.67	—
Zinc	12	1	4.52	3.5	---	---	3.5	55

Table C.10. Dissolved Metal Concentrations in Columbia River Transect Water Near Hanford Site

Metal	No. of Samples	No. of Detections	Maximum (µg/L)[a]	Minimum (µg/L)[a]	Average (±2 SD) (µg/L)[a]		Minimum Detectable Concentrations	Washington State Ambient Surface Water Quality Chronic Toxicity Level[b]
300 Area								
Antimony	10	0	—	—	—	—	1	–
Arsenic	10	0	—	—	—	—	1.7	190
Beryllium	10	0	—	—	—	—	0.2	—
Cadmium	10	0	—	—	—	—	0.11	—
Chromium	10	0	—	—	—	—	2	10
Copper	10	10	0.84	0.65	0.74	0.13	0.35	6
Lead	10	0	—	—	—	—	0.5	1.1
Nickel	10	10	0.73	0.51	0.66	0.12	0.5	83
Selenium	10	0	—	—	—	—	1.5	5
Silver	10	0	—	—	—	—	0.2	—
Thallium	10	0	—	—	—	—	0.45	—
Uranium	10	10	1.6	0.56	0.82	0.77	0.67	—
Zinc	10	0					3.5	55
Richland								
Antimony	10	0	—	—	—	—	1.0	—
Arsenic	10	0	—	—	—	—	1.7	190
Beryllium	10	0	—	—	—	—	0.2	—
Cadmium	10	0	—	—	—	—	0.11	—
Chromium	10	0	—	—	—	—	2	10
Copper	10	10	0.89	0.68	0.76	0.14	0.35	6
Lead	10	0	—	—	—	—	0.5	1.1
Nickel	10	10	0.67	0.55	0.62	0.07	0.5	83
Selenium	10	0	—	—	—	—	1.5	5
Silver	10	0	—	—	—	—	0.2	—
Thallium	10	0	—	—	—	—	0.45	—
Uranium	10	10	0.76	0.54	0.60	0.16	0.67	—
Zinc	10	4	7.8	3.5	4.0	2.5	3.5	55

[a] Dashes indicate results at or below minimum detectable concentrations.
[b] WAC 173-201A-240, and WAC 173-201A-250. Table 240(3) Toxic Substances Criteria for the protection of aquatic life. For hardness—dependent criteria, the minimum value of 47 mg CaCo3/L, for 1992 through 2000 water samples collected near Vernita Bridge by the U.S. Geological Survey was used. Parts per million (ppm) values are equivalent to the reported micrograms per liter (µg/L) concentrations shown.
[c] Single detected value.
[d] Average calculated using reporting limit values for all results at or below minimum detectable concentrations.
SD = Standard deviation.

Table C.11. Radionuclide and Total Organic Carbon Concentrations in Columbia River Sediment (Near Hanford Site)

