

4.1 Air Surveillance



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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's Environmental Monitoring Plan for the Hanford Site (DOE/RL-91-50). Comparing measured radionuclide concentrations from locations on and around the Hanford Site to concentrations measured at 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-14687, APP. 1). In addition to the radiological monitoring network, a small non-radiological monitoring network is operated onsite. This network measures particulate matter (dust) concentrations at a few locations across the Hanford Site. Results are mainly used for scientific studies in an attempt to better understand windblown dust on and around the Hanford Site.

4.1.1 Collection of Air Samples and Analytes Tested

During 2003, airborne radionuclide samples were collected at 44 continuously operating samplers. The sampling stations are grouped into four location groups: onsite (23 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 7.4) that were managed and operated by local schoolteachers 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 7.1). 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-14184) and analyzed for up to 8 analytes (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 of radionuclides of concern. 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 gamma-emitting radionuclides (Appendix F). Most composite samples were also analyzed for strontium-90, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238.

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.

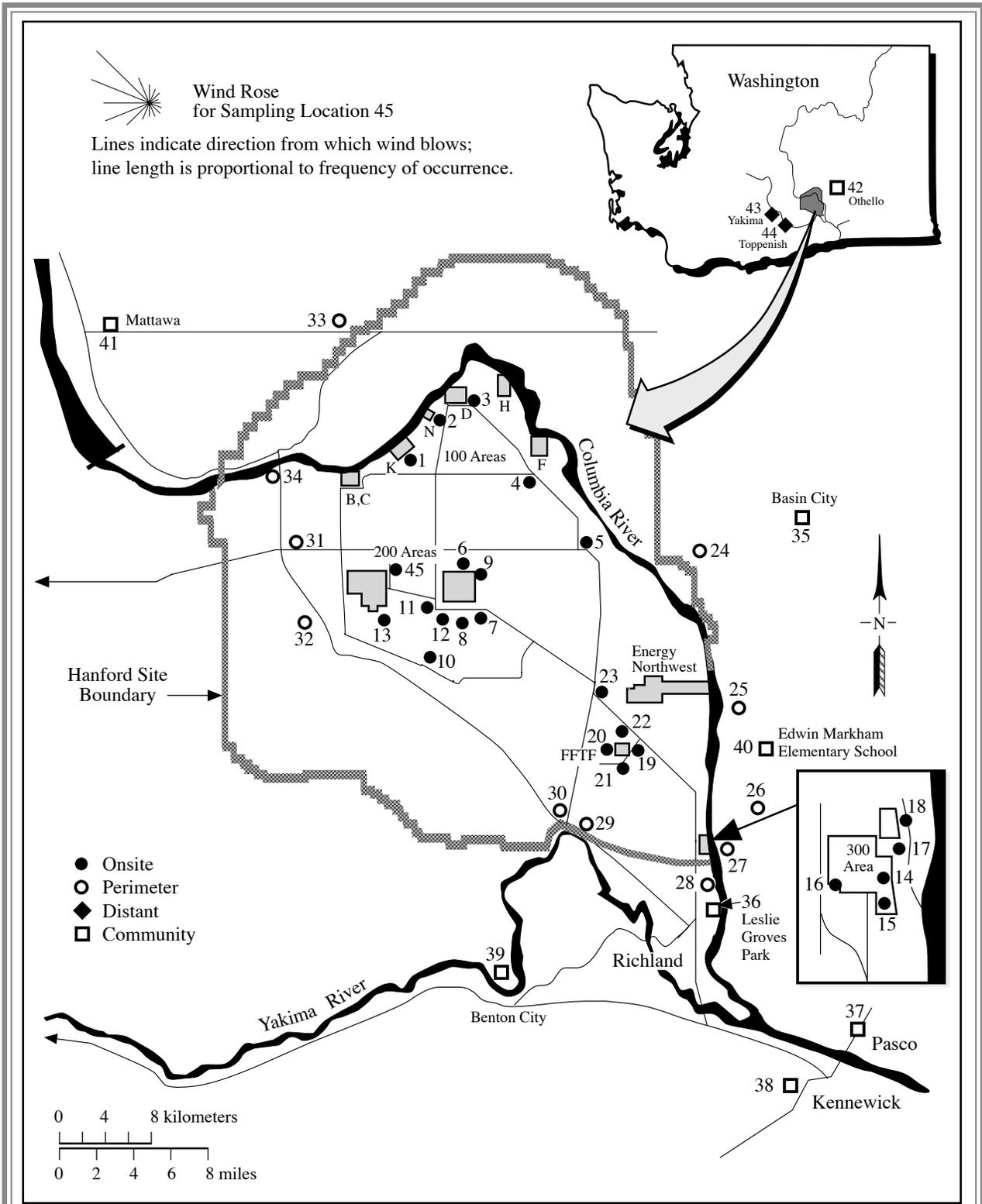


Figure 4.1.1. Pacific Northwest National Laboratory Air Sampling Locations On and Around the Hanford Site During 2003 (see Table 4.1.1 for location names)

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Table 4.1.1. Pacific Northwest National Laboratory Air Sampling Locations On and Around the Hanford Site, Sample Composite Groups, and Analytes, 2003

