ENVIRONMENTAL MONITORING

Routine Monitoring Program

Routine activities at the West Valley Demonstration Project (WVDP) can lead to the release of radioactive or hazardous substances that could affect the environment. Possible pathways for the movement of radionuclides or hazardous substances from the WVDP to the public include milk and food consumed by humans; forage consumed by animals; sediments, soils, groundwater, and surface water; and effluent air and liquids released by the WVDP.

The food pathway is monitored by collecting samples of beef, hay, milk, and produce at near-site and remote locations, samples of fish upstream and downstream of the site, and venison samples from near-site deer and deer taken from background locations. Stream sediments are sampled upstream and downstream of the WVDP, and both on-site groundwater and off-site drinking water are routinely sampled. Direct radiation is monitored on-site, at the perimeter of the site, in communities near the site, and at background locations.

The primary focus of the monitoring program, however, is on surface water and air pathways, as these are the principal means of transport of radionuclides from the WVDP.

Liquid and air effluents are monitored on-site by collecting samples at locations where radioactivity or other regulated substances are released or might be released. Release points include water effluent outfalls and plant ventilation stacks.

Surface water samples are collected within the Project site from ponds, swamps, seeps, and drainage channels that flow through the Western New York Nuclear Service Center (WNYNSC) and thence off-site into Cattaraugus Creek.

Both surface water and air samples are collected at site perimeter locations where the highest off-site concentrations of transported radionuclides might be expected. Samples are also collected at remote locations to provide background concentration data for comparison with data from on-site and near-site samples.

Sampling Program Overview

The complete environmental monitoring schedule is delineated in Appendix B. This schedule provides information on monitoring and reporting requirements and the types and extent of sampling and monitoring at each location. An explanation of the codes that identify the sample medium and the specific sampling or monitoring location is also found in Appendix B (p.B-iii). For example, a sample location code such as AFGRVAL indicates an air sample (A), off-site (F), at the Great Valley (GRVAL) sampling station. These codes are used throughout this report for ease of reference and to be consistent with the data reported in the appendices.

Surface Water Sampling Locations. Automatic samplers collect surface water at points along drainage channels within the WNYNSC that are most likely to show any radioactivity released from the site. These automatic samplers collect a 50-milliliter (mL) aliquot (about one-quarter of a cup of water) every half-hour. The aliquots are pumped into a large container for compositing samples from which the samples are then collected.

The samplers operate on-site at four locations: WNSP006, the point in Frank's Creek where Project drainage leaves the security-fenced area; WNNDADR, the drainage point downstream of the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA); WNSWAMP, the northeast swamp drainage; and WNSW74A, the north swamp drainage.

Off-site, automatic samplers collect surface waters from Buttermilk Creek at a background station upstream of the site (WFBCBKG), from Buttermilk Creek downstream of the site at Thomas Corners Road bridge (WFBCTCB), the last monitoring point before Buttermilk Creek leaves the WNYNSC, and from Cattaraugus Creek at Felton Bridge (WFFELBR).Grab samples are collected at several other surface water locations both on-site and off-site, including a background location on Cattaraugus Creek at Bigelow Bridge (WFBIGBR).

Collecting a Sample at a Stream Sampling Location

Figure A-2 (p.A-4 in Appendix A) shows the locations of the on-site surface water monitoring points. Figure A-3 (p.A-5) shows the locations of the off-site surface water monitoring points.

Air Sampling Locations. Air samplers are located on-site, at the perimeter of the site, and at points remote from the WVDP. Figure A-4 (p.A-6) shows the locations of the on-site air effluent monitors and samplers and the on-site ambient air samplers; Figure A-5 (p.A-7)

and Figure A-12 (p.A-14) show the locations of the perimeter and remote air samplers.

Radiological Monitoring: Surface Water

The WVDP site is drained by several small streams. (See Surface Water Hydrology of the West Valley Site in Chapter 3, p.3-2, and Figs.A-2 [p.A-4] and A-3 [p.A-5].) Frank's Creek flows along and receives drainage from the south plateau. As Frank's Creek flows northward, it is joined by a tributary, Erdman Brook, which receives effluent from the low-level waste treatment facility. On the north plateau, beyond the Project fence line, the north and northeast swamp areas and Quarry Creek drain into Frank's Creek.

Frank's Creek continues past the WVDP perimeter and flows across the WNYNSC, where it enters Buttermilk Creek. Radionuclide concentrations in Buttermilk Creek are monitored upstream and downstream of the WVDP. Further downstream, Buttermilk Creek leaves the WNYNSC and enters Cattaraugus Creek, which is also monitored for radionuclide concentrations both upstream and downstream of the point where the creek receives effluents from the WVDP.

Two liquid effluents, from the low-level waste treatment facility and from the northeast and north swamp drainage, are primary contributors to site dose estimates. (See Chapter 4, Radiological Dose Assessment, Table 4-2 [p.4-6] for an estimate of the dose attributable to these waterborne effluents.)

