



4.1 AIR SURVEILLANCE

B. G. Fritz

Atmospheric releases of radioactive material from the Hanford Site to the surrounding region are a potential source of human exposure. Radioactive constituents in air are monitored at a network of air sampling locations on and around the Hanford Site. Detailed descriptions of all routine radiological sampling and analytical techniques are provided in DOE, Richland Operations Office's environmental monitoring plan (DOE/RL-91-50). Comparing measured radionuclide concentrations from locations on and around the Hanford Site to upwind sites assumed to be uninfluenced by Hanford Site operations provides an evaluation of the impact of radionuclide air emissions from the Hanford Site on surrounding ambient air. A complete listing of all radiological analytical results summarized in this section is reported separately (PNNL-14295, APP. 1). Non-radiological, particulate air monitoring data are also summarized in Section 4.1.3.

4.1.1 COLLECTION OF AIR SAMPLES AND ANALYTES TESTED

Airborne radionuclide samples were collected at 45 continuously operating samplers. The sampling stations are grouped into four distance classes: onsite (24 stations), perimeter (11 stations), community (8 stations), and distant (2 stations) (Figure 4.1.1 and Table 4.1.1). Four of the stations were community-operated environmental surveillance stations (Section 8.4) that were managed and operated by local school teachers as part of an ongoing DOE-sponsored program to promote public awareness of Hanford Site environmental monitoring programs. Air samplers on the Hanford Site were located primarily around major operational areas to maximize the ability to detect radiological contaminants resulting from site operations. Perimeter samplers were located around the site, with emphasis on the prevailing downwind directions to the south and east of the site (Section 8.1). Samplers located in

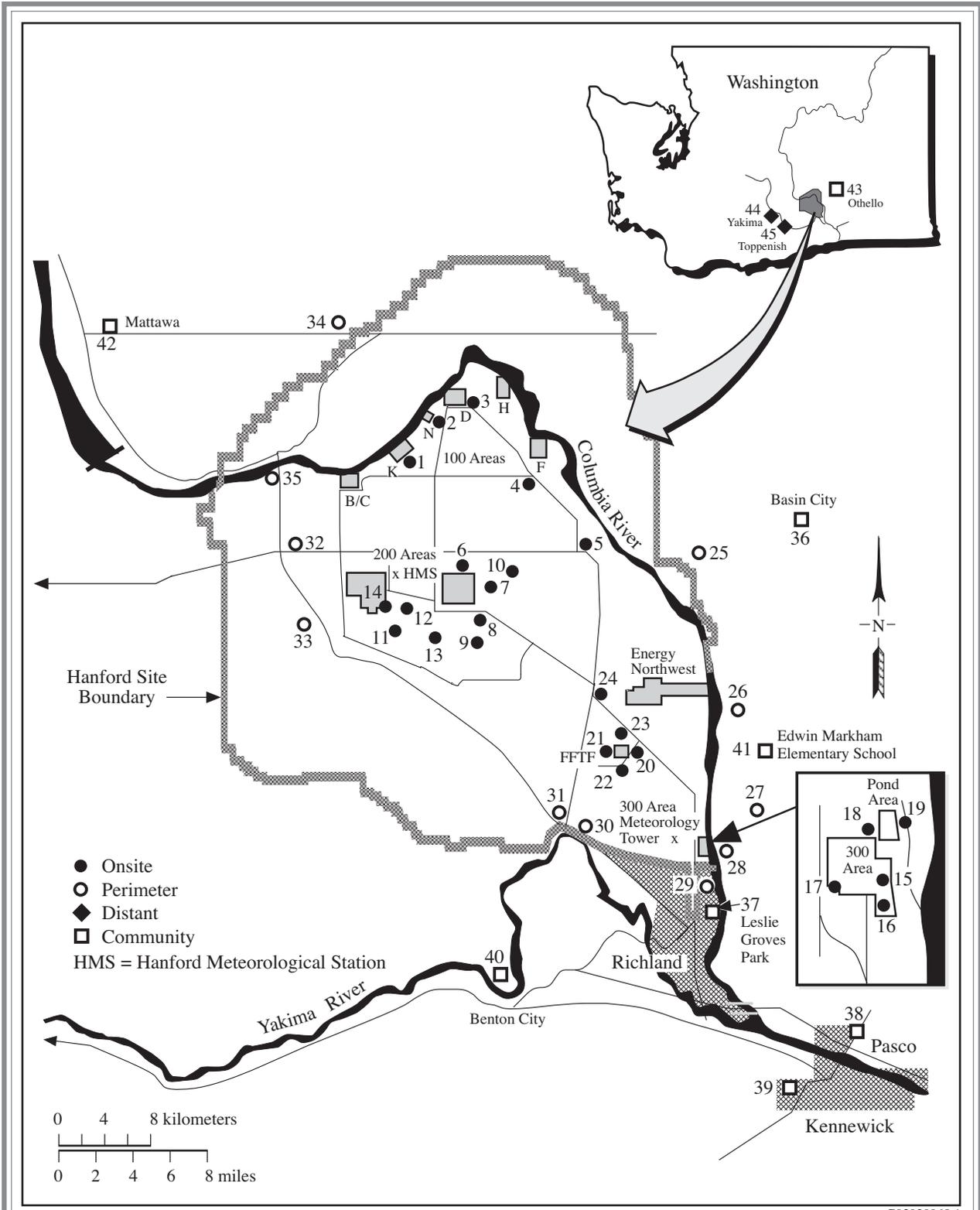
Basin City, Benton City, Kennewick, Mattawa, Othello, Pasco, and Richland, Washington, provided data for the nearest population centers. Samplers in Toppenish and Yakima, Washington, provided background data for communities essentially unaffected by Hanford Site operations.