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	200 ESE	Alpha, Beta, ³ H, ¹²⁹ I	200 E Area	Gamma, Sr, Pu, U
8	S of 200 E	Alpha, Beta		
9	B Pond	Alpha, Beta	B Pond	Gamma, Sr, Pu, U
10	Army Loop Camp	Alpha, Beta	200 W South East	Gamma, Sr, Pu, U
11	200 Tel. Exchange	Alpha, Beta, ³ H		
12	SW of B/C Crib	Alpha, Beta		
13	200 W SE	Alpha, Beta	200 West	Gamma, Sr, Pu, U
14	300 Water Intake	Alpha, Beta, ³ H	300 Area	Gamma, Sr, Pu, U
15	300 South Gate	Alpha, Beta, ³ H		
16	300 South West	Alpha, Beta, ³ H		
17	300 Trench	Alpha, Beta, ³ H U, Gamma	300 NE	Sr, Pu
18	300 NE	Alpha, Beta, ³ H U, Gamma		
19	400 E	Alpha, Beta, ³ H	400 Area	Gamma, Sr, Pu
20	400 W	Alpha, Beta		
21	400 S	Alpha, Beta		
22	400 N	Alpha, Beta		
23	Wye Barricade	Alpha, Beta	Wye Barricade	Gamma, Sr, Pu, U
Perimeter				
24	Ringold Met Tower	Alpha, Beta, ³ H, ¹²⁹ I	Ringold Met Tower	Gamma, Sr, Pu
25	W End of Fir Road	Alpha, Beta	W End of Fir Road	Gamma, Sr, Pu, U
26	Dogwood Met Tower	Alpha, Beta, ³ H	Dogwood Met Tower	Gamma, Sr, Pu, U
27	Byers Landing	Alpha, Beta, ³ H, ¹²⁹ I	Byers Landing	Gamma, Sr, Pu, U
28	Battelle Complex	Alpha, Beta, ³ H	Battelle Complex	Gamma
29	Horn Rapids Substation	Alpha, Beta	Prosser Barricade	Gamma, Sr, Pu, U
30	Prosser Barricade	Alpha, Beta, ³ H		
31	Yakima Barricade	Alpha, Beta	Yakima Barricade	Gamma, Sr, Pu
32	Rattlesnake Springs	Alpha, Beta		
33	Wahluke Slope	Alpha, Beta, ³ H	Wahluke Slope	Gamma, Sr, Pu
34	S End Vernita Bridge	Alpha, Beta		

Table 4.1.1. (contd)

<u>Map^(a) Location</u>	<u>Sampling Location</u>	<u>Analytes^(b)</u>	<u>Composite Group</u>	<u>Analytes^(c)</u>
Nearby Communities				
35	Basin City School ^(d)	Alpha, Beta, ³ H	Basin City School	Gamma, Sr, Pu, U
36	Leslie Groves-Rchlnd ^(d)	Alpha, Beta, ³ H	Leslie Groves-Rchlnd	Gamma, Sr, Pu, U
37	Pasco	Beta	Tri-Cities	Gamma, Sr, Pu
38	Kennewick	Alpha, Beta		
39	Benton City	Beta	Benton City	Gamma
40	Edwin Markham School ^(d)	Alpha, Beta, ³ H	Edwin Markham School	Gamma, Sr, Pu, U
41	Mattawa	Beta	Mattawa	Gamma
42	Othello	Beta	Othello	Gamma
Distant Communities				
43	Yakima	Alpha, Beta, ³ H, ¹²⁹ I	Yakima	Gamma, Sr, Pu, U
44	Toppenish ^(d)	Alpha, Beta, ³ H	Toppenish	Gamma, Sr, Pu, U
Non-Radiological Monitoring				
45	Hanford Meteorology Station	PM ₁₀ , PM _{2.5} ^(e)		

(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.

(e) See Section 4.1.3.

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 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.