Low-level Waste Treatment Facility Sampling Location. The discharge from the low-level waste treatment facility (LLW2) through the lagoon 3 weir (WNSP001 on Fig.A-2 [p.A-4]) into Erdman Brook, a tributary of Frank's Creek, is the largest single source of radioactivity released to surface waters from the Project. There were six batch releases totaling about 43.7 million liters (11.5 million gal) in 2000. Composite samples were collected near the beginning and end of each discharge and one effluent grab sample was collected during each day of discharge. Samples were analyzed for gross alpha and gross beta radioactivity, for gamma-emitting radionuclides, and for specific radionuclides as noted in Appendix B, p.B-7.

The total amounts of radioactivity from specific radionuclides in the lagoon 3 effluent are listed in Appendix C, Table C-1 (p.C-3). The annual average concentration of each radionuclide is divided by its corresponding Department of Energy (DOE) derived concentration guide (DCG) in order to determine what percentage of the DCG was released. (DOE standards and DCGs for radionuclides of interest at the WVDP are found in Appendix K [Table K-1, p.K-3].) As a DOE policy, the sum of the percentages calculated for all radionuclides released should not exceed 100%.

The combined annual average of radionuclide concentrations from the lagoon 3 effluent discharge weir in 2000 was approximately 34.0% of the DCGs. (See Table C-2 [p.C-4].) This is comparable to the average concentration over the last five years of approximately 31%.

The low-level waste treatment facility was designed to efficiently remove strontium-90 and cesium-137, the more prevalent of the long-lived fission products in WVDP wastewaters. Other radionuclides are also removed to a lesser extent by the low-level waste treatment facility. For example, one other major contributor to the total combined DCG in lagoon 3 effluent is uranium-232, which averaged about 13% of its

DCG in 2000. Uranium-232 and other uranium isotopes are found in WVDP liquid waste because they were present in the nuclear fuel that was once reprocessed at the site. Variations in liquid effluent radionuclide ratios continue to reflect the dynamic nature of the waste streams being processed through the low-level waste treatment facility.

(Outfall WNSP001, the lagoon 3 weir, is monitored also for nonradiological parameters under the New York State Pollutant Discharge Elimination System [SPDES] program. See Nonradiological Monitoring: Surface Water [p.2-26].)

Northeast Swamp and North Swamp Sampling Locations. The northeast and north swamp drainages on the site's north plateau conduct surface water and emergent groundwater off-site.

The northeast swamp sampling location (WNSWAMP) monitors surface water drainage from the site's north plateau. The north swamp sampling point (WNSW74A) monitors drainage to Quarry Creek from the northern end of the Project premises. (See Fig.A-2 [p.A-4].) Waters from the northeast swamp drainage run into Frank's Creek downstream of location WNSP006, the point in Frank's Creek where Project drainage leaves the security-fenced area. (See Other Surface Water Sampling Locations below.)

Samples from WNSWAMP and WNSW74A are collected weekly and analyzed for radiological parameters. Although DCGs are not directly applicable to these points, other than gross beta and strontium-90, concentrations of all radiological parameters detected at WNSWAMP and WNSW74A were less than 1% of the DCGs for these parameters. The maximum and minimum gross alpha and gross beta results from WNSWAMP and WNSW74A are noted on Tables 2-1 and 2-2 (*facing page*). Complete data from these two locations are found in Tables C-7 and C-8 (pp.C-8 and C-9 in Appendix C). An upward trend in gross beta concentrations at WNSWAMP, first noted in 1993, continued through 1999. Concentrations in 2000 were lower than in 1999. Gross beta activity at this location is largely attributable to strontium-90. (See Special Groundwater Monitoring, p.3-16.)

Strontium-90 concentrations at WNSWAMP in 2000 ranged from a low of 9.00E-07 µCi/mL to a high of 2.10E-06 µCi/mL (33.3 Bq/L to 77.6 Bq/L), with an annual average of 1.48E-06 µCi/mL (54.8 Bq/L). (See Chapter 3, Fig.3-4, p.3-17, for a graph of the annualized average strontium-90 concentration at WNSWAMP in 2000.) Even though waters with elevated strontium-90 concentrations drain from WNSWAMP into Frank's Creek, waters collected from Cattaraugus Creek downstream at the first point of public access (WFFELBR) averaged less than 1% of the DCG for strontium-90, 1E-06 µCi/mL (37 Bq/L). Moreover, strontium-90 concentrations at WFFELBR were not significantly different from those at the background location, WFBIGBR, which is upstream of the location where site drainage enters Cattaraugus Creek. (See Off-site Surface Water Sampling Locations, p.2-9.)