Samples were collected according to a schedule established before the monitoring year (PNNL-13749). The air sampling locations and the analytes tested for at each location are given in Table 4.1.1. Airborne particle samples were collected biweekly at each of these locations by continuously drawing air through a high efficiency glass-fiber filter. The samples were transported to an analytical laboratory and stored for at least 72 hours. The storage period was necessary to allow for the decay of short-lived, naturally occurring radionuclides (e.g., radon gas decay products) that would otherwise obscure detection of longer-lived radionuclides potentially present from Hanford Site emissions. The filters were then analyzed for gross beta radiation. Selected filters were also analyzed for gross alpha radiation.

Historically, for most radionuclides, the amount of radioactive material collected on a filter during a 2-week period has been too small for accurate analysis. In order to increase the sensitivity and accuracy of the analysis, biweekly samples were combined into quarterly composite samples. The quarterly composite samples were analyzed for specific gamma-emitting radionuclides (Appendix F). Most composite samples were also analyzed for strontium-90, plutonium isotopes, and uranium isotopes.

Samples were collected for iodine-129 analysis at four locations by drawing air through a chemically treated, low-background petroleum-based charcoal adsorbent cartridge. Samples were collected monthly and combined to form quarterly composite samples for each location.

Atmospheric water vapor was collected for tritium analysis at 21 locations by continuously drawing air through columns containing adsorbent silica gel. The silica gel columns were



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Figure 4.1.1. Pacific Northwest National Laboratory Air Sampling Locations On and Around the Hanford Site During 2002 (see Table 4.1.1 for location names)

Table 4.1.1. Pacific Northwest National Laboratory Air Sampling Locations On and Around the Hanford Site, Sample Composite Groups, and Analytes, 2002

Map^(a) Location	Sampling Location	Analytes^(b)	Composite Group	Analytes^(c)
Onsite				
1	100 K Area	Alpha, Beta, ³ H	100 Areas	Gamma, Sr, Pu
2	100 N-1325 Crib	Alpha, Beta, ³ H		
3	100 D Area	Alpha, Beta		
4	100 F Met Tower	Alpha, Beta	Hanford Townsite	Gamma, Sr, Pu
5	Hanford Townsite	Alpha, Beta		
6	N of 200 E	Beta	N of 200 E	Gamma
7	E of 200 E	Alpha, Beta	E of 200 E	Gamma, Sr, Pu, U
8	200 ESE	Alpha, Beta, ³ H, ¹²⁹ I	200 E Area	Gamma, Sr, Pu, U
9	S of 200 E	Alpha, Beta		
10	B Pond	Alpha, Beta	B Pond	Gamma, Sr, Pu, U
11	Army Loop Camp	Alpha, Beta	200 W South East	Gamma, Sr, Pu, U
12	200 Tel. Exchange	Alpha, Beta, ³ H		
13	SW of B/C Crib	Alpha, Beta		
14	200 W SE	Alpha, Beta	200 West	Gamma, Sr, Pu, U
15	300 Water Intake	Alpha, Beta, ³ H	300 Area	Gamma, Sr, Pu, U
16	300 South Gate	Alpha, Beta, ³ H		
17	300 South West	Alpha, Beta, ³ H		
18	300 Trench	Alpha, Beta, ³ H U, Gamma	300 NE	Sr, Pu
19	300 NE	Alpha, Beta, ³ H U, Gamma		
20	400 E	Alpha, Beta, ³ H	400 Area	Gamma, Sr, Pu
21	400 W	Alpha, Beta		
22	400 S	Alpha, Beta		
23	400 N	Alpha, Beta		
24	Wye Barricade	Alpha, Beta	Wye Barricade	Gamma, Sr, Pu, U
Perimeter				
25	Ringold Met Tower	Alpha, Beta, ³ H, ¹²⁹ I	Ringold Met Tower	Gamma, Sr, Pu
26	W End of Fir Road	Alpha, Beta	W End of Fir Road	Gamma, Sr, Pu, U
27	Dogwood Met Tower	Alpha, Beta, ³ H	Dogwood Met Tower	Gamma, Sr, Pu, U
28	Byers Landing	Alpha, Beta, ³ H, ¹²⁹ I	Byers Landing	Gamma, Sr, Pu, U
29	Battelle Complex	Alpha, Beta, ³ H	Battelle Complex	Gamma
30	Horn Rapids Substation	Alpha, Beta	Prosser Barricade	Gamma, Sr, Pu, U
31	Prosser Barricade	Alpha, Beta, ³ H		
32	Yakima Barricade	Alpha, Beta	Yakima Barricade	Gamma, Sr, Pu
33	Rattlesnake Springs	Alpha, Beta		
34	Wahluke Slope	Alpha, Beta, ³ H	Wahluke Slope	Gamma, Sr, Pu
35	S End Vernita Bridge	Alpha, Beta		

Table 4.1.1. (contd)

