ENVIRONMENTAL MONITORING

Monitoring Program

The goal of the West Valley Demonstration Project (WVDP or Project) environmental monitoring program is to ensure that public health and safety and the environment continue to be protected with respect to releases from site activities. To achieve this goal, possible exposure pathways are monitored.

The primary focus of the monitoring program is on surface water and air pathways, as these are the principal means by which potential contaminants are transported off site. Samples are collected from water, air, and other environmental media and measured for radiological and nonradiological constituents. A description of and schedule for the sampling program at each location and discussion of the environmental monitoring program drivers and rationale are presented in Appendix A, as well as maps showing the 2007 sampling locations. In accordance with United States (U.S.) Department of Energy (DOE) Order 450.1, the monitoring program includes both effluent monitoring and environmental surveillance.

Effluent Monitoring. Liquid effluents and air emissions are monitored by collecting samples at locations on site where radioactivity or chemical pollutants are (or might be) released. Release points include discharge outfalls, storm water outfalls, site drainage points, and plant ventilation stacks. The WVDP maintains required permits and/or certificates from regulatory agencies applicable to releases to air and water, as listed in Table ECS-3.

Environmental Surveillance. Surface water, drinking water, air, sediment, soil, venison, fish, and milk are collected at locations where the highest concentrations of transported contaminants might be expected. Samples are also collected at remote locations to provide background data for comparison with data from on-site and near-site samples. Direct radiation is monitored on site, at the site perimeter, in nearby communities, and at a remote background location.

Data Evaluation. Data are assessed to determine whether the constituents of interest are present and, if so, at what concentrations. Data from each sampling location are compared with regulatory or guidance limits (if applicable) to determine if any limits have been exceeded. Guidance levels for radiological constituents in air and water are listed in Table UI-4 in the "Useful Information" section of this report. Regulatory limits for nonradiological constituents in discharges to surface water, additional water quality standards and potable water standards are listed in Appendix B-1CD. Guidance levels for soil and sediment are listed in Appendix F-1CD.

Data from near-site locations are compared with background concentrations using standard statistical methods as a means of assessing possible site impacts to the environment. Results from each location are also compared with historical data from that location to determine if any trends, such as increasing concentrations of a constituent, are occurring. If indicated, follow-up actions are evaluated and implemented as warranted.

Effluent Monitoring

Liquid Effluents. The Project is drained by several small streams. Franks Creek enters from the south and receives drainage from the south plateau. As it flows northward, Franks Creek is joined by Erdman Brook, which receives effluent from the low-level waste treatment facility (LLW2). After leaving the Project at the site security fence, Franks Creek receives drainage from the north and northeast swamp areas on the north plateau and from Quarry Creek. Franks Creek then flows into Buttermilk Creek, which, after flowing northward through the Western New York Nuclear Service Center (WNYNSC), enters Cattaraugus Creek and leaves the WNYNSC. (See maps on Figs. A-2 and A-5.)

- Radiological Releases

  Two locations, the lagoon 3 weir at outfall 001 (WNSP001 on Fig. A-2) and a natural drainage from the northeast swamp (monitoring point WNSWAMP on Fig. A-2), are the primary sources of radionuclide releases to surface waters. (Note that two other liquid release points, the sewage treatment outfall [point WNSP007] and another drainage

point on the north plateau [the north swamp, point WNSW74A] are also evaluated each year. Releases from these points are minor and are not included in this discussion. However, they are addressed in Chapter 3, Dose Assessment.)

The discharge through the lagoon 3 weir at outfall 001 into Erdman Brook is the primary controlled point source of liquid release from the Project. Six batch releases totaling about 10.8 million gallons (40.7 million liters) were discharged from WNSP001 in 2007. Drainage from the northeast swamp in CY 2007 was estimated to be approximately 58.0 million gallons (219 million liters). Estimates of curies released from these two sources in 2007 and average radionuclide concentrations are summarized in Tables 2-1 and 2-2.

DOE Order 5400.5 defines radionuclide concentrations that, under conditions of continuous exposure for one year by one exposure mode, would result in an effective dose equivalent of 100 mrem (1 mSv). These derived concentration guides (DCGs) are applicable only at locations where members of the public could

TABLE 2-1
Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2007 and Comparison of Concentrations with DOE DCGs

Isotope [a]	*Discharge Activity* [b] *(Ci)*	*Radioactivity* [c] *(Becquerels)*	*Average Concentration (µCi/mL)*	*DCG* [d] *(µCi/mL)*	*Ratio of Concentration to DCG*
Gross Alpha	1.11±0.11E-03	4.12±0.40E+07	2.73±0.26E-08	NA[e]	NA
Gross Beta	1.01±0.02E-02	3.75±0.08E+08	2.49±0.05E-07	NA[e]	NA
H-3	5.27±0.14E-02	1.95±0.05E+09	1.29±0.03E-06	2E-3	0.0006
C-14	-0.52±5.73E-04	-0.19±2.12E+07	-0.13±1.41E-08	7E-5	<0.0002
K-40	-3.17±9.90E-04	-1.17±3.66E+07	-0.78±2.43E-08	NA[f]	NA
Co-60	4.61±3.41E-05	1.71±1.26E+06	1.13±0.84E-09	5E-6	0.0002
Sr-90	3.95±0.07E-03	1.46±0.03E+08	9.71±0.18E-08	1E-6	0.0971
Tc-99	5.68±0.43E-04	2.10±0.16E+07	1.40±0.11E-08	1E-4	0.0001
I-129	6.98±1.76E-05	2.58±0.65E+06	1.71±0.43E-09	5E-7	0.0034
Cs-137	2.42±0.10E-03	8.94±0.36E+07	5.94±0.24E-08	3E-6	0.0198
U-232[g]	2.63±0.10E-04	9.72±0.37E+06	6.46±0.24E-09	1E-7	0.0646
U-233/234[g]	1.72±0.08E-04	6.35±0.31E+06	4.22±0.21E-09	5E-7	0.0084
U-235/236[g]	1.10±0.21E-05	4.08±0.78E+05	2.71±0.52E-10	5E-7[h]	0.0005
U-238[g]	1.57±0.08E-04	5.82±0.30E+06	3.86±0.20E-09	6E-7	0.0064
Pu-238	1.53±0.72E-06	5.66±2.67E+04	3.76±1.77E-11	4E-8	0.0009
Pu-239/240	1.40±0.68E-06	5.19±2.53E+04	3.45±1.68E-11	3E-8	0.0012
Am-241	1.94±0.83E-06	7.17±3.08E+04	4.76±2.05E-11	3E-8	0.0016
Sum of Ratios					**0.205**

NA - Not applicable

[a] Half-lives are listed in Table UI-4.

[b] Total volume released: 4.07E+10 mL (1.08E+07 gal)

[c] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci

[d] DCGs are listed for reference only. DCGs are applicable at the point at which water is available for ingestion by the public (i.e., at the site boundary) but not to release point concentrations, as might be inferred from their inclusion in this table.

[e] DOE DCGs do not exist for indicator parameters gross alpha and beta.

[f] The DCG is not applied to potassium-40 (K-40) activity because of its natural origin.

[g] Total uranium (g) = 4.70±0.05E+02; average uranium concentration (µg/mL) = 1.15±0.01E-02

[h] The DCG for U-236 is used for this comparison.