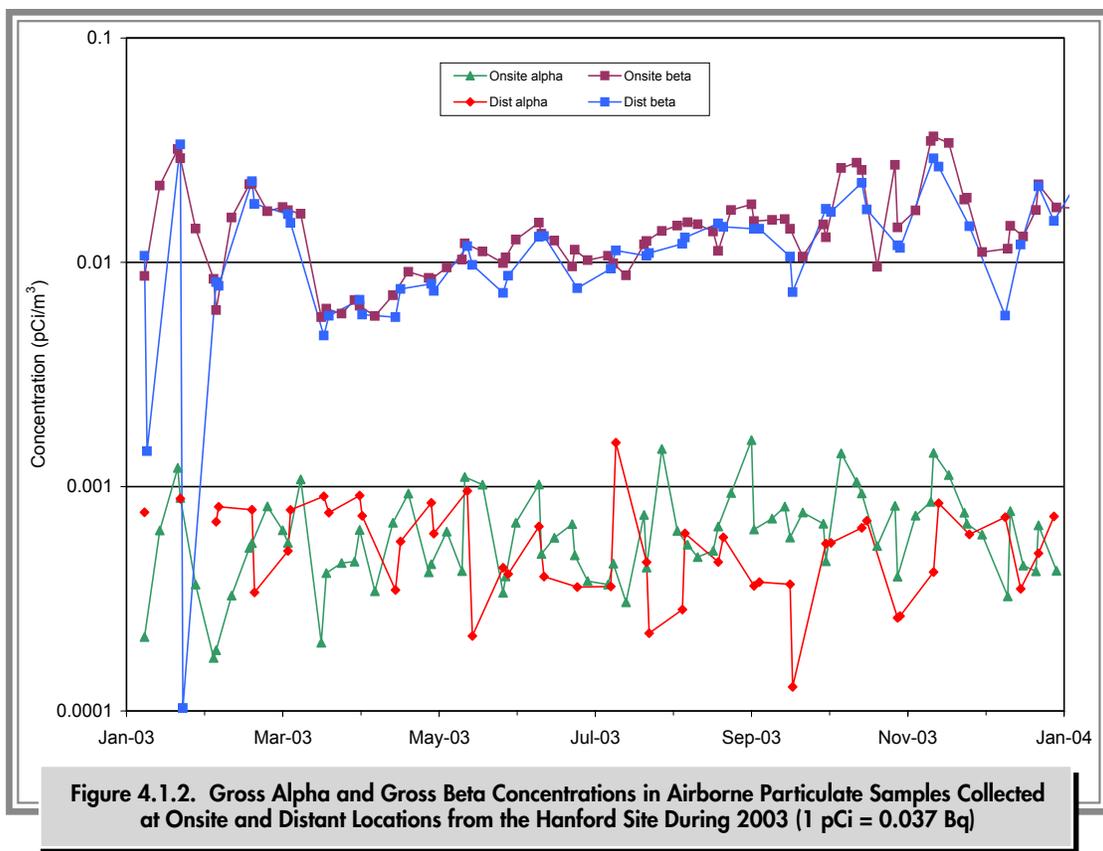
4.1.2 Radiological Results for Air Samples

All sample results showed low to very low radiological concentrations in air during 2003. All samples were below the DOE derived concentration guides for each radionuclide analyzed (Appendix D, Table D.5). The DOE derived

concentration guide values are based on a 100 mrem/year dose. A more conservative dose standard is the U.S. Environmental Protection Agency (EPA) *Clean Air Act* standard of 10 mrem/year from airborne radiological material. All air samples collected in 2003 were below one-tenth of the DOE derived concentration guide values, which would be equivalent to concentrations that would result in a 10 mrem/year dose.

During 2003, the annual average onsite gross alpha concentration was higher than the average concentration measured at the distant location by a small but statistically significant amount (two-sample means t-test, 95% confidence level) (Figure 4.1.2). The highest average gross alpha concentration for 2003 was observed at onsite locations (650 aCi/m³ [24 Bq/m³]). The average gross alpha concentrations observed at each location group during





2003 were similar to the 5-year average concentrations observed from 1998 through 2002 (Table 4.1.2).

Gross beta concentrations in air peaked during the winter months of 2003 (Figure 4.1.2), repeating a pattern of natural radioactivity fluctuations (Eisenbud 1987). The annual average gross beta concentration at onsite locations during 2003 was slightly higher than at the distant locations. The difference was small but statistically significant (two-sample means *t*-test, 95% confidence level). The average gross beta concentrations reported for 2003 were similar to concentrations reported from 1998 through 2002 (Table 4.1.2).

Average tritium concentrations measured during 2003 were slightly higher than average values reported for 1998 through 2002 (Table 4.1.2 and Figure 4.1.3). The 2003 annual average tritium concentrations at each location group were also elevated relative to the 2002 annual average concentrations (PNNL-14295). Approximately 98% of atmospheric moisture samples collected in 2003 contained detectable amounts of tritium (Table 4.1.2). In the 5-year period from 1998 through 2002, about 75% of the samples collected had detectable levels of tritium. In 2003,

the tritium sampling systems were modified to provide a more accurate measurement of sample volume. These modifications resulted in more consistent sampling rates over the sampling period. These improvements may have been partially responsible for the elevated tritium concentrations observed in 2003 and the more frequent detection of tritium. The annual average 300 Area, perimeter, and community concentrations were higher by a statistically significant amount relative to the distant location (two-sample means *t*-test, 95% confidence level). The sample with the highest tritium concentration measured during 2003 (74 pCi/m³ [2.7 Bq/m³]) was collected at the Battelle Complex in Richland (location 28 in Figure 4.1.1) during the month of July. This concentration was 0.074% 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 (PUREX), at two downwind perimeter locations, and at a distant location (Yakima) in 2003