Map^(a) Location	Sampling Location	Analytes^(b)	Composite Group	Analytes^(c)
Nearby Communities				
36	Basin City School ^(d)	Alpha, Beta, ³ H	Basin City School	Gamma, Sr, Pu, U
37	Leslie Groves-Rchlnd ^(d)	Alpha, Beta, ³ H	Leslie Groves-Rchlnd	Gamma, Sr, Pu, U
38	Pasco	Beta	Tri-Cities	Gamma, Sr, Pu
39	Kennewick	Alpha, Beta		
40	Benton City	Beta	Benton City	Gamma
41	Edwin Markham School ^(d)	Alpha, Beta, ³ H	Edwin Markham School	Gamma, Sr, Pu, U
42	Mattawa	Beta	Mattawa	Gamma
43	Othello	Beta	Othello	Gamma
Distant Communities				
44	Yakima	Alpha, Beta, ³ H, ¹²⁹ I	Yakima	Gamma, Sr, Pu, U
45	Toppenish ^(d)	Alpha, Beta, ³ H	Toppenish	Gamma, Sr, Pu, U

(a) See Figure 4.1.1.

(b) Alpha (gross) and beta (gross) samples are collected and analyzed every 2 weeks, ³H samples are collected and analyzed every 4 weeks, and ¹²⁹I samples are collected every 4 weeks, combined into a quarterly composite sample and analyzed for each location.

(c) Gamma spectroscopy, strontium-90, isotopic plutonium (²³⁸Pu, ^{239/240}Pu), and isotopic uranium (²³⁴U, ²³⁵U, ²³⁸U) analyses are performed on quarterly composite samples.

(d) A community-operated environmental surveillance station.

exchanged every 4 weeks to prevent loss of sample as a result of breakthrough. The collection efficiency of the silica gel adsorbent is discussed in Patton et al. (1997). The collected water was distilled from the silica gel and analyzed for its tritium content.

The samples collected at the community-operated environmental surveillance stations were submitted to the analytical laboratory and treated the same as all other submitted samples.

4.1.2 RADIOLOGICAL RESULTS FOR AIR SAMPLES

Radiological air sampling results for onsite, site perimeter, nearby communities, and distant communities for gross alpha, gross beta, and specific radionuclides are summarized in Table 4.1.2.

A detectable value is defined in this section as a value reported above the minimum detectable level and above the total propagated analytical uncertainty. A nominal detection limit is defined as the average total propagated analytical uncertainty of the population of reported values.

During 2002, the average onsite gross alpha concentration was higher than the average concentration measured at the distant location. However, the difference was not statistically significant. The highest average gross alpha concentration was observed at the community locations. Again, there was no statistically significant difference between the average concentrations observed at the community and distant locations. The average gross alpha concentrations from 1997 through 2001 were slightly higher than the average concentrations observed during 2002 (Table 4.1.2).

Gross beta concentrations in air peaked during the winter months of 2002 (Figure 4.1.2), repeating a pattern of natural radioactivity fluctuations (Eisenbud 1987). The annual average gross beta concentration during 2002 was slightly

Table 4.1.2. Airborne Radionuclide Concentrations in the Environs of the Hanford Site, 2002 Compared to Previous Years

Radionuclide	Location Group ^(a)	2002				1997-2001				Derived Concentration Guide ^(e)
		No. of Samples	No. of Detections ^(b)	Maximum ^(c)	Average ^(d)	No. of Samples	No. of Detections ^(b)	Maximum ^(c)	Average ^(d)	
				pCi/m ^{3(f)}	pCi/m ^{3(f)}			pCi/m ^{3(f)}	pCi/m ^{3(f)}	
				aCi/m ^{3(g)}	aCi/m ^{3(g)}			aCi/m ^{3(g)}	aCi/m ^{3(g)}	
Tritium	300 Area	75	75	15 ± 2.2	5.1 ± 5.1	321	272	25 ± 3.0	3.9 ± 7.5	100,000
	Onsite	65	60	15 ± 1.3	3.3 ± 5.3	318	184	13 ± 1.9	1.8 ± 3.0	
	Perimeter	77	66	23 ± 2.1	4.4 ± 8.9	333	173	36 ± 3.6	2.1 ± 6.1	
	Nearby communities	39	35	33 ± 2.9	4.1 ± 11	186	107	15 ± 1.3	2.2 ± 5.1	
	Distant communities	25	15	6.4 ± 1.5	2.2 ± 3.4	127	47	7.9 ± 1.1	1.3 ± 2.6	
Gross beta	Onsite	631	631	0.069 ± 0.011	0.016 ± 0.021	2,855	2,848	0.084 ± 0.014	0.015 ± 0.017	No standard
	Perimeter	290	289	0.074 ± 0.012	0.015 ± 0.021	1,214	1,214	0.070 ± 0.011	0.015 ± 0.016	
	Nearby communities	208	208	0.056 ± 0.0094	0.015 ± 0.021	1,050	1,049	0.053 ± 0.0088	0.016 ± 0.017	
	Distant communities	53	53	0.054 ± 0.0093	0.015 ± 0.022	282	281	0.059 ± 0.010	0.014 ± 0.016	
Gross alpha	Onsite	631	374	2,600 ± 1,100	490 ± 790	3,332	2,181	5,500 ± 1,300	600 ± 880	No standard
	Perimeter	290	182	1,900 ± 790	470 ± 750	1,430	985	5,100 ± 1,300	600 ± 880	
	Nearby communities	104	63	1,800 ± 1,000	500 ± 780	663	457	6,300 ± 1,700	670 ± 1,000	
	Distant communities	53	27	1,600 ± 680	400 ± 860	333	200	5,500 ± 1,900	570 ± 1,000	
Strontium-90	Onsite	44	9	1,300 ± 280	44 ± 410	139	34	340 ± 130	26 ± 110	9,000,000
	Perimeter	28	0	58 ± 41	-4.4 ± 59	98	15	390 ± 79	17 ± 99	
	Nearby communities	16	0	54 ± 67	3.5 ± 71	56	7	220 ± 190	23 ± 98	
	Distant communities	8	1	300 ± 100	40 ± 210	28	2	79 ± 37	0.16 ± 88	
Iodine-129	Onsite	4	4	2.2 ± 2.5	18 ± 6.4	20	20	32 ± 2.9	20 ± 12	70,000,000
	Perimeter	8	8	0.87 ± 0.096	0.40 ± 0.63	40	40	1.5 ± 0.12	0.64 ± 0.72	
	Distant communities	4	4	0.059 ± 0.0081	0.048 ± 0.016	20	20	0.22 ± 0.015	0.058 ± 0.090	
Plutonium-238	Onsite	44	3	4.3 ± 7.1	0.19 ± 1.8	139	5	5.3 ± 1.7	-0.038 ± 1.6	30,000
	Perimeter	28	0	1.6 ± 1.6	-0.023 ± 1.2	98	1	1.9 ± 1.4	-0.18 ± 0.85	
	Nearby communities	16	0	2.2 ± 3.2	0.010 ± 1.8	56	0	1.5 ± 1.8	-0.15 ± 1.1	
	Distant communities	8	0	0.37 ± 1.8	-0.26 ± 0.65	28	0	0.31 ± 1.8	-0.36 ± 0.72	
Plutonium-239/240	Onsite	44	7	8.7 ± 2.8	1.1 ± 4.6	139	48	36 ± 6.4	1.5 ± 7.8	20,000
	Perimeter	28	0	1.1 ± 1.8	0.025 ± 1.2	98	10	5.2 ± 2.5	0.48 ± 1.9	
	Nearby communities	16	2	2.1 ± 1.2	0.43 ± 1.6	56	4	1.7 ± 2.3	0.35 ± 1.1	
	Distant communities	8	0	2.4 ± 3.0	0.46 ± 2.0	28	1	3.2 ± 2.9	0.29 ± 1.8	