TABLE 2-2
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2007 and Comparison of Concentrations with DOE DCGs

Isotope [a]	*Discharge Activity* [b] *(Ci)*	*Radioactivity* [c] *(Becquerels)*	*Average Concentration (µCi/mL)*	*DCG* [d] *(µCi/mL)*	*Ratio of Concentration to DCG*
Gross Alpha	1.26±4.12E-04	0.47±1.53E+07	0.58±1.88E-09	NA[e]	NA
Gross Beta	6.44±0.12E-01	2.38±0.05E+10	2.94±0.06E-06	NA[e]	NA
H-3	1.11±0.77E-02	4.12±2.86E+08	5.07±3.52E-08	2E-03	<0.0001
C-14	-5.39±6.91E-03	-1.99±2.56E+08	-2.46±3.15E-08	7E-05	0.0005
Sr-90	3.43±0.02E-01	1.27±0.01E+10	1.56±0.01E-06	1E-06	1.56
I-129	-0.26±1.00E-04	-0.97±3.72E+06	-1.19±4.58E-10	5E-07	0.0009
Cs-137	0.57±2.09E-04	2.09±7.74E+06	2.57±9.54E-10	3E-06	0.0003
U-232[f]	0.66±1.35E-05	2.45±4.98E+05	3.01±6.13E-11	1E-07	0.0006
U-233/234[f]	4.62±1.95E-05	0.17±7.22E+05	2.11±0.89E-10	5E-07	0.0004
U-235/236[f]	0.95±1.14E-05	3.53±1.23E+05	4.35±5.22E-11	5E-07	0.0001
U-238[f]	3.61±1.67E-05	0.13±6.18E+05	1.64±0.76E-10	6E-07	0.0003
Pu-238	0.00±1.24E-05	0.03±4.58E+05	0.04±5.65E-11	4E-08	0.0014
Pu-239/240	0.66±1.24E-05	2.46±4.58E+05	3.03±5.65E-11	3E-08	0.0019
Am-241	1.13±2.63E-06	4.18±9.75E+04	0.52±1.20E-11	3E-08	0.0004
Sum of Ratios					**1.57**

NA - Not applicable

[a] Half-lives are listed in Table UI-4.

[b] Total volume released: 2.19E+11 mL (5.80E+07 gal)

[c] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci

[d] DCGs are listed for reference only. DCGs are applicable at the point at which water is available for ingestion by the public (i.e., at the site boundary) but not to release point concentrations, as might be inferred from their inclusion in this table.

[e] DOE DCGs do not exist for indicator parameters gross alpha and beta.

[f] Total uranium (g) = 6.67±0.38E+01; average uranium concentration (µg/mL) = 3.04±0.18E-04

[g] The DCG for U-236 is used for this comparison.

be exposed to effluents containing contaminants. DCGs for radionuclides measured at the WVDP are listed in Table UI-4. Note that DCGs are not used for dose assessment. Methods for estimating dose from the liquid pathway are discussed in Chapter 3.

To evaluate each of the releases with respect to the DCGs, each annual average radionuclide concentration was divided by its respective DCG and the fractions from all nuclides were summed. As a DOE policy, the sum of the fractions should not exceed 1.0. That is, the sum of percentages should not exceed 100%. Tables 2-1 and 2-2 list the sum of fractions for each release point.

The sum of fractions for the release from WNSP001 in 2007 was about 0.205, well below the 1.0 criterion. However, the sum of fractions from WNSWAMP was 1.57, above the DOE Order 5400.5 criterion. Drainage at this point largely consists of emergent groundwater. Elevated gross beta concentrations were first noted at this location in 1993. Subsequent investigations delineated a plume of strontium-90 contaminated groundwater on the north plateau. Annualized average strontium-90 concentrations, which first exceeded the strontium-90 DCG (1E-06 µCi/mL) in 1995, continued to exceed the DCG through 2007. (See Fig. 4-6 in Chapter 4, "Groundwater Protection Program".) Ongoing activities to characterize and remediate the strontium-90 groundwater plume are discussed in Chapter 4.

Even though waters with elevated strontium-90 concentrations drain from WNSWAMP into Franks Creek, then into Buttermilk Creek, and ultimately into Cattaraugus Creek, concentrations in water collected from Cattaraugus Creek downstream of the WVDP at the first point of public access continue to show little difference from background concentrations. (See Table B-5A in Appendix B-5CD.)

State Pollutant Discharge Elimination System (SPDES) Permit-Required Monitoring. Liquid discharges from the WVDP are regulated for nonradiological constituents under a SPDES permit, as identified in Table ECS-3. The permit identifies compliance points from which liquid effluents are released to Erdman Brook (Fig. A-2), identifies 20 storm water outfalls (Figs. A-3 and A-4) and specifies the sampling and analytical requirements for each.

The conditions and requirements of the SPDES permit are summarized in Appendix B-1CD. The permit identifies 25 outfalls and compliance points with monitoring requirements and discharge limits. The monitored outfalls include:

- outfall 001 (monitoring point WNSP001), discharge from the low-level waste treatment facility (LLW2)
- outfall 007 (monitoring point WNSP007), discharge from the sanitary and industrial wastewater treatment facility
- outfall 008 (monitoring point WNSP008), a groundwater french drain around the perimeter of the LLWTF storage lagoons (closed in May 2001 but still on the permit)
- outfall 116 (pseudo-monitoring point WNSP116), a location in Franks Creek that represents the confluence of outfalls WNSP001, WNSP007, and WNSP008, as well as storm water runoff, groundwater seepage, and augmentation water. Samples from upstream sources are used to calculate total dissolved solids (TDS) at this location and to demonstrate compliance with the SPDES permit limit for this parameter. (Outfall 116 is referred to as a "pseudo-monitoring" point on the SPDES permit.)
- outfall 01B (monitoring point WNSP01B), an internal monitoring point for the liquid waste treatment system evaporator effluent, being monitored for flow and total mercury.
- 20 storm water discharge outfalls that also receive flows from other minor sources, such as fire hydrant testing and groundwater seepage, being monitored on a rotational basis. The objectives of SPDES permit requirements for monitoring storm water runoff are to determine (1) the levels of water quality and specific chemicals in storm water discharges from specified locations on the WVDP, (2) the amount of rainfall, (3) duration of the storm event, and (4) the resulting flow at the outfalls. The 20 storm water outfalls at the WVDP are grouped into eight representative drainage basins that could potentially be influenced by industrial or construction activity runoff. One representative outfall for each of the eight outfall groups listed in Appendix ACD must be sampled on a semiannual basis.

The SPDES permit recommends the following guidelines for a qualifying storm water event eligible for monitoring: (1) a period of 72 hours between the monitored event and the previous measurable event of 0.1 inches of precipitation; (2) a total rainfall of more than 0.1 inch; (3) resultant storm discharge at the outfall.

Appendix B-2CD presents process effluent data with SPDES permit limits provided for comparison with these data. Appendix B-3CD presents storm water runoff monitoring data for storm water outfalls designated in the WVDP SPDES permit.

In CY 2007, all samples were collected and analyzed in accordance with requirements of the permit. No SPDES effluent limits were exceeded.

Radiological Air Emissions. Federal law allows air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. The releases must meet dose criteria specified in the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations to ensure that public health and safety and the environment are protected. At the WVDP, radiological releases are measured and/or estimated from six permitted emission points (see Table ECS-3), five non-permitted points, and three diffuse sources (wastewater storage lagoons, stored waste containers, and demolition activities). Sampling locations for air emissions are shown in Appendix A on Figure A-6. Releases are evaluated and reported to the U.S. Environmental Protection Agency (EPA) in an annual NESHAP report.

Measured radionuclide concentrations in air are also compared with DOE DCGs. Unlike NESHAP dose criteria, the DOE DCGs are expressed in units of microcuries per milliliter (µCi/mL) and can be directly compared with measurements from the monitoring program. Although the DOE DCGs are applicable only where the public may breathe air containing radionuclides, the DCGs are used at the WVDP as a tool for evaluating airborne emissions at the point of release. DCGs for radionuclides of interest at the WVDP are found in Table UI-4 in the "Useful Information" section at the end of this report. When only gross alpha and beta measurements are available, activity is assumed to come from americium-241 and strontium-90, respectively, because the DCGs for these radionuclides are the most limiting for major particulate emissions at the WVDP.