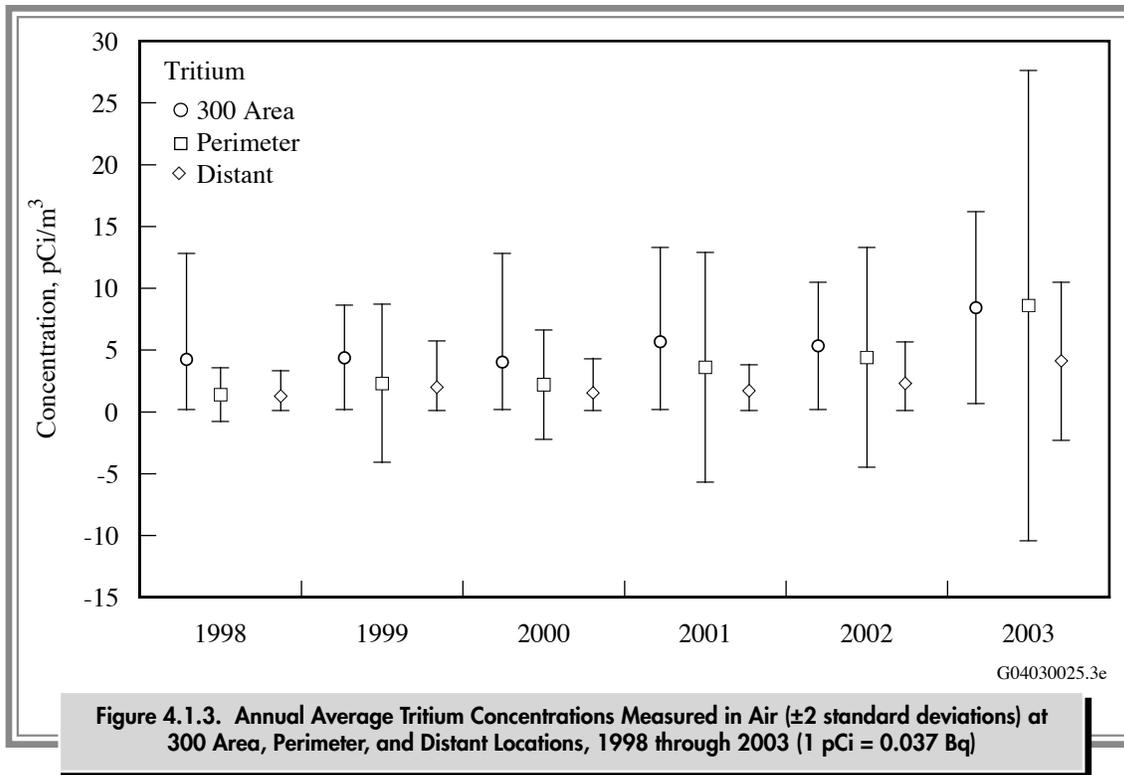
Table 4.1.2. Airborne Radionuclide Concentrations in the Environs of the Hanford Site, 2003 Compared to Previous Years

Radionuclide (approximate detection limit)	Location Group ^(a)	2003				1998-2002				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)}	
Tritium (1.5 pCi/m ³)	300 Area	76	76	23 ± 3.5	8.2 ± 7.7	351	336	25 ± 3.0	4.6 ± 7.1	100,000
	Onsite	67	67	16 ± 2.4	5.4 ± 6.4	321	226	15 ± 1.3	2.3 ± 3.7	
	Perimeter	82	82	74 ± 10	8.6 ± 19	350	231	36 ± 3.6	2.9 ± 7.3	
	Nearby communities	42	42	47 ± 6.8	9.1 ± 18	187	137	33 ± 2.9	2.9 ± 7.0	
	Distant communities	25	21	11 ± 2.2	4.0 ± 6.4	126	60	7.9 ± 1.1	1.6 ± 2.9	
Gross beta (0.001 pCi/m ³)	Onsite	586	584	0.041 ± 0.0071	0.015 ± 0.015	3,014	3,007	0.084 ± 0.014	0.015 ± 0.018	No standard
	Perimeter	286	286	0.038 ± 0.0064	0.014 ± 0.013	1,307	1,306	0.074 ± 0.012	0.015 ± 0.017	
	Nearby communities	206	206	0.037 ± 0.0066	0.015 ± 0.013	1,062	1,061	0.056 ± 0.0094	0.015 ± 0.017	
	Distant communities	53	52	0.034 ± 0.0058	0.013 ± 0.013	286	285	0.059 ± 0.010	0.014 ± 0.017	
Gross alpha (350 aCi/m ³)	Onsite	586	472	2,600 ± 880	650 ± 820	2,875	1,916	3,600 ± 1,500	610 ± 880	No standard
	Perimeter	286	241	2,900 ± 920	640 ± 730	1,251	870	5,100 ± 1,300	610 ± 910	
	Nearby communities	113	102	1,900 ± 700	620 ± 550	557	390	6,300 ± 1,700	680 ± 1,100	
	Distant communities	53	41	1,600 ± 600	560 ± 570	283	168	5,500 ± 1,900	580 ± 1,100	
Strontium-90 (70 aCi/m ³)	Onsite	40	16	180 ± 86	40 ± 90	174	42	1,300 ± 280	32 ± 230	9,000,000
	Perimeter	28	6	110 ± 64	34 ± 94	119	15	390 ± 79	13 ± 96	
	Nearby communities	16	4	160 ± 62	50 ± 100	68	7	220 ± 190	19 ± 96	
	Distant communities	8	1	100 ± 74	38 ± 110	34	3	300 ± 100	10 ± 130	
Iodine-129 (0.01 aCi/m ³)	Onsite	4	4	26 ± 2.6	21 ± 8.9	20	20	27 ± 1.3	19 ± 8.7	70,000,000
	Perimeter	8	8	0.78 ± 0.062	0.49 ± 0.40	40	40	1.5 ± 0.12	0.60 ± 0.74	
	Distant communities	4	4	0.029 ± 0.0037	0.025 ± 0.0062	20	20	0.22 ± 0.015	0.059 ± 0.087	
Plutonium-238 (2 aCi/m ³)	Onsite	40	3	2.5 ± 1.6	0.06 ± 1.3	174	8	5.3 ± 1.7	0.020 ± 1.7	30,000
	Perimeter	28	0	1.5 ± 3.0	-0.22 ± 1.5	119	1	1.9 ± 1.4	-0.15 ± 0.96	
	Nearby communities	16	1	3.7 ± 3.6	0.46 ± 2.2	68	0	2.2 ± 3.2	-0.13 ± 1.3	
	Distant communities	8	0	0.063 ± 1.5	-0.92 ± 1.6	34	0	0.37 ± 1.8	-0.36 ± 0.70	
Plutonium- 239/240 (2 aCi/m ³)	Onsite	40	6	14 ± 4.3	1.2 ± 5.2	174	49	36 ± 6.4	1.4 ± 7.3	20,000
	Perimeter	28	1	1.7 ± 2.7	0.28 ± 1.7	119	7	5.2 ± 2.5	0.38 ± 1.8	
	Nearby communities	16	0	1.9 ± 2.5	0.48 ± 1.2	68	4	2.1 ± 1.2	0.36 ± 1.2	
	Distant communities	8	0	1.5 ± 2.4	0.47 ± 1.2	34	1	3.2 ± 2.9	0.37 ± 1.9	