Table 4.1.2. (contd)

Radionuclide	Location Group ^(a)	2002				1997-2001				Derived Concentration Guide ^(e)
		No. of Samples	No. of Detections ^(b)	Maximum ^(c)	Average ^(d)	No. of Samples	No. of Detections ^(b)	Maximum ^(c)	Average ^(d)	
				aCi/m ^{3(g)}	aCi/m ^{3(g)}			aCi/m ^{3(g)}	aCi/m ^{3(g)}	
Uranium-234	Onsite	36	36	150 ± 44	30 ± 56	113	107	85 ± 21	21 ± 32	90,000
	Perimeter	16	16	87 ± 16	32 ± 37	56	56	140 ± 32	29 ± 43	
	Nearby communities	12	12	58 ± 18	27 ± 25	42	41	54 ± 17	25 ± 26	
	Distant communities	8	8	33 ± 11	33 ± 20	28	27	41 ± 15	17 ± 17	
Uranium-235	Onsite	36	0	4.0 ± 4.7	0.40 ± 3.4	113	8	3.7 ± 2.7	0.44 ± 2.3	100,000
	Perimeter	16	0	3.8 ± 3.8	0.56 ± 2.5	56	4	6.0 ± 6.0	0.77 ± 2.9	
	Nearby communities	12	0	4.6 ± 6.4	0.64 ± 3.9	42	3	6.2 ± 5.6	0.63 ± 3.8	
	Distant communities	8	0	3.1 ± 4.3	-0.54 ± 4.1	28	0	7.0 ± 9.3	0.41 ± 3.7	
Uranium-238	Onsite	36	36	120 ± 47	27 ± 46	113	102	92 ± 27	20 ± 32	100,000
	Perimeter	16	16	74 ± 20	31 ± 38	56	54	140 ± 32	27 ± 42	
	Nearby communities	12	12	46 ± 14	27 ± 18	42	40	56 ± 18	24 ± 26	
	Distant communities	8	8	28 ± 19	18 ± 13	28	28	33 ± 15	16 ± 15	
Cobalt-60	Onsite	52	0	1,700 ± 2,700	67 ± 680	238	1	3,800 ± 2,500	100 ± 890	80,000,000
	Perimeter	32	0	610 ± 690	90 ± 560	163	0	1,000 ± 530	0.62 ± 840	
	Nearby communities	28	0	1,100 ± 690	210 ± 610	130	0	1,800 ± 3,600	33 ± 920	
	Distant communities	8	0	700 ± 600	180 ± 610	44	0	650 ± 490	84 ± 530	
Cesium-137	Onsite	52	0	450 ± 540	-44 ± 810	238	1	710 ± 530	3.4 ± 490	400,000,000
	Perimeter	32	0	810 ± 530	60 ± 460	163	0	1,200 ± 2,000	27 ± 630	
	Nearby communities	28	0	500 ± 460	27 ± 530	130	0	2,100 ± 3,100	26 ± 700	
	Distant communities	8	0	530 ± 520	100 ± 770	44	0	400 ± 510	9.0 ± 520	

(a) Location groups are identified in Table 4.1.1.

(b) Detection is defined as a value reported above the minimum detectable activity and above the total propagated analytical uncertainty.