Location / 2014 Total Organic Carbon Concentration Value	Radionuclide	2014			2009-2013		
		No. of Samples	Concentration, Ci/g[a] Average[b]	Concentration, Ci/g[a] Maximum[d]	No. of Samples	Concentration, Ci/g[a] Average[bc]	Concentration, Ci/g[a] Maximum[d]
Priest Rapids Dam (21,500 – 39,500 mg/kg)	Cobalt-60	2	-0.00343 ± 0.0057	-0.00057 ± 0.0141	10	-0.0057 ± 0.017	0.009 ± 0.017
	Strontium-90	2	-0.00584 ± 0.008	0.00184 ± 0.0245	10	0.0094 ± 0.035	0.043 ± 0.021
	Cesium-137	2	0.23 ± 0.01	0.23 ± 0.032	10	0.284 ± 0.075	0.35 ± 0.05
	Europium-152	2	-0.0193 ± 0.0792	0.0203 ± 0.0528	10	-0.011 ± 0.11	0.089 ± 0.038
	Europium-155	2	0.0566 ± 0.0304	0.0718 ± 0.0524	10	0.071 ± 0.053	0.114 ± 0.057
	Uranium-234	2	1.27 ± 0.08	1.35 ± 0.227	10	1.2 ± 0.28	1.4 ± 0.20
	Uranium-235	2	0.1025 ± 0.003	0.104 ± 0.0496	10	0.059 ± 0.028	0.09 ± 0.032
	Uranium-238	2	1.15 ± 0.14	1.22 ± 0.209	10	1.1 ± 0.25	1.2 ± 0.17
	Plutonium-239/240	2	0.0095 ± 0.0027	0.0109 ± 0.0044	10	0.010 ± 0.003	0.013 ± 0.002
100-F Slough (2,520 mg/kg)	Cobalt-60	1		-0.00234 ± 0.0262	4	0.013 ± 0.012	0.019 ± 0.019
	Strontium-90	1		0.0104 ± 0.0274	4	0.019 ± 0.010	0.027 ± 0.025
	Cesium-137	1		0.226 ± 0.0519	4	0.211 ± 0.053	0.24 ± 0.025
	Europium-152	1		-0.0357 ± 0.0647	4	0.030 ± 0.049	0.064 ± 0.033
	Europium-155	1		0.0346 ± 0.0537	4	0.044 ± 0.063	0.079 ± 0.056
	Uranium-234	1		0.457 ± 0.0956	4	0.46 ± 0.17	0.59 ± 0.15
	Uranium-235	1		0.0646 ± 0.0345	4	0.041 ± 0.025	0.054 ± 0.035
	Uranium-238	1		0.431 ± 0.0925	4	0.417 ± 0.025	0.437 ± 0.129
	Plutonium-239/240	1		0.00428 ± 0.00328	4	0.002 ± 0.001	0.002 ± 0.002
White Bluffs Slough (9,870 mg/kg)	Cobalt-60	1		0.0093 ± 0.0282	6	0.007 ± 0.028	0.024 ± 0.026
	Strontium-90	1		0.000268 ± 0.0206	6	0.0044 ± 0.04	0.04 ± 0.031
	Cesium-137	1		0.415 ± 0.0595	6	0.38 ± 0.17	0.47 ± 0.11
	Europium-152	1		0.232 ± 0.144	6	0.065 ± 0.086	0.145 ± 0.0766
	Europium-155	1		0.101 ± 0.0639	6	0.071 ± 0.49	0.1 ± 0.068
	Uranium-234	1		1.11 0.0459 ± 0.183	6	0.79 ± 0.30	1.01 ± 0.184
	Uranium-235	1		0.0459 ± 0.0342	6	0.043 ± 0.010	0.053 ± 0.035
	Uranium-238	1		1.05 ± 0.175	6	0.78 ± 0.35	1.03 ± 0.179
	Plutonium-239/240	1		0.00508 ± 0.00366	6	0.003 ± 0.001	0.004 ± 0.003
100-D Spring 102-1 (4,030 mg/kg)	Cobalt-60	1		0.00675 ± 0.0173	2	-0.002 ± 0.012	0.0022 ± 0.019
	Strontium-90	1		0.00157 ± 0.0272	2	0.017 ± 0.004	0.019 ± 0.026
	Cesium-137	1		0.117 ± 0.0371	2	0.16 ± 0.11	0.209 ± 0.0238
	Europium-152	1		0.0465 ± 0.0537	2	-0.0052 ± 0.042	0.016 ± 0.054
	Europium-155	1		0.0395 ± 0.0687	2	0.044 ± 0.010	0.0487 ± 0.0351
	Uranium-234	1		0.363 ± 0.0815	2	0.502 ± 0.028	0.516 ± 0.11

Table C.11. Radionuclide and Total Organic Carbon Concentrations in Columbia River Sediment (Near Hanford Site)