Ventilation and Emission Systems. The exhaust from each EPA-permitted ventilation system is continuously filtered and the permanent systems are monitored as air is released to the atmosphere. Because radionuclide concentrations in air emissions are quite low, a large volume of air must be sampled to measure the quantities of radionuclides released from the facility. Emissions are sampled for radioactivity in both particulate forms (e.g., strontium-90 and americium-241) and gaseous forms (e.g., tritium and iodine-129). The total release of each radionuclide varies from year to year in response to changing site activities. For instance, releases of iodine-129 dropped sharply after vitrification was completed. Over the years, annual calculated dose from air emissions at the WVDP has remained a small fraction of the NESHAP standard. (See "Predicted Dose From Airborne Emissions" in Chapter 3.)

- The Main Plant Ventilation Stack

  The primary controlled air emission point at the WVDP is the main plant process building (MPPB) ventilation stack, monitoring location code ANSTACK, which vents to the atmosphere at a height of approximately 200 feet (ft) (more than 60 meters [m]). This stack has historically released ventilation exhaust from several facilities, including the liquid waste treatment system, the analytical laboratories, and off-gas from the former vitrification system. In 2007, the main plant stack continued to release ventilation exhaust from a variety of main plant spaces.

  Total curies released from the main stack in 2007 are listed in Table 2-3, together with annual averages, maxima, and a comparison of average isotopic concentrations with the applicable DCGs. The sum of fractions for radiological concentrations from ANSTACK was 0.025, far below the DOE guideline of 1.0. Airborne concentrations from the stack to the site boundary were further reduced by dispersion. Results from air samples taken near the site boundary confirm that WVDP operations had no discernible effect on off-site air quality. (See "Ambient Air," later in this chapter.)

- Other On-Site Air Sampling Systems

  Sampling systems similar to those of the MPPB are used to monitor airborne effluents from the former vitrification heating, ventilation, and air-conditioning system (ANVITSK), the 01-14 building ventilation stack (ANCSSTK), the contact size-reduction facility ventilation stack (ANCSRFK), the supernatant treatment system ventilation stack (ANSTSTK), the container sorting and packaging facility ventilation stack (ANCSPFK), and the remote-handled waste facility (ANRHWFK) (Fig. A-6).

  Permitted portable outdoor ventilation enclosures (OVEs) are used to provide the ventilation necessary for the safety of personnel working with radioactive materials in areas outside permanently ventilated facilities or in areas where permanent ventilation must be augmented. Air samples from OVEs are collected continuously while emission points are discharging, and data from these portable ventilation units are included in annual evaluations of airborne emissions.

  One ambient air sampler continued operating on site in 2007 to monitor air near the lag storage area (ANLAGAM) (Fig. A-6). This sampler was put in place to monitor potential diffuse releases of radioactivity.

  Appendix C[CD] presents total radioactivity released for specific radionuclides at each of the on-site air sampling locations, with the exception of ANCSRFK, which did not operate in 2007.

  No results exceeding the DOE DCGs were noted at any of the air emission sampling locations. Most results showed no detectable radioactivity.

- Nonradiological Air Emissions

  Nonradiological air emissions at the WVDP are regulated under an air facility registration certifi-

TABLE 2-3
Total Radioactivity Released at Main Plant Stack (ANSTACK) in 2007 and Comparison of Concentrations with DOE DCGs

Isotope [a]	N	Total Activity Released [b] (Ci)	Average Concentration (µCi/mL)	Maximum Concentration (µCi/mL)	DCG [c] (µCi/mL)	Ratio of Concentration to DCG
Gross Alpha	26	5.90±0.67E-07	7.95±0.91E-16	1.89E-15	NA[e]	NA
Gross Beta	26	1.28±0.02E-05	1.73±0.03E-14	7.11E-14	NA[e]	NA
H-3	26	2.07±0.04E-03	2.79±0.01E-12	1.60E-11	1E-07	<0.0001
Co-60	2	2.89±3.72E-08	3.90±5.02E-17	<6.45E-17	8E-11	<0.0001
Sr-90	2	2.25±0.16E-06	3.04±0.21E-15	4.02E-15	9E-12	0.0003
I-129	2	2.72±0.21E-05	3.66±0.28E-14	3.75E-14	7E-11	0.0005
Cs-137	2	4.56±0.26E-06	6.14±0.35E-15	6.47E-15	4E-10	<0.0001
Eu-154	2	-0.03±1.23E-07	-0.04±1.65E-16	<2.40E-16	5E-11	<0.0001
U-232[d]	2	4.77±4.99E-09	6.42±6.73E-18	9.65E-18	2E-14	<0.0003
U-233/234[d]	2	2.54±0.74E-08	3.42±1.00E-17	3.93E-17	9E-14	0.0004
U-235/236[d]	2	6.99±4.09E-09	9.42±5.51E-18	9.27E-18	1E-13	<0.0001
U-238[d]	2	1.81±0.69E-08	2.43±0.93E-17	2.31E-17	1E-13	0.0002
Pu-238	2	5.00±1.23E-08	6.73±1.65E-17	6.20E-17	3E-14	0.0022
Pu-239/240	2	9.67±1.64E-08	1.30±0.22E-16	1.61E-16	2E-14	0.0065
Am-241	2	2.08±0.21E-07	2.80±0.29E-16	3.43E-16	2E-14	0.014
Sum of Ratios						**0.025**

N - Number of samples
NA - Not applicable
[a] Half-lives are listed in Table UI-4.
[b] Total volume released at 50,000 cubic feet per minute: 7.42E+14 mL
[c] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci
[d] DCGs are listed for reference only. DCGs are applicable at the point at which air could be inhaled by the public (i.e., at the site boundary) but not to release point concentrations, as might be inferred from their inclusion in this table.
[e] DOE DCGs do not exist for indicator parameters gross alpha and beta.
[f] The DCG is not applied to potassium-40 (K-40) activity because of its natural origin.
[g] Total uranium (g) = 3.14±0.15E-02; average uranium concentration (µg/mL) = 4.23±0.21E-11
[h] The DCG for U-236 is used for this comparison.

cate that includes a cap, which limits the nitrogen and sulfur oxide emissions from the facility to 99 tons per year. (See Table ECS-3.) The WVDP certificate applies 50% of the capping limit (i.e., 49.5 tons) for each. Two site utility steam boilers are left as the only remaining sources of nitrogen and sulfur oxides. During 2007, approximately 1,611 kilograms (1.8 tons) of nitrogen oxides and 0.56 kilogram (0.00062 ton) of sulfur dioxide were emitted from these units. These releases comprised about 3.6% and 0.0013%, respectively, of the 49.5-ton capping limit for each.

Environmental Surveillance

Surface Water. On-site surface water drainage is routinely sampled at several points on the north and south plateaus, as shown in Appendix A, Figure A-2. Monitoring points are sited at locations where releases from possible source areas on the south and north plateaus could be detected.

- South Plateau

  Two inactive underground radioactive waste disposal areas, the Nuclear Regulatory Commission (NRC)-Licensed Disposal Area (NDA) and the New

York State-Licensed Disposal Area (SDA) lie on the south plateau. These disposal sites are possible sources of contaminants to surface water. Also located on the south plateau is the drum cell, formerly used to store approximately 20,000 drums of processed low-level radioactive waste. During 2007, shipment of drums to an off-site facility was completed and the drum cell is now empty. Areas of the south plateau are being used to store radioactive vessels removed from site facilities and to temporarily store radioactive waste containers and stage them for shipment.

At the NDA interceptor trench, samples are collected from a sump at the lowest point in the collection trench system that intercepts groundwater from the northeastern and northwestern sides of the NDA (interceptor trench at sampling point WNNDATR). Water collected underground at this location is pumped to the LLWTF for treatment prior to discharge at outfall WNSP001. If contamination were to migrate through the NDA, it would most likely be first detected at the interceptor trench.

Surface water drainage downstream of the NDA is also monitored at point WNNDADR and at Erdman Brook (point WNERB53), before it joins with drainage from the MPPB and lagoon areas. Some drainage from western and northwestern portions of the SDA is also captured at these sampling points.

Although strontium-90 and associated gross beta results at all three locations were elevated with respect to background concentrations from Buttermilk Creek (WFBCBKG), all were below the strontium-90 DCG. Residual soil contamination from past waste burial activities is thought to be the source of the strontium-90 activity. The NDA is thought to be the predominant source of gross beta activity observed at WNNDATR.