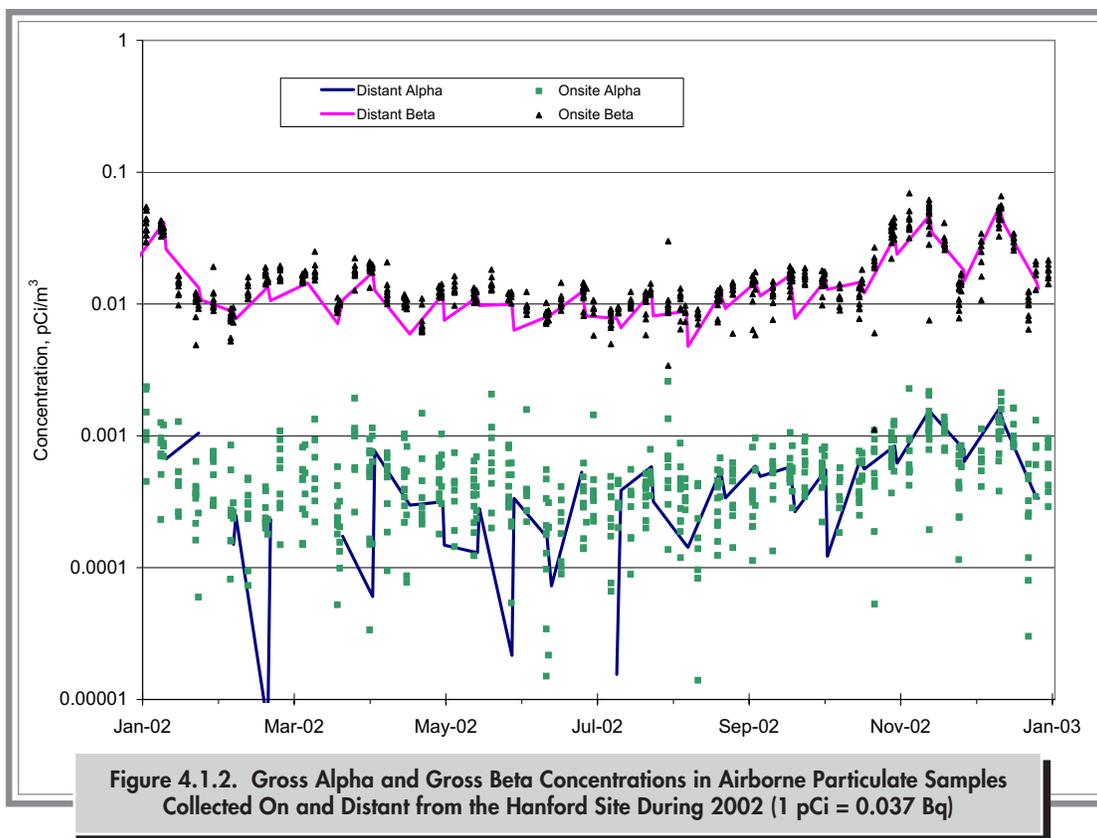
(c) Maximum single sample result ± total analytical uncertainty. Negative concentration values are explained in Appendix A.

(d) Average of all samples ± 2 times the standard deviation.

(e) DOE derived concentration guide (see Appendix D, Table D.5).

(f) 1 pCi = 0.037 Bq.

(g) There are 1 million attocuries (aCi) in 1 picocurie (pCi).