Location / 2014 Total Organic Carbon Concentration Value	Radionuclide	2014			2009-2013		
		No. of Samples	Concentration, Ci/g[a] Average[b]	Concentration, Ci/g[a] Maximum[d]	No. of Samples	Concentration, Ci/g[a] Average[bc]	Concentration, Ci/g[a] Maximum[d]
	Uranium-235	1		0.0377 ± 0.026	2	0.048 ± 0.017	0.057 ± 0.037
	Uranium-238	1		0.491 ± 0.0988	2	0.468 ± 0.044	0.49 ± 0.104
	Plutonium-239/240	1		0.000688 ± 0.00194	2	0.0010 ± 0.0037	0.0028 ± 0.0019
Hanford Slough (8,580 – 10,200 mg/kg)	Cobalt-60	1		0.0000275 ± 0.0318	5	0.007 ± 0.061	0.038 ± 0.018
	Strontium-90	1		0.00567 ± 0.0192	5	0.002 ± 0.025	0.015 ± 0.014
	Cesium-137	1		0.26 ± 0.0629	5	0.21 ± 0.17	0.288 ± 0.036
	Europium-152	1		-0.00786 ± 0.0947	5	0.04 ± 0.05	0.074 ± 0.058
	Europium-155	1		-0.0498 ± 0.0894	5	0.069 ± 0.048	0.094 ± 0.045
	Uranium-234	1		0.83 ± 0.161	5	1.4 ± 2.7	4.1 ± 0.58
	Uranium-235	1		0.0496 ± 0.0364	5	0.087 ± 0.185	0.267 ± 0.083
	Uranium-238	1		0.74 ± 0.149	5	0.787 ± 0.42	1.09 ± 0.192
	Plutonium-239/240	1		0.0031 ± 0.00183	5	0.002 ± 0.002	0.004 ± 0.0015
McNary Dam (16,100 – 24,200 mg/kg)	Cobalt-60	2	0.0278 ± 0.0092	0.0324 ± 0.0262	10	0.0001 ± 0.038	0.017 ± 0.027
	Strontium-90	2	0.04165 ± 0.0091	0.0462 ± 0.0313	10	0.0035 ± 0.029	0.031 ± 0.028
	Cesium-137	2	0.2565 ± 0.005	0.259 ± 0.0458	10	0.23 ± 0.042	0.27 ± 0.038
	Europium-152	2	0.0708 ± 0.0046	0.0731 ± 0.0675	10	0.047 ± 0.076	0.097 ± 0.084
	Europium-155	2	0.0837 ± 0.0002	0.0838 ± 0.0598	10	0.077 ± 0.056	0.123 ± 0.062
	Uranium-234	2	1.47 ± 0.08	1.51 ± 0.223	10	1.5 ± 0.26	1.7 ± 0.31
	Uranium-235	2	0.08105 ± 0.0317	0.0969 ± 0.0332	10	0.073 ± 0.022	0.09 ± 0.05
	Uranium-238	2	1.22 ± 0.04	1.24 ± 0.189	10	1.23 ± 0.06	1.4 ± 0.23
	Plutonium-239/240	2	0.007975 ± 0.00465	0.0103 ± 0.00472	10	0.009 ± 0.004	0.021 ± 0.0061

[a] 1 pCi = 0.037 Bq.
b Average values are not provided when only one sample was analyzed; Values are ± 2 standard deviations of the mean.
c Average values calculated using reporting limit values for all results at or below minimum detectable concentrations.
d Values are ± total propagated analytical uncertainty (2 sigma).
e No sample data for this time period.

Table C.12. Dissolved Metal Concentrations in Columbia River Sediment (Near Hanford Site)

Metal	**Priest Rapids Dam** *(mg/kg dry weight)*	**Hanford Sloughs [a]** *(mg/kg dry weight)*	**McNary Dam** *(mg/kg dry weight)*	**Hanford Shoreline [b]** *(mg/kg dry weight)*
Antimony	0.8 – 1.2 [c]	0.51 [c] – 2.7	0.66 – 0.78	1.9
Arsenic	6.6 – 7.6	2.8 – 13	5.0 – 6.0	3.1
Beryllium	0.97 – 1.0	0.49 – 0.83	0.88 – 1.2	0.68
Cadmium	4.0 – 5.3	0.91 – 1.9	0.94 – 1.5	1.1
Chromium	32 - 33	11 - 26	17 - 20	70
Copper	42 - 46	14 - 38	18 - 28	13.8
Lead	35 - 37	0.55 - 71	14 - 18	6.6
Mercury	0.10 – 0.12	0.01 – 0.05	0.07 – 0.08	0.03
Nickel	36 - 36	10 - 20	17 - 20	11
Selenium	3.1 – 4.1	Not Detected	3.7 – 3.8	Not Detected
Silver	0.24 – 0.31 [c]	0.15 [c] – 0.38	0.20 – 0.24	0.30
Thallium	1.2 – 1.5 [c]	0.77 – 4.1	1.0 – 1.2 [c]	2.8
Zinc	386 - 428	121-549	155 - 176	161
No. of Samples	**2**	**4**	**2**	**1**