Tritium concentrations have generally decreased over time at both WNNDATR and WNNDADR. Since the half-life of tritium is slightly longer than 12 years, decreasing tritium concentrations may be partially attributable to radioactive decay.

Immediately south of the SDA, Franks Creek was sampled to monitor surface drainage from the area around the drum cell (point WNDCELD, on Fig. A-2). To the north of the SDA, Franks Creek is again sampled to monitor drainage downstream of the drum cell and the eastern and southern borders of the SDA (point WNFRC67).

- North Plateau

  Besides the effluent and drainage locations discussed earlier in the liquid effluents section, additional monitoring locations on the north plateau include drainage and groundwater seepage on the east side of the MPPB (point WNSP005) and coolant water from a contained basin within the facility (point WNCOOLW).

  On the north plateau, possible sources of contamination to surface water include the high-level waste tanks, process buildings, the lagoon system associated with the LLW2, and facilities for handling and storing wastes.

  Appendices B-4 through B-6 present data for subsurface drainage water, contained water, ambient surface water, and potable water monitoring locations. Also provided for side-by-side comparison with these data are reference values, where available, including background ambient water monitoring data and/or pertinent ambient water quality standards (AWQS), guidelines, or maximum contaminant levels (MCLs).

- Off-Site Surface Water

  Surface water samples are collected at four off-site locations, upstream background locations and downstream locations on both Buttermilk Creek and Cattaraugus Creek. Sampling locations are shown on Fig. A-5. Results are presented in Appendix B-5.

  – Buttermilk Creek at Fox Valley Road and Thomas Corners Bridge is the major surface drainage from the WNYNSC. The background monitoring point is located upstream of the WVDP at Fox Valley Road (WFBCBKG) and the downstream point is located at Thomas Corners Bridge (WFBCTCB), just before Buttermilk Creek enters Cattaraugus Creek.

  – Background samples are collected at Cattaraugus Creek at Bigelow Bridge (WFBIGBR) before the point where Buttermilk Creek flows into Cattaraugus Creek. Downstream of that point, samples are collected at Felton Bridge (WFFELBR), the first point of public access below the WVDP.

  Radiological and nonradiological results from surface water samples were compared with applicable water quality standards and guidelines. Results

TABLE 2-4
2007 Comparison of Environmental Monitoring Results with Applicable Limits and Backgrounds

Sample Type	*Number of Sampling Locations*	*Locations with Results Greater than Applicable Limits or Screening Levels [a] (Constituent)*	*Number of Locations with Results Greater Than Background*	*Locations with Results Statistically Greater than Background (Constituent)*
Air (1 background location)				
On-site air emission points	7	0	4	**ANSTACK** (tritium, strontium-90, iodine-129, cesium-137, plutonium-238, plutonium-239/240, americium-241); **ANSTSTK** (iodine-129); **ANCSPFK** (iodine-129); **ANRHWFK** (iodine-129)
On-site ambient air points	1	0	0	None
Off-site ambient air points	5	0	0	None
Surface water (2 background locations, one on Buttermilk Creek and one [historical] on Cattaraugus Creek)				
On-site controlled effluents	2	0	2	**WNSP001** (gross alpha, gross beta, tritium, strontium-90, technetium-99, iodine-129, cesium-137, uranium-232, uranium-233/234, uranium-235/236, uranium-238, bromide, sulfate, total dissolved solids); **WNSP007** (gross beta)
On-site surface water	10	**WNSWAMP** (strontium-90, total iron[b]); **WNSP006** (total iron[b], total dissolved solids, alpha-BHC)	7	**WNSP006** (gross beta, strontium-90, cesium-137, uranium-233/234, uranium-238, chloride, total sodium); **WNSP005** (gross beta, strontium-90); **WNSWAMP** (gross beta, tritium, strontium-90, bromide); **WNSW74A** (gross beta, strontium-90, nonpurgeable organic carbon, total dissolved solids); **WNNDADR** (gross beta, tritium, strontium-90); **WNNDATR** (gross alpha, gross beta, tritium, strontium-90); **WNERB53** (gross beta, strontium-90)
Off-site surface water	2	**WFBCTCB** (total iron[b])	2	**WFBCTCB** (gross beta, chloride, total sodium); **WFFELBR** (gross beta)

Note: DOE derived concentration guides for water and air are listed in Table UI-4 of the "Useful Information Section of this report.

[a] Applicable regulatory, guidance, or screening limits for each matrix are listed in Appendices B and F at the beginning of the data tables for water (Appendix B) and soil and sediment (Appendix F).

[b] Background location WFBCBKG also exceeded the water quality standard for iron.

TABLE 2-4 *(concluded)*
2007 Comparison of Environmental Monitoring Results with Applicable Limits and Backgrounds

Sample Type	*Number of Sampling Locations*	*Locations with Results Greater than Applicable Limits or Screening Levels [a] (Constituent)*	*Number of Locations with Results Greater Than Background*	*Locations with Results Statistically Greater than Background (Constituent)*
Standing water (1 historical background location [no longer sampled])				
Standing water	1	0	0	None
Drinking water (2 background locations, one on site and one off site)				
On-site drinking water	3	0	0	None
Off-site drinking water	9	NS	NS	NS
Soil (1 background location)				
Off-site soil	5	0	2	**SFFXVRD** (cesium-137); **SFRSPRD** (cesium-137)
Sediment (2 background locations, one on Buttermilk Creek and one [historical] on Cattaraugus Creek)				
On-site sediment/soil	3	**SNSWAMP** (strontium-90, cesium-137, arsenic, silver, zinc), **SNSP006** (arsenic, manganese, nickel, silver), **SNSW74A** (calcium, magnesium, selenium, zinc)	3	**SNSWAMP** (gross alpha, gross beta, strontium-90, cesium-137, plutonium-238, plutonium-239/240, americium-241); **SNSP006** (gross beta, strontium-90, cesium-137, plutonium-239/240); **SNSW74A** (strontium-90, cesium-137, plutonium-239/240)
Off-site sediment	3	0	3	**SFTCSED** (cesium-137); **SFSDSED** (cesium-137, uranium-238); **SFCCSED** (cesium-137)
Biologicals (3 background deer; 1 background per matrix for remainder)				
Fish	2	NA	0	None
Milk	3	NA	0	None
Deer	3	NA	1	**BFDNEAR** (cesium-137)
Vegetables/ fruits	3	NA	0	None
Environmental dosimetry (1 background)				
On-site, near facilities	14	NA	10	**DNTLDs #24, 26, 28, 33, 35, 36, 38, 39, 40, 43**
Perimeter	17	NA	0	None
Communities	2	NA	0	None

NA - No regulatory, guidance, or screening limits are available for these matrices.
NS - Not sampled in 2007.
[a] Applicable regulatory, guidance, or screening limits for each matrix are listed in Appendices B and F at the beginning of the data tables for water (Appendix B) and soil and sediment (Appendix F).

from on-site and downstream locations on Franks and Buttermilk Creeks were compared with results from the background location on Buttermilk Creek, upstream of the WVDP. Results near Felton Bridge over Cattaraugus Creek (sampling point WFFELBR, the first point of public access to surface water downstream of the Project), were compared with results from the Cattaraugus Creek background at Bigelow Bridge (sampling point WFBIGBR). Results exceeding applicable limits and those statistically greater than background values are summarized in Table 2-4.