Table 4.1.2. (contd)

Radionuclide (approximate detection limit)	Location Group ^(a)	2003				1998-2002				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 (10 aCi/m ³)	Onsite	32	30	120 ± 31	32 ± 50	141	135	150 ± 52	23 ± 40	90,000
	Perimeter	16	16	76 ± 20	33 ± 35	68	68	140 ± 32	30 ± 42	
	Nearby communities	12	12	53 ± 15	35 ± 24	51	50	58 ± 21	26 ± 27	
	Distant communities	8	7	34 ± 14	20 ± 16	34	33	41 ± 15	18 ± 17	
Uranium-235 (10 aCi/m ³)	Onsite	32	0	6.5 ± 8.5	0.57 ± 4.1	141	5	4.0 ± 4.7	0.40 ± 2.6	100,000
	Perimeter	16	0	3.9 ± 5.8	0.99 ± 2.6	68	2	6.0 ± 6.0	0.69 ± 2.8	
	Nearby communities	12	0	2.1 ± 3.0	-0.57 ± 4.4	51	0	6.2 ± 5.6	0.60 ± 3.9	
	Distant communities	8	0	2.7 ± 4.4	0.46 ± 4.2	34	0	7.0 ± 9.3	0.20 ± 3.9	
Uranium-238 (10 aCi/m ³)	Onsite	32	29	160 ± 37	33 ± 63	141	130	120 ± 47	21 ± 36	100,000
	Perimeter	16	16	61 ± 18	32 ± 32	68	66	140 ± 32	28 ± 42	
	Nearby communities	12	12	40 ± 14	28 ± 19	51	49	56 ± 18	24 ± 25	
	Distant communities	8	8	28 ± 11	19 ± 12	34	34	33 ± 15	17 ± 15	
Cobalt-60 (1,200 aCi/m ³)	Onsite	48	0	730 ± 950	69 ± 560	217	1	3,800 ± 2,500	100 ± 470	80,000,000
	Perimeter	32	0	720 ± 570	62 ± 610	145	0	910 ± 740	10 ± 400	
	Nearby communities	28	0	860 ± 810	56 ± 800	127	0	1,800 ± 3,600	90 ± 450	
	Distant communities	8	0	730 ± 1,000	58 ± 600	37	0	700 ± 600	50 ± 270	
Cesium-137 (950 aCi/m ³)	Onsite	48	0	920 ± 690	46 ± 460	217	1	540 ± 870	-5.1 ± 580	400,000,000
	Perimeter	32	0	850 ± 770	2 ± 610	145	0	1,200 ± 2,000	39 ± 590	
	Nearby communities	28	0	690 ± 900	-12 ± 660	127	0	2,100 ± 3,100	22 ± 680	
	Distant communities	8	0	99 ± 480	-130 ± 340	37	0	530 ± 520	42 ± 580	

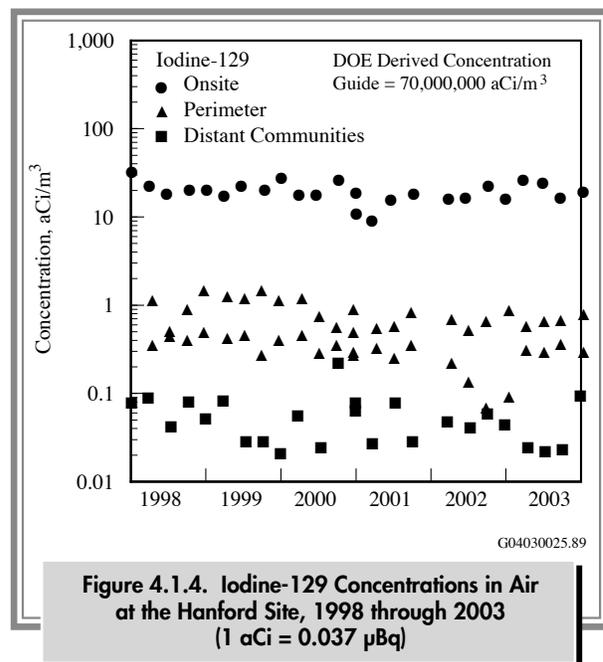
- (a) Location groups are identified in Table 4.1.1.
 (b) Detection is defined as a value reported above the minimum detectable activity and above the total propagated analytical uncertainty.
 (c) Maximum single sample result ± total analytical uncertainty. Negative concentration values are explained 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).