[a] 100-F Slough (n=1), Hanford Slough (n=1), White Bluffs Slough (n=1); where n = number of samples.
[b] 100-D Area at 100-D Spring 102-1 (n=1).
[c] Minimum detection limit met but fell below required detection limit.

Table C.13. Radionuclide Concentrations Measured in Water Samples Collected from Shoreline Seeps along the Hanford Site (2009-2014)

Location/Radionuclide	2014			2009-2013			Washington State Ambient Surface Water Quality Standard,[d] pCi/L
	No. of Samples	Concentration,[a] pCi/L Maximum[b]	Concentration,[a] pCi/L Average[c]	No. of Samples	Concentration,[a] pCi/L Maximum[b]	Concentration,[a] pCi/L Average[c]	
100-B Area (Spring 38-3)							
Strontium-90	1	7.8E-03 ± 0.034[e]	NC	5	5.5E-02 ± 3.8E-02[e]	2.2E-02 ±5.0E-02[e]	8.0E+00
Tritium	1	1.0E+03 ± 2.8E+02	NC	5	1.5E+03 ± 3.7E+02	1.3E+03 ± 4.3E+02	2.0E+04
100-D Area (Spring 110-1)							
Alpha (gross)	1	2.9E+00 ± 2.6E+00[e]	NC	5	2.6E+00 ± 1.6E+00[e]	7.0E-01 ± 2.0E+00[e]	1.5E+01
Beta (gross)	1	1.1E+01 ± 3.0E+00	NC	5	1.0E+01 ± 2.2E+00	4.3E+00 ± 5.9E+00	5.0E+01
Strontium-90	1	2.7E+00 ± 4.7E-01	NC	6	3.2E+00 ± 5.2E-01[e]	7.9E-01 ± 2.2E+00[e]	8.0E+00
Technetium-99	1	3.5E-01 ± 4.2E-01[e]	NC	4	6.3E-01 ± 5.3E-01[e]	2.5E-01 ± 5.2E-01[e]	9.0E+02[f]
Tritium	1	2.5E+03 ± 1.2E+03	NC	5	3.0E+03 ± 6.2E+02	9.6E+02 ± 2.1E+03	2.0E+04
Uranium-234	1	1.0E+00 ± 1.9E-01	NC	3	1.1E+00 ± 1.6E-01	5.4E-01 ± 8.5E-01	[g]
Uranium-235	1	5.9E-02 ± 4.2E-02	NC	3	4.9E-02 ± 2.1E-02[e]	2.6E-02 ± 3.6E-02[e]	[g]
Uranium-238	1	7.9E-01 ± 1.5E-01	NC	3	1.0E+00 ± 1.5E-01	4.7E-01 ± 7.5E-01	[g]
100-F Area (Spring 207-1)							
Strontium-90	1	-3.2E-02 ± 3.1E-02[e]	NC	3	2.2E-02 ± 3.4E-02[e]	-6.3E-03 ± 4.0E-02[e]	8.0E+00
Tritium	1	4.5E+02 ± 1.9E+02	NC	3	8.8E+02 ± 2.4E+02	6.8E+02 ± 3.9E+02	2.0E+04
100-F Area (Spring 211-1)							
Strontium-90	1	-1.1E-02 ± 3.2E-02[e]	NC	0	Data not available		8.0E+00
Tritium	1	3.2E+02 ± 1.6E+02	NC	0	Data not available		2.0E+04
100-H Area (Spring 145-1)							
Strontium-90	1	-2.2E-02 ± 3.1E-02[e]	NC	4	3.2E-03 ± 3.2E-02[e]	6.2E-04 ±4.0E-02[e]	8.0E+00
Technetium-99	1	2.7E-01 ± 3.7E-01[e]	NC	4	1.7E+00 ± 8.6E-01[e]	6.7E-01 ± 1.3E+00[e]	9.0E+02[f]
Tritium	1	1.5E+02 ± 1.4+02[e]	NC	4	1.6E+03 ± 3.8E+02	7.4E+02 ± 1.1E+03	2.0E+04
100-K Area (Spring 63-1)							
Alpha (gross)	1	4.3E-01 ± 1.9E+00[e]	NC	4	3.7E+00 ± 2.4E+00	2.5E+00 ± 1.9E+00	1.5E+01
Beta (gross)	1	5.0E+00 ± 2.7E+00	NC	4	1.9E+01 ± 2.7E+00	1.3E+01 ± 9.6E+00	5.0E+01
Carbon-14	1	4.1E+02 ± 4.0E+02	NC	1	2.2E+03 ± 4.0E+02	NC	2.0E+03
Strontium-90	1	-7.1E-03 ± 3.2E-02[e]	NC	4	3.2E-02 ± 3.3E-02[e]	1.5E-02 ± 3.8E-02[e]	8.0E+00
Tritium	1	2.0E+02 ± 1.4E+02[e]	NC	4	1.4E+03 ± 3.4E+02	1.0E+03 ± 5.2E+02	2.0E+04
100-K Area (Spring 68-1)							
Alpha (gross)	1	-7.8E-01 ± 1.5E+00[e]	NC	0	Data not available		1.5E+01
Beta (gross)	1	2.7E+00 ± 2.2E+00[e]	NC	0	Data not available		5.0E+01