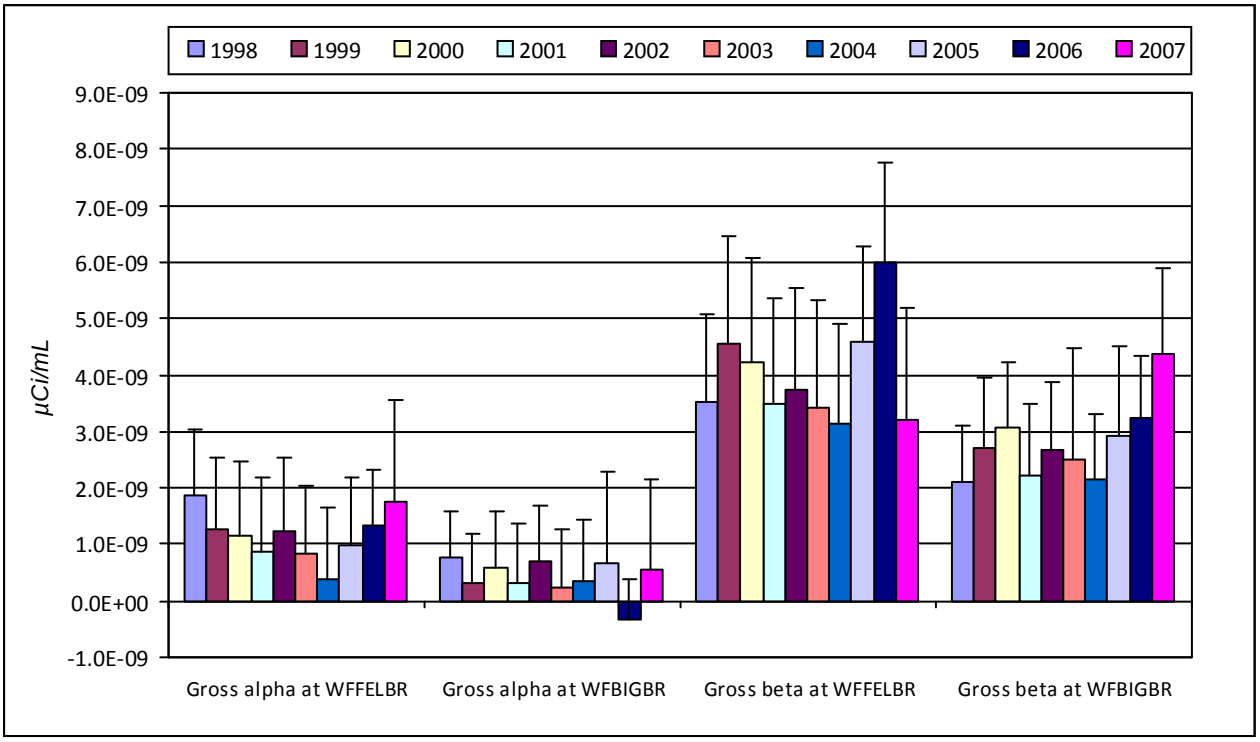
Applicable guidance levels were exceeded at three (of 14) surface water monitoring locations affected by the WVDP in 2007.

The New York State (NYS) Class C and D water quality limit for total iron, 0.3 milligrams per liter (mg/L), was exceeded at locations WNSWAMP, WNSP006, and WFBCTCB, with concentrations of 1.00, 2.00, and 0.5 mg/L, respectively. However, the limit was also exceeded at background location WFBCBKG, with a concentration of 0.44 mg/L. These fluctuating elevated levels are thought to reflect natural variability of stream conditions, not related to activities at the WVDP. The NYS Class C water quality limits for alpha-hexachlorocyclohexane (alpha-BHC) (0.000002 mg/L) and total dissolved solids (500 mg/L) were exceeded at point WNSP006, with maximum concentrations of 0.000017 and 1,332 mg/L, respectively.

A DOE DCG was exceeded at the northeast swamp (WNSWAMP), where the average strontium-90 concentration was 1.56E-06 µCi/mL. (The strontium-90 DCG is 1E-06 µCi/mL.)

Consistent with historical data, concentrations of radiological constituents above background values, usually gross beta and strontium-90, were noted at several on-site surface water monitoring locations. However, results from samples taken downstream at the first point of public access were usually statistically indistinguishable from background or, as with gross beta concentrations, only slightly higher than background, indicating little Project influence downstream.

FIGURE 2-1
Ten-Year Average Gross Alpha and Gross Beta Concentrations in Cattaraugus Creek Downstream of the WVDP at Felton Bridge and Upstream at Background Location Bigelow Bridge



Note: All tritium averages were non-detects, so tritium was not included in this plot. The upper limit of the uncertainty term for the result is indicated with each point.

See Figure 2-1 for a plot comparing average gross alpha and gross beta concentrations in Cattaraugus Creek at WFFELBR with those at background point WFBIGBR over the last 10 years. Although relative concentrations vary from year to year, in general, downstream results are only slightly higher than background. The highest average gross beta result at WFFELBR over the last 10 years (5.99E-09 µCi/mL in 2006) was only about 0.6% of the DOE DCG for strontium-90 (1E-06 µCi/mL). The average result in 2007 was about 0.3% of the DOE DCG.

Drinking Water. Project drinking water (potable water) and utility water is drawn from two on-site surface water reservoirs and is sampled for both radiological and nonradiological constituents. It is monitored at the distribution entry point (WNDNKUR) and at other site tap water locations to verify compliance with EPA and New York State Department of Health (NYSDOH) regulations. Results from 2007 indicated that no radiological contaminants were found in on-site drinking water and that the Project's drinking water continued to remain below the MCLs and drinking water standards of the EPA, NYSDOH, and the Cattaraugus County Health Department. The results are presented in Appendix B-6CD.

Nine off-site private residential wells near the WVDP and a tenth background well south of the Project have been routinely sampled for more than 16 years. These wells represent the closest unrestricted use of groundwater near the Project. None of the wells draw from geologic units underlying the site.

In 2005, the sampling frequency for near-site private wells was reduced from annually to once every other year. Near-site wells were last sampled in 2006. Results from 2006 (as well as results from the preceding 15 years) showed no contamination associated with the WVDP. Only the background well was sampled in 2007 (See Table B-6ACD). As part of an evaluation and streamlining of the monitoring program conducted in late 2007, off-site drinking water monitoring was dropped from the program effective January 2008.

Sediment and Soil. Airborne particulates may be deposited onto soil by wind or precipitation. Particulate matter in streams can adsorb radiological constituents in liquid effluents and settle on the bottom of the stream as sediment. Soils and sediment may subsequently be eroded or resuspended, especially during periods of high winds or high stream flow. The resuspended particles may provide a pathway for radiological constituents to reach humans either directly via exposure or indirectly through the food pathway. In 2007, on-site sediment/soil samples were collected at three locations on the north plateau where drainage has the potential to be contaminated (SNSP006, SNSWAMP, and SNSW74A on Fig. A-2). Off-site sediment samples were collected at one background location on Buttermilk Creek and at two downstream locations, one on Buttermilk and one on Cattaraugus Creek (SFBCSED, SFTCSED, and SFCCSED, respectively, on Fig. A-5). Soil samples were collected at one background and three near-site air sampling locations (Figs. A-5, A-13, and A-14). All samples were analyzed for radiological constituents.

The NRC and the EPA, in a 2002 memorandum of understanding (MOU) pertaining to decommissioning and decontamination of contaminated sites, agreed upon concentrations of residual radioactivity in soil that would trigger consultation between the two agencies. This MOU lists consultation "trigger" levels for contamination in both residential and industrial soil.

In 2006, the NRC, in a decommissioning guidance document (NUREG-1757, Vol. 2, 2006), provided concentration screening values for common radionuclides in soils that could result in a dose of 25 mrem/year. The screening levels and trigger levels for radionuclides found at the WVDP are listed in Table F-1DCD.

The three on-site sediment/soil samples were also analyzed for metals. Results were compared with concentration screening limits for radiological and nonradiological constituents. (See Appendix FCD for a listing of screening values and for tables presenting the results from 2007.) Results were also compared with results from background samples. Locations and constituents for which either screening limits or background concentrations were exceeded in 2007 are listed in Table 2-4.