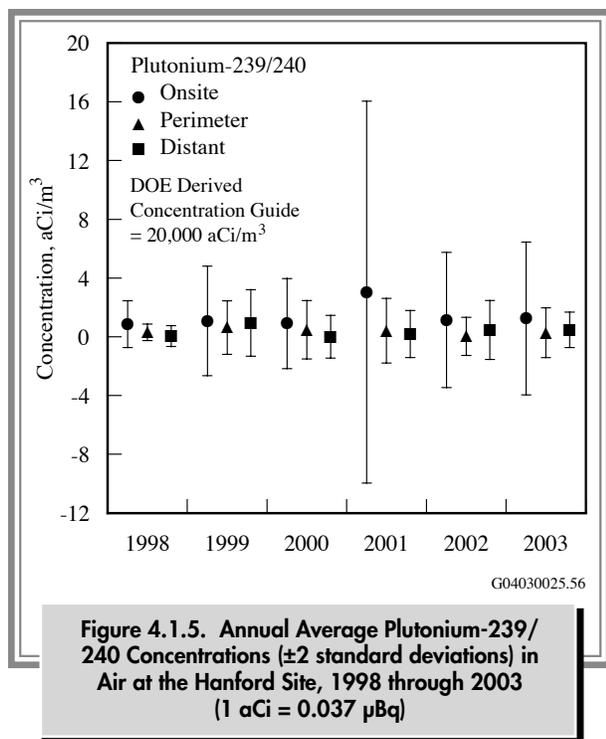


(Table 4.1.1). Concentrations measured onsite during 2003 were elevated compared to those measured at the site perimeter, and perimeter levels were higher than those measured at the distant location in Yakima (Figure 4.1.4 and Table 4.1.2). Concentration differences between these locations were statistically significant and indicated a Hanford source. Onsite and perimeter air concentrations observed in 2003 were consistent with the levels observed from 1998 through 2002 (Figure 4.1.4). Onsite air concentrations of iodine-129 were influenced by minor emissions (Table 3.1.1) from the Plutonium-Uranium Extraction Plant (PUREX) and possible releases from waste storage tanks and cribs. The annual average iodine-129 concentration (0.49 ± 0.40 aCi/m³ [0.018 ± 0.015 μ Bq/m³]) observed at the downwind perimeter in 2003 was 0.0000007% of the DOE derived concentration guide (70 million aCi/m³ [2.6 Bq/m³]).

Plutonium-238 was detected in three onsite composite samples during 2003 (Table 4.1.2). The maximum reported plutonium-238 concentration in 2003 was 3.7 ± 3.6 aCi/m³ (0.14 ± 0.13 μ Bq/m³), or 8,000 times below the DOE derived concentration guide for plutonium-238 (30,000 aCi/m³ [1.1 mBq/m³]).

The annual average plutonium-239/240 concentration (Figure 4.1.5 measured in air samples in 2003 at onsite locations) was 1.2 ± 5.2 aCi/m³ (0.044 ± 0.19 μ Bq/m³). Of the 40 onsite samples analyzed for plutonium-239/240, 6 had detectable amounts in the sample (Table 4.1.2). Four of





the samples were from the 100 Areas composite group (Table 4.1.1), and may have been impacted by cleanup activities ongoing at various locations in the 100 Areas. Only 1 of the 52 perimeter, community, and distant samples collected in 2003 had a detectable amount of plutonium-239/240. The maximum Hanford Site plutonium-239/240 air concentration (14 ± 4.3 aCi/m³ [0.52 ± 0.16 μ Bq/m³]) was observed for the 100 Areas fourth quarter composite group sample (locations 1, 2, and 3 on Figure 4.1.1). This maximum reported concentration was 0.07% of the DOE derived concentration guide (20,000 aCi/m³ [0.73 mBq/m³]) for plutonium-239/240.

Average isotopic uranium concentrations (uranium-234, uranium-235, and uranium-238) in airborne particulate matter in 2003 were similar to average concentrations between 1998 and 2002 for all location groups (Table 4.1.2). The 2003 annual average uranium-238 concentration for the site perimeter was 32 ± 32 aCi/m³ (1.2 ± 1.2 μ Bq/m³), which is 0.03% of the DOE derived concentration guide (100,000 aCi/m³ [3.7 mBq/m³]). The onsite and perimeter uranium-234 and uranium-238 average concentrations were higher than the average distant community concentrations by a statistically significant amount (two-sample means t-test, 95% confidence level).

A total of 92 airborne particulate samples were analyzed for strontium-90 in 2003 (Table 4.1.2). While 40% of the onsite samples had detectable concentrations of strontium-90, only one of the distant community samples had a detectable concentration. Comparison of the average concentrations from different location groups was considered meaningless due to the low number of detected sample results and the large variability in concentrations. The highest measured strontium-90 concentration (180 ± 86 aCi/m³ [6.7 ± 3.2 μ Bq/m³]) was only 0.002% of the DOE derived concentration guide (9 million aCi/m³ [0.33 Bq/m³]).