Table C.13. Radionuclide Concentrations Measured in Water Samples Collected from Shoreline Seeps along the Hanford Site (2009-2014)

Location/Radionuclide	2014			2009-2013			Washington State Ambient Surface Water Quality Standard,[d] pCi/L
	No. of Samples	Concentration,[a] pCi/L		No. of Samples	Concentration,[a] pCi/L		
		Maximum[b]	Average[c]		Maximum[b]	Average[c]	
Strontium-90	1	4.7E-03 ± 4.0E-02[e]	NC	0	Data not available		8.0E+00
Tritium	1	2.4E+03 ± 5.1E+02	NC	1	2.9E+03 ± 6.1E+02	NC	2.0E+04
100-N Area (Spring 8-13)							
Alpha (gross)	1	6.1E-01 ± 1.0E+00[e]	NC	5	1.0E+01 ± 4.0E+00	3.3E+00 ± 7.3E+00	1.5E+01
Beta (gross)	1	1.8E+00 ± 1.3E+00[e]	NC	5	1.8E+01 ± 3.8E+00	5.8E+00 ± 1.2E+01	5.0E+01
Strontium-90	1	1.4E-02 ± 3.4E-02[e]	NC	5	4.8E-02 ± 3.2E-02[e]	2.8E-02 ± 3.4E-02[e]	8.0E+00
Tritium	1	4.2E+03 ± 8.5E+02	NC	5	4.0E+03 ± 8.2E+02	2.5E+03 ± 2.8E+03	2.0E+04
100-N Area (Spring 89-1)							
Strontium-90	1	1.3E+01 ± 2.0E+00	NC	2	4.4E+01 ± 6.9E+00	2.4E+01 ± 3.9E+01	8.0E+00
Tritium	1	2.6E+02 ± 1.5E+02	NC	2	1.5E+03 ± 3.5E+02	1.2E+03 ± 6.1E+02	2.0E+04
300 Area (300 Area Spring 42-2 and 300 Area Spring DR 42-2)							
Alpha (gross)	2	6.6E+01 ± 7.2E+00	4.1E+01 ± 4.9E+01	5	3.1E+01 ± 6.4E+00	2.4E+01 ± 7.3E+00	1.5E+01
Beta (gross)	2	3.0E+01 ± 3.1E+00	2.2E+01 ± 1.5E+01	5	3.9E+01 ± 4.9E+00	2.0E+01 ± 1.9E+01	5.0E+01
Tritium	2	5.4E+03 ± 1.1E+03	4.9E+03 ± 9.8E+02	5	6.1E+03 ± 1.2E+03	4.3E+03 ± 1.9E+03	2.0E+04
Uranium-234	2	3.7E+01 ± 5.9E+00	2.3E+01 ± 2.7E+01	5	1.6E+01 ± 3.7E+00	1.3E+01 ± 4.9E+00	[g]
Uranium-235	2	3.0E+00 ± 5.7E-01	1.9E+00 ± 2.3E+00	5	1.7E+00 ± 5.1E-01	9.8E-01 ± 7.5E-01	[g]
Uranium-238	2	3.5E+01 ± 5.7E+00	2.2E+01 ± 2.6E+01	5	1.7E+01 ± 4.1E+00	1.2E+01 ± 6.2E+00	[g]
Hanford Townsite (Hanford Spring 25-4)							
Alpha (gross)	2	5.8E-01 ± 1.6E+00[e]	NC	0	Data not available		1.5E+01
Beta (gross)	2	6.1E+00 ± 2.2E+00[e]	NC	0	Data not available		5.0E+01
Strontium-90	2	5.7E-03 ± 3.4E-02[e]	NC	0	Data not available		8.0E+00
Tritium	2	5.1E+00 ± 1.2E+02	NC	0	Data not available		2.0E+04
Hanford Townsite (Hanford Spring 28-2)							
Alpha (gross)	1	3.7E+00 ± 2.4E+00	NC	8	6.6E+00 ± 2.7E+00[e]	2.8E+00 ± 3.2E+00[e]	1.5E+01
Beta (gross)	1	4.7E+01 ± 4.5E+00	NC	8	4.5E+01 ± 4.8E+00	2.5E+01 ± 2.1E+01	5.0E+01
Tritium	1	2.1E+04 ± 4.1E+03	NC	8	3.7E+04 ± 7.2E+03	2.3E+04 ± 1.6E+04	2.0E+04