- Radiological Results

  Strontium-90 and cesium-137 screening values in soil (1.76E-06 and 6E-06 µCi/g, respectively) were exceeded in 2007 at location SNSWAMP. Measured concentrations for strontium-90 and cesium-137 were 1.71E-05 and 1.66E-05 µCi/g, respectively. (Note that these limits are applicable to soil rather than sediment; however, the screening values have been applied since the SNSWAMP sample may be partially composed of soil, depending on the meteorological conditions and drainage patterns over the year.) Other screening levels were not exceeded.

When radiological results were compared with background results, most were statistically indistinguishable from background. However, consistent with historic data, radiological concentrations exceeded background concentrations for several constituents at all three on-site sampling locations. To a lesser extent and consistent with historical values, radiological concentrations above background, largely due to cesium-137, were noted in downstream sediment from Cattaraugus Creek. Although values were slightly greater than background, concentrations have remained steady through the past 16 years.

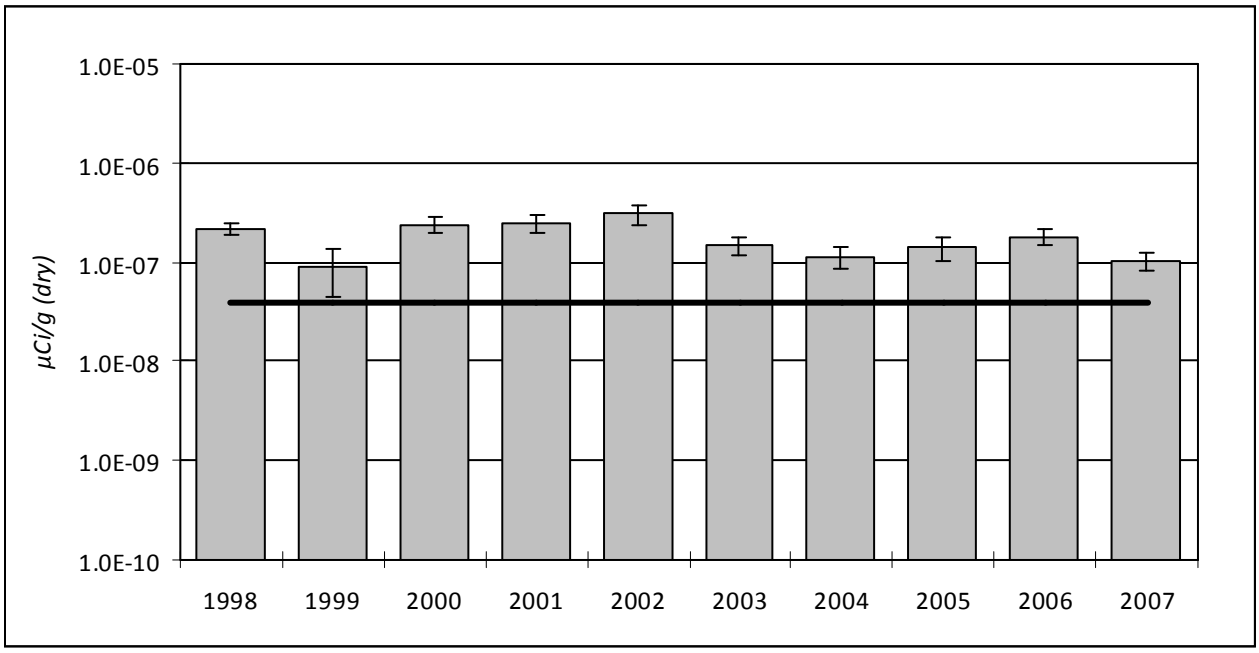
A plot of annual cesium-137 concentrations over 10 years at downstream sampling location SFCCSED is illustrated on Figure 2-2. As the figure indicates, cesium-137 concentrations at SFCCSED, although relatively stable, are consistently higher than the ten-year average cesium-137 concentration at the former background location (SFBISED). Even so, the levels are far lower at these downstream locations than those of naturally occurring gamma emitters, such as potassium-40. (See Table F-2E[CD].)

Also noted in Table 2-4 and consistent with previous years, cesium-137 concentrations slightly above background were found in near-site soil collected at the Rock Springs Road and Fox Valley Road air samplers. Elevated Cs-137 concentrations at the Rock Springs Road location are thought to be attributable to an airborne release during NFS operations in the late 1960s. An area of above-background Cs-137 concentrations observed in soil north and west of the site after this release is referred to as the “cesium prong.”

- Nonradiological Results

Metals results from sediments collected at Franks Creek, near the point at which it leaves the WVDP (SNSP006), were compared with the New York State Department of Environmental Conservation (NYSDEC) screening concentrations for contaminated sediment (See Appendix F-2[CD]). All results were below the "Severe Effect Levels" and the "No Appreciable Contaminant Levels," with the exception of silver, which was detected at 2.3 mg/kg, slightly above the "Severe Effect Level" of 2.2 mg/kg. Arsenic, manganese, and nickel were also detected at SNSP006 above the "Low Effect Level" for contaminated sediment. (Levels are based on estimated toxicity to sediment-dwelling biological communities of organisms.)

FIGURE 2-2
Ten-Year Cesium-137 Concentrations in Sediment From Cattaraugus Creek Downstream of the WVDP (SFCCSED) Compared With Historical Average Upstream Concentrations (SFBISED [solid line])



Note: The upper and lower limits of the uncertainty term are plotted with each result.

Metals concentrations at SNSWAMP and SNSW74A were compared with the "Eastern U.S. Background Concentrations for Soil" and the "Remedial Soil Cleanup Objectives" (Appendix F-2[DOE]). While most metals concentrations were below the guidance limits, a few were exceeded at each location (calcium, magnesium, selenium, and zinc at SNSW74A; arsenic, silver, and zinc at WNSWAMP).

Exceedances may be attributable to localized, naturally elevated concentrations of these metals in soil (e.g., iron, calcium, zinc), application of materials used to treat roads (e.g., magnesium used in deicing salts), or as a result of runoff from industrial activities on site.

Fallout. Fallout samples were collected at the rain gauge outside the Environmental Laboratory (ANRGFOP on Fig. A-6) in 2007 to monitor short-term deposition of radionuclides in rainfall. Results were similar to those from previous years, showing no measurable effects from WVDP emissions.

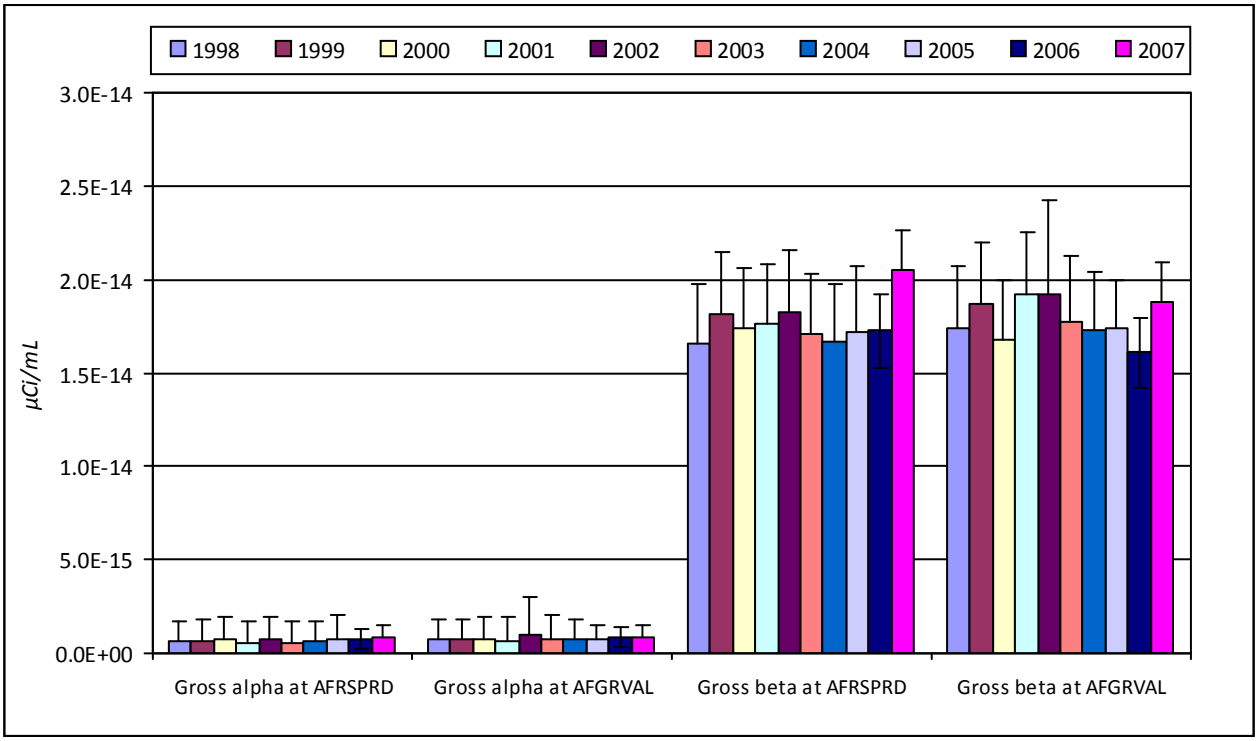
Ambient Air. In 2007, samples for radionuclides in air were collected at one on-site sampler near a waste storage area (ANLAGAM), three locations around the perimeter of the site, and three remote locations.