All 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. None of the 116 samples analyzed by gamma spectroscopy had concentrations of cobalt-60 or cesium-137 above their respective minimum detectable concentrations (Table 4.1.2). This is consistent with the 5-year average data from 1998 through 2002 (Table 4.1.2).

4.1.3 Monitoring of Particulate Matter

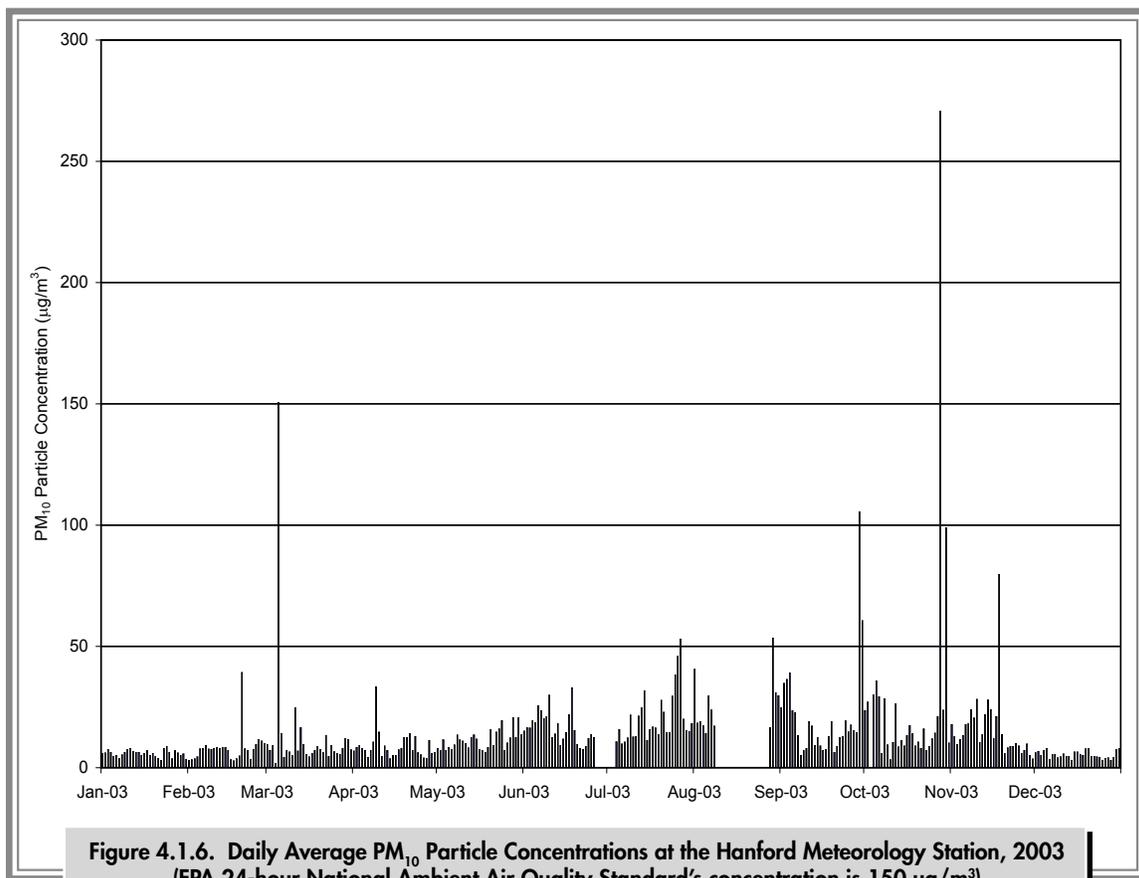
Airborne particulate matter (dust) is one of the EPA's criteria pollutants. The EPA classifies particulate matter by particle size. PM₁₀ is an air pollutant consisting of small particles with aerodynamic diameters less than or equal to 10 micrometers. Similarly, PM_{2.5} is an air pollutant consisting of small particles with aerodynamic diameters less than or equal to 2.5 micrometers (PM₁₀ particles can include PM_{2.5}, since particles smaller than 2.5 micrometers are also smaller than 10 micrometers). 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 less than 150 μ g/m³, and an annual average concentration less than 50 μ g/m³. There is currently no enforced EPA standard for PM_{2.5}, although proposed standards are 65 μ g/m³ for a 24-hour average concentration and a 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 $\mu\text{g}/\text{m}^3$ increase in PM_{10} concentrations results in a 17% increase in hospital admissions for pneumonia and chronic obstructive pulmonary disorder (Schwartz 1994). Similar relationships were found between PM_{10} concentrations and daily human mortality in areas where windblown dust was the main contributor to high PM_{10} 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 Wildfire in 2000 (PNNL-13487), as well as information requests from the public. It was expected that the decrease in vegetative cover would result in increased wind erosion, and subsequently, increased particulate matter concentrations in air. In 2003, particulate monitoring was done at the Hanford Meteorological Station (location 45, Figure 4.1.1 and Table 4.1.1) using a tapered element

oscillating microbalance. The unique design of this instrument measures the difference in mass collected on a filter by measuring the change in frequency of oscillation of the filter. The instrument records an hourly average concentration, but daily average concentration data were calculated for this report. PM_{10} concentration data have been collected at the Hanford Meteorology Station since February 2001, while $\text{PM}_{2.5}$ concentration data collection began at the Hanford Meteorology Station in October 2001.