(a) To convert to the International System of Units, multiply pCi/L by 0.037 to obtain Bq/L.
(b) Maximum values are ± total propagated analytical uncertainty.
(c) Average values are not calculated (NC) when only one sample was analyzed. Averages are ±2 standard deviations of the mean.
(d) WAC 246-290, 40 CFR 141, and Appendix D, Table D.4.
(e) Value below the minimum detectable concentration.
(f) WAC 173-201A-250 and EPA-570/9-76-003.
(g) No concentration guides available.

Table C.13. Radionuclide Concentrations in Columbia River Shoreline Sediment (100-D Seep)

Radionuclide	No. of Samples	Result, pCi/g [a, b]
Antimony-125 [c]	1	0.83E-02 ± 3.8E-02
Cobalt-60 [c]	1	6.8E-03 ± 1.7E-02
Cesium-134	1	4.1E-02 ± 3.3E-02
Cesium-137	1	1.2E-01 ± 3.7E-02
Europium-152 [c]	1	4.7E-02 ± 5.4E-02
Europium-154 [c]	1	-4.3E-02 ± 5.6E-02
Europium-155 [c]	1	4.0E-02 ± 6.9E-02
Potassium-40	1	1.4E+01 ± 1.4E+00
Plutonium-238 [c]	1	1.7E-04 ± 1.2E-03
Plutonium-239/240 [c]	1	6.9E-04 ± 1.9E-03
Ruthenium-106 [c]	1	3.4-02 ± 1.3E-01
Strontium-90 [c]	1	1.6E-03 ± 2.7E-02
Uranium-234	1	3.6E-01 ± 8.2E-02
Uranium-235	1	3.8E-02 ± 2.6E-02
Uranium-238	1	4.9E-01 ± 9.9E-02

a International System of Units conversion (dry weight): multiply pCi/g by 0.037 to obtain Bq/g.
b Values are ± total propagated analytical uncertainty (2 sigma).
c Results at or below minimum detectable concentrations.