Near-site perimeter sampling locations at Fox Valley Road (AFFXVRD), Rock Springs Road (AFRSPRD), and Route 240 (AFRT240) were chosen because they provide historical continuity as former Nuclear Fuel Services, Inc. sampling locations or because they represent the most likely locations for detecting airborne radioactivity.

The remote locations provide data from nearby communities (West Valley [AFWEVAL] and Springville [AFSPRVL]) and from a more distant background area (Great Valley [AFGRVAL], 18 miles [29 km] south of the site), which is considered representative of regional background air. Ambient air monitoring locations are shown on maps in Figures A-6, A-7, A-13, and A-14.

Figure 2-3 presents 10-year average gross alpha and gross beta concentrations in ambient air at the Rock Springs Road sampler (AFRSPRD), the nearest off-site

FIGURE 2-3
Ten-Year Average Gross Alpha and Gross Beta Concentrations at Near-Site Ambient Air Sampler AFRSPRD as Compared with Concentrations at Background Air Sampler AFGRVAL, Located 18 Miles (29 km) from the WVDP



Note: The upper limit of the uncertainty term is plotted with each result.

ambient air sampling location, and concentrations from the Great Valley background sampler. Near-site and background concentrations were statistically indistinguishable from each other. Results from other ambient air samplers around the site perimeter and from nearby communities were also statistically indistinguishable from results from background samples, suggesting no evidence of adverse site influence on the quality of ambient air.

Food. Each year food samples are collected from locations near the site (Fig. A-10) and from remote locations (Figs. A-13 and A-14). Fish and deer are collected during periods when they would normally be taken by sportsmen. Corn, apples, and beans are collected annually at the time of harvest. Edible portions are analyzed for radionuclides.

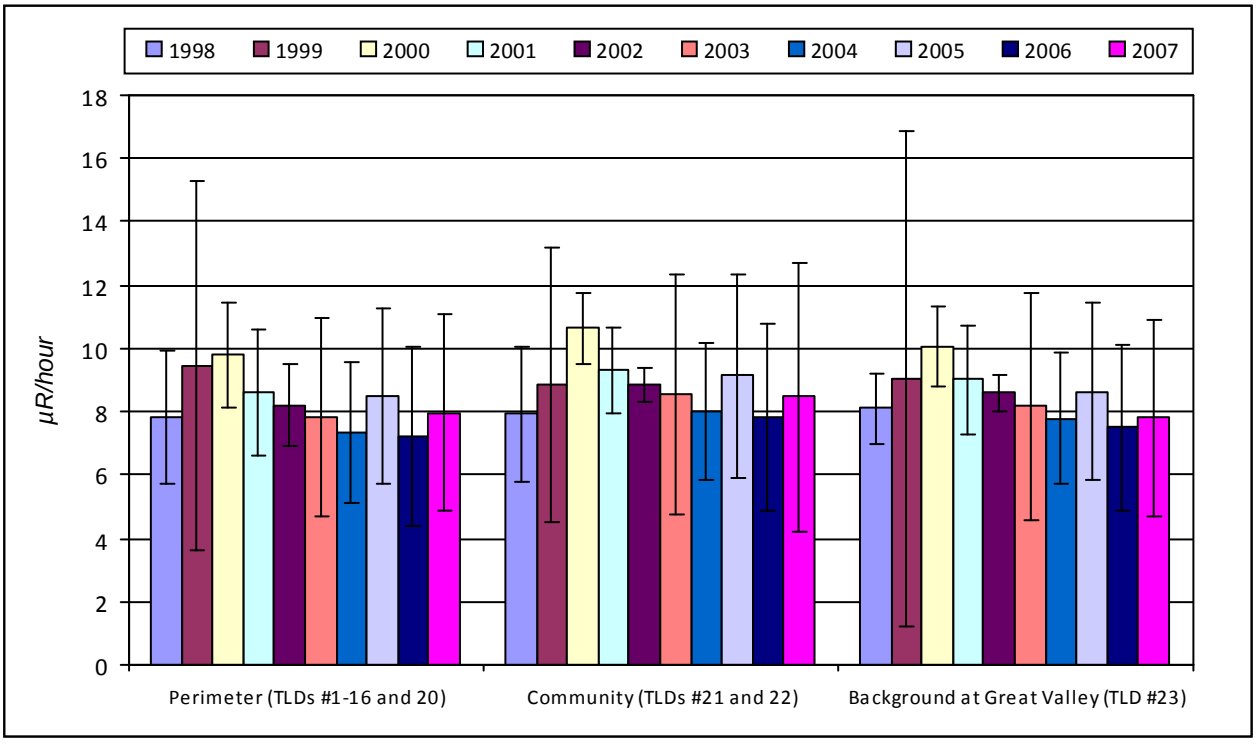
Data have consistently demonstrated that the Project has little or no effect on local food sources. Dose calculations based on results from food sources have consistently confirmed low dose estimates modeled on the basis of results from air and water monitoring. (See Chapter 3, Dose Assessment.)

Locations with results greater than background are listed in Table 2-4. All results were indistinguishable from background in 2007 with the exception of one near-site deer, for which the cesium-137 concentration was above background. Results from this animal were used in the confirmatory dose calculation. (See Chapter 3, "Dose Assessment," "Calculated Dose From Food.")

Environmental Radiation. Thermoluminescent dosimeters (TLDs) are placed on-site at waste management units, at the site security fence, around the WNYNSC perimeter and the access road, at nearby communities, and at a background location remote from the site. These dosimeters directly measure radiation in the environment. TLD measurements were independently confirmed in 2007 by taking a set of measurements with a high-pressure ion chamber, another method of measuring environmental radiation levels, at each TLD location.

Consistent with historical data, results from TLDs located near on-site facilities in 2007 were generally higher than background results, as shown in Table 2-4; these locations are well within the WNYNSC boundary and are not accessible by the public. However, results at perimeter and community locations were statistically the same as results from the back-

FIGURE 2-4
Ten-Year Trends of Environmental Radiation Levels at Perimeter, Community, and Background TLDs



Note: The upper and lower limits of the uncertainty term are plotted with each result.

ground TLDs, indicating no measurable dose from Project activities at these locations. Figure 2-4 presents a graph of annual average exposure rates (in µR/hr) over the last 10 years at background, perimeter, and community locations. As can be seen, results at perimeter and community locations are basically the same as background. In addition, no discernible trends over time are evident.

Meteorological Monitoring. Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local and regional climatology. These data are used to assess potential effects of routine and nonroutine releases of airborne radioactivity and to provide input to dispersion models used to calculate dose to off-site residents.