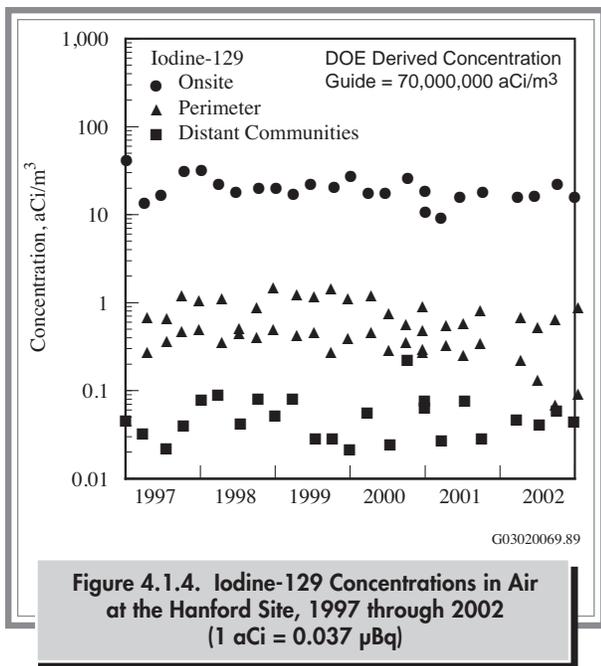
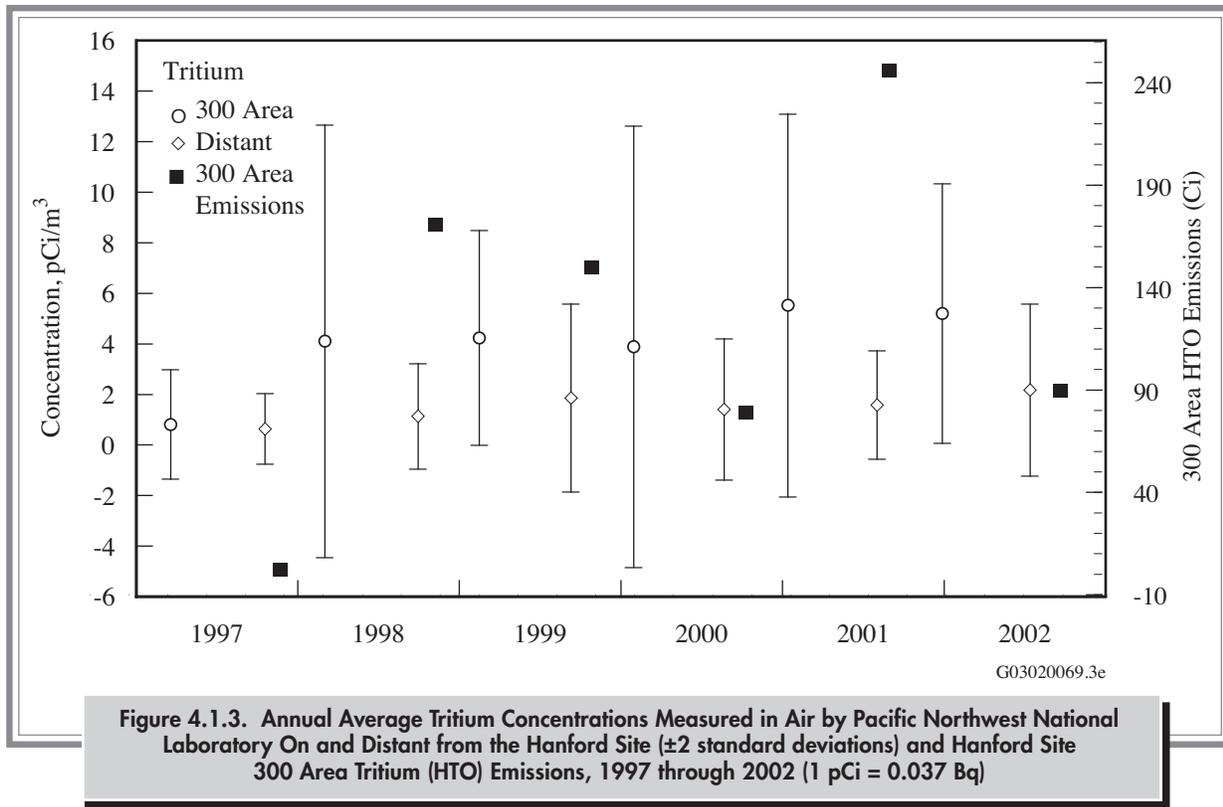


higher onsite than at the distant locations. The difference, however, was not statistically significant (two-sample means t-test, 95% confidence level). The average gross beta concentrations reported for 2002 were similar to concentrations reported from 1997 through 2001 (Table 4.1.2).

Average tritium concentrations measured during 2002 were slightly higher than average values reported for 1997 through 2001 (Table 4.1.2 and Figure 4.1.3). For non-300 Area samples in 2002, ~85% contained detectable amounts of tritium (the analytical method is capable of detecting concentrations below 3 pCi/m³ [0.11 Bq/m³]). All 300 Area tritium results in 2002 were above the minimum detectable concentration. Tritium releases in the 300 Area (associated with research and development activities [Table 3.1.1]) resulted in average 300 Area tritium concentrations that were higher than at distant sampling locations. The difference between 300 Area perimeter and community average concentrations was statistically significant relative to the distant location. The sample with the highest tritium concentration measured during 2002 (33 pCi/m³ [1.2 Bq/m³]) was collected at Leslie Groves Park in Richland (location 37 in Figure 4.1.1) during the month of April. This

concentration was only 0.033% of the DOE derived concentration guide (Appendix D, Table D.5). For an evaluation of longer term trends in tritium concentrations on the Hanford Site, see PNNL-13909.

Iodine-129 analyses were performed on samples collected onsite at a location downwind of the Plutonium-Uranium Extraction Plant, at two downwind perimeter locations, and at a distant location (Yakima) in 2002 (Table 4.1.1). Concentrations measured onsite during 2002 were elevated compared to those measured at the site perimeter, and perimeter levels were higher than those measured at the distant location, Yakima (Figure 4.1.4 and Table 4.1.2). Concentration differences between these locations were statistically significant and indicated a Hanford source. Onsite and perimeter air concentrations have remained at their respective levels from 1997 through 2002 (Figure 4.1.4). Onsite air concentrations of iodine-129 were influenced by minor emissions (0.0012 curie [44 MBq]; Table 3.1.1) from the Plutonium-Uranium Extraction Plant and possible releases from waste storage tanks and cribs. The annual average iodine-129 concentration (0.40 ± 0.63 aCi/m³ [0.015 ± 0.023 μBq/m³]) at the downwind



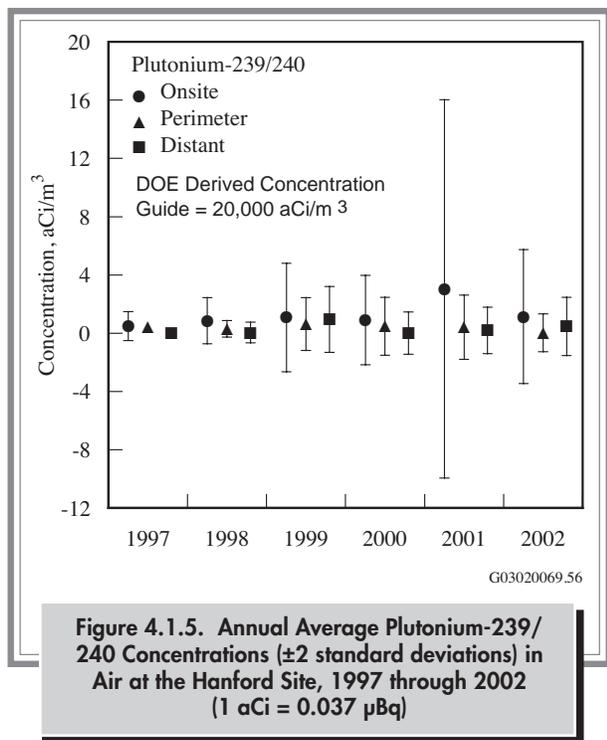
perimeter in 2002 was $<0.0000006\%$ of the DOE derived concentration guide (70 million aCi/m³ [2.6 Bq/m³]).