Figure 4.1.6 illustrates the daily average PM_{10} concentrations recorded at the Hanford Meteorology Station during 2003 for all time periods where the instrument was operating. Daily average concentrations on the Hanford Site were higher than the EPA 24-hour average standard twice during 2003 (March 5 and October 28). The observed annual average PM_{10} concentration at the Hanford Meteorology Station during 2003 ($14 \mu\text{g}/\text{m}^3$) was well below the EPA annual average standard ($50 \mu\text{g}/\text{m}^3$). Hanford Site measurements are not used to determine compliance with air quality standards (Section 2.2.7). EPA



policy also allows exemptions for natural events that result in high particulate matter concentrations, such as windstorms. The 2 days with elevated PM_{10} concentrations observed on the Hanford Site in 2003 appeared to be a result of high winds (Table 4.1.3).

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 2003 (Figure 4.1.7) were well below the proposed EPA standards for $PM_{2.5}$ ($15 \mu\text{g}/\text{m}^3$ annual average, $65 \mu\text{g}/\text{m}^3$ 24-hour average). The measured annual average $PM_{2.5}$ concentration at the Hanford Meteorology Station during 2003 was $6 \mu\text{g}/\text{m}^3$, while the highest 24-hour average concentration observed was $29 \mu\text{g}/\text{m}^3$.

Table 4.1.3. Daily Average PM_{10} Concentrations and Corresponding Wind Speed Data for Several Days Before and After an Exceedance of the $150 \mu\text{g}/\text{m}^3$ PM_{10} Threshold

Date	Daily Average PM_{10} Concentration ($\mu\text{g}/\text{m}^3$)	Daily Average Wind Speed (m/s)	Peak Gust Wind Speed (m/s)
March 4, 2003	2	2.8	12
March 5, 2003	150	7.3	24
March 6, 2003	14	8.3	20
March 7, 2003	4	3.4	12
October 27, 2003	21	1.8	12
October 28, 2003	270	7.8	27
October 29, 2003	24	4.7	16
October 30, 2003	99	9.1	18
October 31, 2003	10	4.9	13

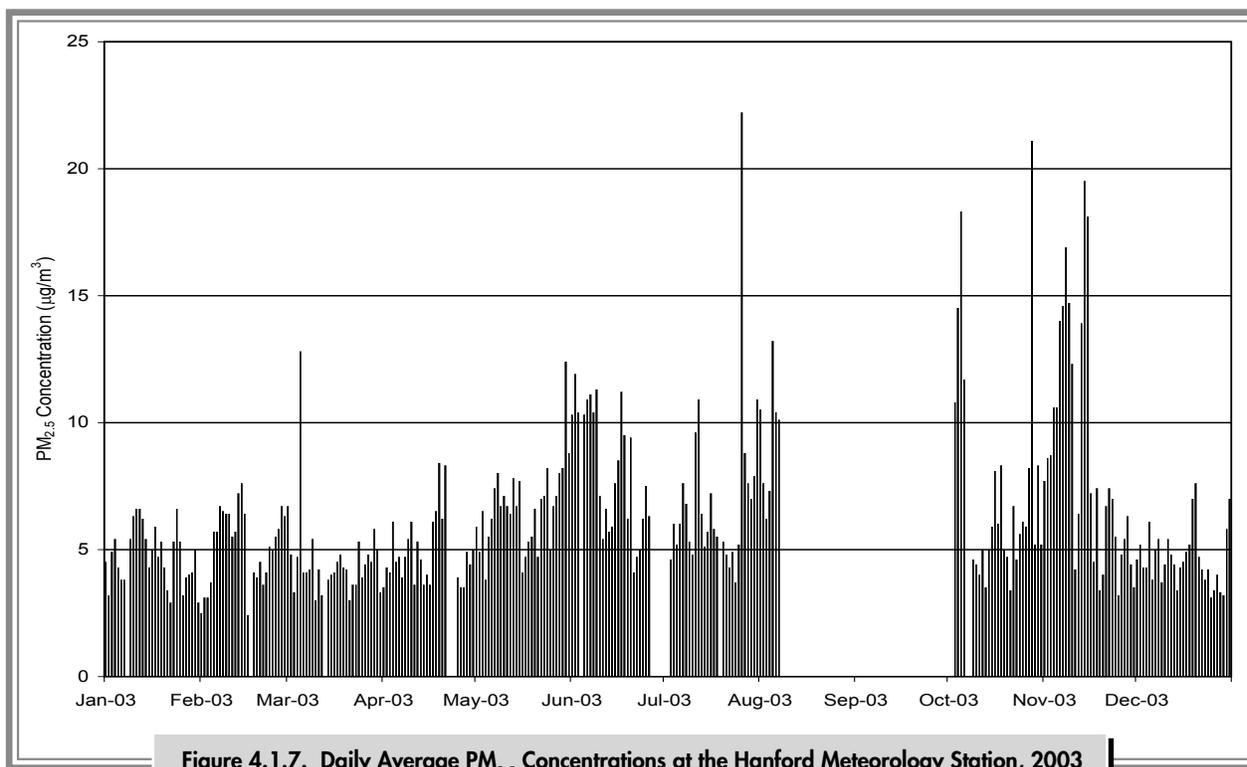


Figure 4.1.7. Daily Average $PM_{2.5}$ Concentrations at the Hanford Meteorology Station, 2003