The on-site 197-ft (60-m) meteorological tower (Figure A-1) continuously monitors wind speed, wind direction, and temperature at both the 197-ft (60-m) and 33-ft (10-m) elevations. Dewpoint and precipitation are also monitored at the on-site tower. Precipitation in 2007 totaled approximately 40.1 inches (102 cm), essentially equal to the long-term annual average. (See Table 2-5.) Barometric pressure is measured with instrumentation located in the Environmental Laboratory.

TABLE 2-5
WVDP 2007 Monthly Precipitation Totals Compared With 10-Year Monthly Averages

Month	*Monthly Total*	*Ten-Year Monthly Average (1997 to 2006)*
January	4.99	3.22
February	2.28	2.09
March	3.40	2.73
April	2.91	3.04
May	0.87	3.41
June	1.90	3.57
July	4.72	3.90
August	2.16	3.57
September	3.06	3.64
October	2.99	3.43
November	5.65	3.48
December	5.17	3.30
Total (inches)	40.10	39.38
(Centimeters)	101.854	100.02

In addition, an independent, remote 33-ft (10-m) meteorological station, located approximately 5 miles (8 km) south of the site on a hillcrest on Dutch Hill Road (Figure A-13), continuously monitors wind speed and wind direction. The two towers supply data to the primary digital and analog data acquisition systems located within the Environmental Laboratory. On-site systems are provided with either uninterruptible or standby power backup in the event of site power failures. In 2007, the on–site system data recovery rate (the time valid data were logged versus the total elapsed time) was approximately 97.4%. Documentation, such as meteorological system calibration records, site log books, and analog strip charts, is stored in protected archives.

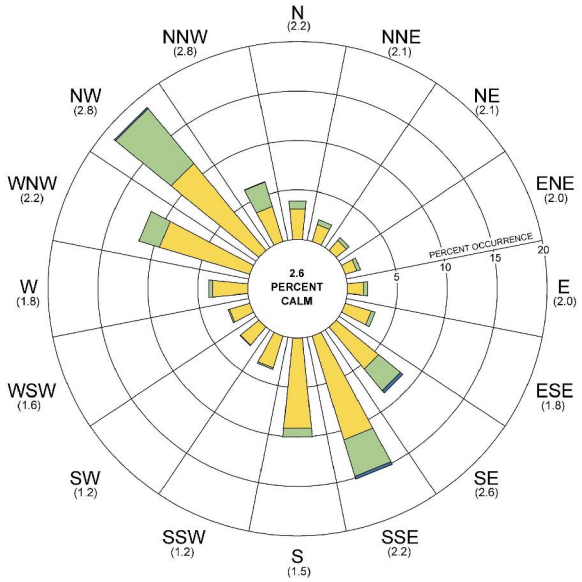
"Wind roses" showing the predominant direction of the wind as measured at the on-site meteorological tower (60-m and 10-m elevations) and at the regional tower (10-m elevation) are shown in Figure 2-5. As shown, wind measurements on-site at the 60-m elevation are predominantly from the west-northwest or south-southeast. Those measured on-site at the 10-m elevation are predominantly from northwest or the south-southeast, apparently influenced by the orientation of the topography around the site. At the regional tower, winds are predominantly from the west-southwest and the west. Wind speeds measured at the on-site 10-m elevation were the lowest, while those from the 60-m on-site tower and the regional tower, located on a hillcrest, were the highest.

Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which includes a function of the difference in temperature between two elevations), these parameters are closely monitored and are available to the emergency response organization at the WVDP. If a release to the air occurred, meteorological data would be used to predict the direction in which the plume would move.

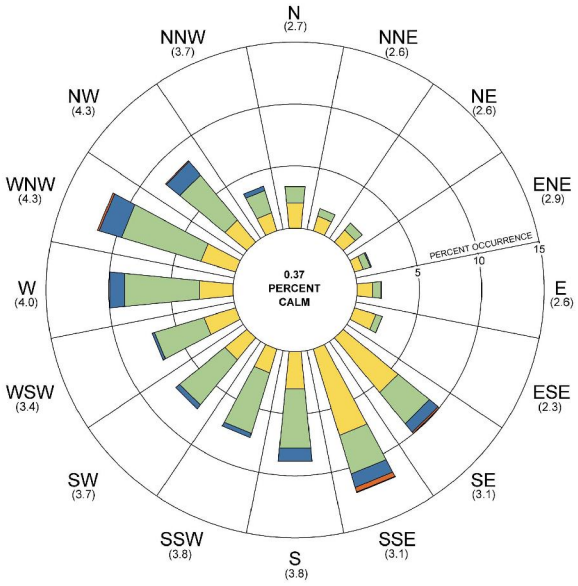
Special Monitoring

Monitoring may be conducted outside the scope of the routine environmental monitoring program to address topics of environmental interest, or as part of investigations or characterizations. Special monitoring efforts conducted in CY 2007 included a hydrogeological evaluation of groundwater in the vicinity of the waste tank farm and sampling for metals as part of characterization of the north plateau (see Chapter 4).

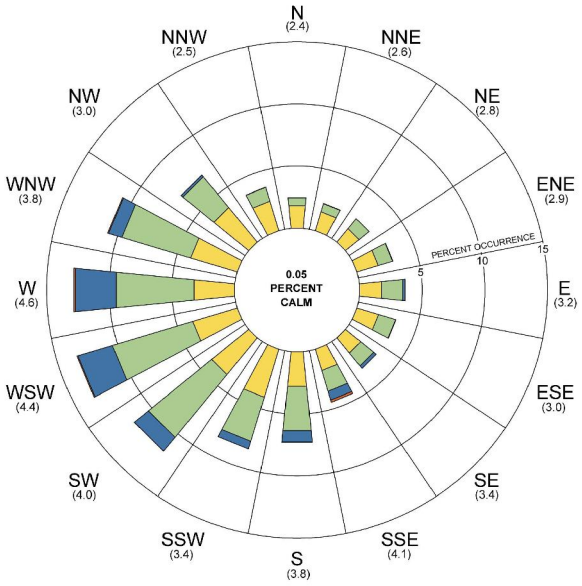
FIGURE 2-5
Wind Frequency and Speed from the On-Site Meteorological Tower (10-m and 60-m Elevations) and from the Regional Meteorological Tower (10-m Elevation), January 1–December 31, 2007



On-Site Meteorological Tower (10-m)



On-Site Meteorological Tower (60-m)



Regional Meteorological Tower (10-m)

Key:

Numbers indicate sector mean wind speed.

Sectors are directions from which the wind is blowing.

Wind Speed Range (m/sec)

- 0.5–3.0
- 3.0–6.0
- 6.0–9.0
- 9.0–12.0
- >12.0

Monitoring Program Changes

Over the last few years, site activities have focused on dismantlement and decontamination of facilities, demolition of unnecessary structures, and processing and shipping of waste. Hazards and potential pollutant sources on site are being reduced. In late 2007, the environmental monitoring program was thoroughly evaluated and changes were identified to streamline the program in response to changing site activities.

Each sampling location was evaluated on several bases: (1) regulatory requirements or legal drivers on which sampling is based, (2) current exposure pathways and hazard conditions, (3) a statistical evaluation of up to 16 years of monitoring data at each location, and (4) a determination of the need for additional data and/or ongoing monitoring for each constituent. As a result, the sampling frequency at some locations was reduced and/or the number of analytical constituents adjusted. At several locations, sampling was discontinued altogether.

Environmental monitoring program modifications were implemented in January of 2008. Specific program changes in CY 2007 and in CY 2008 at each location, with the rationale for the change, are summarized in Appendix A. The maps in Appendix A have been color-coded to show those locations at which sampling has remained unchanged, those locations at which sampling has been reduced, and those locations at which sampling has been discontinued.

Summary

In 2007, no monitoring results exceeded regulatory limits. As in the past, although concentrations of certain radiological and nonradiological constituents from samples collected within the security fence exceeded background or screening concentrations, few results from near-site or downstream locations accessible to the public did.

Monitoring results from CY 2007 continued to demonstrate minimal or no adverse effects of the WVDP on the surrounding environment and confirmed the effectiveness of radiological control measures practiced at the WVDP.

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