Plutonium-238 was detected in three of the onsite composite samples during 2002 (nominal detection limit of

1.8 aCi/m³ [0.067 μ Bq/m³]). The three detected samples were all from the 100 Areas composite sample group. The maximum reported plutonium-238 concentration in 2002 was 4.3 ± 7.1 aCi/m³ (0.15 ± 0.26 μ Bq/m³), or 7,000 times less than the DOE derived concentration guide for plutonium-238 (30,000 aCi/m³ [1.1 mBq/m³]).

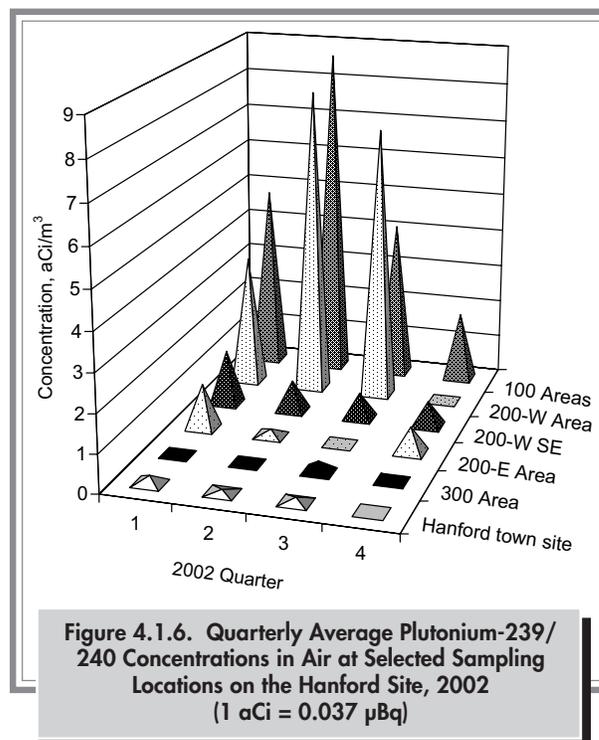
The annual average plutonium-239/240 concentrations measured in air samples for 2002 are given in Table 4.1.2 and Figure 4.1.5. The annual average air concentration of plutonium-239/240 at onsite locations was 1.1 ± 4.6 aCi/m³ (0.04 ± 0.17 μ Bq/m³) during 2002. The annual average air concentrations were higher for the onsite locations than the distant locations; however, the difference was not statistically significant. The maximum Hanford Site plutonium-239/240 air concentration (8.7 ± 2.8 aCi/m³ [0.32 ± 0.1 μ Bq/m³]) was observed for the 100 Areas second quarter composite sample (locations 1, 2, and 3 on Figure 4.1.1). This maximum reported concentration was $<0.05\%$ of the DOE derived concentration guide (20,000 aCi/m³ [0.73 mBq/m³]) for plutonium-239/240.

The 100 Areas and the 200-West Area had statistically significant higher plutonium-239/240 concentrations than other selected onsite locations. Figure 4.1.6



illustrates plutonium-239/240 results for 2002 quarterly composite samples from selected onsite locations. The concentrations measured for the 200-West Area composite samples are presumed to be from stack emissions in the 200-West Area (Section 3.1.1), while the plutonium-238 and plutonium-239/240 detected in the 100 Areas are likely related to cleanup activities in the 100 Areas. The reported plutonium-239/240 stack emissions from the 200-West Area in 2002 were ten times larger than the stack emissions from the 100 Areas. However, average concentrations of plutonium-239/240 in air were similar in the 200-West Area and the 100 Areas (Figure 4.1.6). Cleanup activities in the 100 Areas likely led to increased dust suspension, and subsequently an increase in airborne radioactive particulates in the vicinity of the 100 Areas, resulting in detectable concentrations of plutonium-238, and concentrations of plutonium-239/240 slightly higher than at other onsite locations. For a summary of activities in the 100 Areas, refer to Section 2.3. For an account of an occurrence of radioactive soil being blown off of a cleanup site in the 100-F Area during 2002, refer to Section 2.4.

Average isotopic uranium concentrations (uranium-234, uranium-235, and uranium-238) in airborne particulate matter in 2002 were similar to average concentrations between 1997 and 2001 for all distance classes (Table 4.1.2). The 2002 annual average uranium-238 concentration for



the site perimeter was 31 ± 38 aCi/m³ (1.1 ± 1.4 μ Bq/m³), which is 0.03% of the DOE derived concentration guide (100,000 aCi/m³ [3.7 mBq/m³]). There were no statistical differences observed between average concentrations of each measured uranium isotope at different distance classes (two-sample means t-test, 95% confidence level). This implies that the measured concentrations of the different uranium isotopes are from background material in the air, and not from Hanford emissions.

A total of 96 samples were analyzed for strontium-90 in 2002 (Table 4.1.2). Only 9% (9 of 96) samples analyzed were above the detection limit (~ 90 aCi/m³ [3 μ Bq/m³]). Comparison of the average reported concentration at different distance classes was considered meaningless due to the low number of detected sample results, and the large variability in concentrations. The highest measured strontium-90 concentration ($1,300 \pm 280$ aCi/m³ [48 ± 10 μ Bq/m³]) was from the 400 Area and was only 0.014% of the DOE derived concentration guide (9 million aCi/m³ [0.33 Bq/m³]).

Quarterly composite samples were analyzed by gamma spectroscopy. Naturally occurring beryllium-7 and potassium-40 were routinely identified. The potential Hanford-origin gamma-emitting radionuclides of cobalt-60 and cesium-137 were of particular interest. Cobalt-60 and

cesium-137 results for 2002 samples are included in Table 4.1.2. None of the 120 samples analyzed by gamma spectroscopy had concentrations of cobalt-60 or cesium-137 above their respective minimum detectable concentrations ($\sim 1,000$ and 800 aCi/m³ [~ 37 and 30 μ Bq/m³]).

4.1.3 AIR PARTICULATE MONITORING

Airborne particulate matter (dust) is one of the U.S. Environmental Protection Agency's (EPA) criteria pollutants. EPA classifies particulate matter by particle size. PM₁₀ is defined as a particle having an aerodynamic diameter <10 micrometers. Similarly, PM_{2.5} is defined as a particle having an aerodynamic diameter <2.5 micrometers (a sample of PM₁₀ includes PM_{2.5}, since particles smaller than 2.5 micrometers are also smaller than 10 micrometers). The EPA's National Ambient Air Quality Standard (Title 40, Code of Federal Regulations, Part 50 [40 CFR 50]) for PM₁₀ requires a 24-hour average concentration of <150 μ g/m³, and an annual average concentration <50 μ g/m³. There is currently no enforced EPA standard for PM_{2.5}, although proposed standards are 65 μ g/m³ 24-hour average concentration and 15 μ g/m³ annual average concentration. Health risk studies have shown a positive correlation between increases in concentrations of airborne particulate matter and increased hospital admissions for pulmonary and heart conditions (Schwartz 1994; Morgan et al. 1998; Ostro et al. 1999). Studies have indicated that a 100 μ g/m³ increase in PM₁₀ concentrations has a relative risk^(a) of ~ 1.17 for hospital admissions for pneumonia and chronic obstructive pulmonary disorder (Schwartz 1994). Similar relationships were found between PM₁₀ concentrations and daily human mortality in areas where windblown dust was the main contributor to high PM₁₀ concentrations (similar to the Hanford Site) (Ostro et al. 1999).

During February 2001, monitoring of particulate matter mass concentrations in air on the Hanford Site began. The motivation for this was the decrease in vegetative cover on a large portion of the site after the 24 Command Wildland Fire in 2000 (PNNL-13487), as well as information requests from the public. It was theorized that the decrease

in vegetative cover would result in increased wind erosion, and subsequently, increased particulate matter concentrations in air. Particulate monitoring was done using tapered element oscillating microbalances. The unique design of the tapered element oscillating microbalance instrument measures the difference in mass collected on a filter by measuring the change in frequency of oscillation of the filter. The instruments record hourly average concentrations, but daily average concentration data were calculated for this report. PM₁₀ data have been collected at the Hanford Meteorology Station since February 2001, while PM_{2.5} data collection began at the Hanford Meteorology Station in October of 2001.

Figure 4.1.7 shows the daily average PM₁₀ concentrations recorded at the Hanford Meteorology Station during 2002. Daily average PM₁₀ concentrations on the Hanford Site were higher than the EPA 24-hour average standard for PM₁₀ (150 μ g/m³) three times during 2002 (January 12, January 24, and March 11). The observed annual average PM₁₀ concentration at the Hanford Meteorology Station during 2002 (17 μ g/m³) was well below the EPA annual average standard (50 μ g/m³). Hanford Site measurements are not used by the Benton Clean Air Authority to determine compliance with air quality standards. EPA policy allows exemptions for natural events that result in high particulate matter concentrations, such as windstorms. All of the elevated PM₁₀ concentrations observed on the Hanford Site in 2002 appeared to be a result of high winds (Figure 4.1.8).

There is currently no enforced EPA concentration standard for PM_{2.5}. However, the PM_{2.5} concentrations measured at the Hanford Meteorology Station during 2002 (Figure 4.1.9) were well below the proposed EPA health-based standards for PM_{2.5} (15 μ g/m³ annual average, 65 μ g/m³ 24-hour average). The measured annual average PM_{2.5} concentration at the Hanford Meteorology Station during 2002 was 6 μ g/m³, while the highest 24-hour average concentration observed was 28.5 μ g/m³.

During 2002, Hanford Site particulate monitoring was also conducted at the 300 Area meteorology tower, on the peak of Rattlesnake Mountain, at Rattlesnake Springs, and at the 100-F Area meteorological station. These samples were collected over periods of several months for special studies and projects, and the data are not discussed here.

(a) Relative risk here refers to the increase in hospital admissions after PM₁₀ levels rise. When 24-hour average PM₁₀ increased by 100 μ g/m³, a 17% increase in hospital admissions for pneumonia and chronic obstructive pulmonary disorder occurred.