Other Surface Water Sampling Locations. Samples taken from a point in Frank's Creek (WNSP006), from the sanitary and industrial wastewater treatment facility discharge (WNSP007), and from subsurface drainage from the perimeter of the low-level waste treatment facility storage lagoons (WNSP008) are routinely monitored for radiological parameters. (See Fig.A-2 [p.A-4].) Discharges from WNSP001, WNSP007, and WNSP008 leave the site through point WNSP006. Radiological

Table 2-1
2000 Gross Alpha Concentrations at Surface Water Sampling Locations

Location	Number of Samples	Range		Annual Average	
Off-site		*(µCi/mL)*	*(Bq/L)*	*(µCi/mL)*	*(Bq/L)*
WFBCBKG	12	<4.36E-10 to 8.99E-10	<1.61E-02 to 3.33E-02	0.80±6.86E-10	0.30±2.54E-02
WFBCTCB	12	<5.71E-10 to 4.64E-09	<2.11E-02 to 1.72E-01	1.39±1.07E-09	5.15±3.97E-02
WFBIGBR	12	<7.99E-10 to 4.62E-09	<2.96E-02 to 1.71E-01	5.91±9.71E-10	2.19±3.59E-02
WFFELBR	12	<6.49E-10 to 1.02E-08	<2.40E-02 to 3.78E-01	2.14±1.32E-09	7.92±4.89E-02
On-site					
WNNDADR	12	<6.94E-10 to 2.36E-09	<2.57E-02 to 8.74E-02	0.28±1.35E-09	1.02±5.01E-02
WNSP006	52	<7.10E-10 to 6.75E-09	<2.63E-02 to 2.50E-01	0.76±1.54E-09	2.81±5.69E-02
WNSW74A	52	<1.27E-09 to 1.14E-08	<4.70E-02 to 4.20E-01	-0.22±3.44E-09	-0.08±1.27E-01
WNSWAMP	52	<9.17E-10 to 7.25E-09	<3.39E-02 to 2.68E-01	0.60±1.83E-09	2.21±6.78E-02

Table 2-2
2000 Gross Beta Concentrations at Surface Water Sampling Locations

Location	Number of Samples	Range		Annual Average	
Off-site		*(µCi/mL)*	*(Bq/L)*	*(µCi/mL)*	*(Bq/L)*
WFBCBKG	12	<1.18E-09 to 3.45E-09	<4.36E-02 to 1.28E-01	2.12±1.22E-09	7.84±4.52E-02
WFBCTCB	12	5.39E-09 to 2.21E-08	2.00E-01 to 8.19E-01	8.93±1.57E-09	3.31±0.58E-01
WFBIGBR	12	<1.30E-09 to 8.17E-09	<4.80E-02 to 3.02E-01	3.05±1.19E-09	1.13±0.44E-01
WFFELBR	12	<1.27E-09 to 1.06E-08	<4.70E-02 to 3.92E-01	5.21±1.71E-09	1.93±0.63E-01
On-site					
WNNDADR	12	1.41E-07 to 2.26E-07	5.20E+00 to 8.36E+00	1.93±0.06E-07	7.15±0.23E+00
WNSP006	52	1.80E-08 to 1.94E-07	6.66E-01 to 7.16E+00	4.64±0.41E-08	1.72±0.15E+00
WNSW74A	52	<4.89E-09 to 3.31E-08	<1.81E-01 to 1.22E+00	1.17±0.47E-08	4.33±1.74E-01
WNSWAMP	52	7.30E-07 to 5.00E-06	2.70E+01 to 1.85E+02	2.91±0.03E-06	1.07±0.01E+02

results of analyses from WNSP006, WNSP007, and WNSP008 are summarized in Tables C-4, C-5, and C-6 (pp.C-6 and C-7). Samples from these points also are monitored for nonradiological parameters as part of the site's SPDES program. (See Nonradiological Monitoring: Surface Water [p.2-26].)

WNSP006. WNSP006 is located more than 4.0 kilometers (2.5 mi) upstream from Thomas Corners Road, which is the last monitoring point before Buttermilk Creek leaves the WNYNSC and before the public has access to the creek waters. Samples from WNSP006 are retrieved weekly and composited both monthly and quarterly and are analyzed for the same radionuclides as the effluent samples from WNSP001.

The highest monthly concentration of a beta-emitting radionuclide at WNSP006 was strontium-90 at 3.94E-08 µCi/mL (1.46 Bq/L), which is less than 4% of the DCG for strontium-90. Average concentrations of gross beta (as strontium-90), strontium-90, cesium-137, and tritium were each less than 5% of the comparable DCG. Averages of the radiological parameters monitored at WNSP007 (gross alpha, gross beta, tritium, and cesium-137) and at WNSP008 (gross alpha, gross beta, and tritium) in 2000 also were found at a small percentage of the DCG.

The average gross alpha and gross beta data from location WNSP006 and the maximum and minimum results are noted in Tables 2-1 and 2-2 (p.2-5) for comparison with sampling results from other on- and off-site surface water locations. Figure 2-1 (*below*) shows the fourteen-year trends of gross alpha, gross beta, and tritium concentrations at location WNSP006. Fluctuations in these long-term trends at WNSP006 reflect variable concentrations in treated WVDP liquid effluent being released from the site.

Concentrations observed farther downstream at Felton Bridge (WFFELBR), the sampling location that represents the first point of public access to surface waters leaving the WVDP

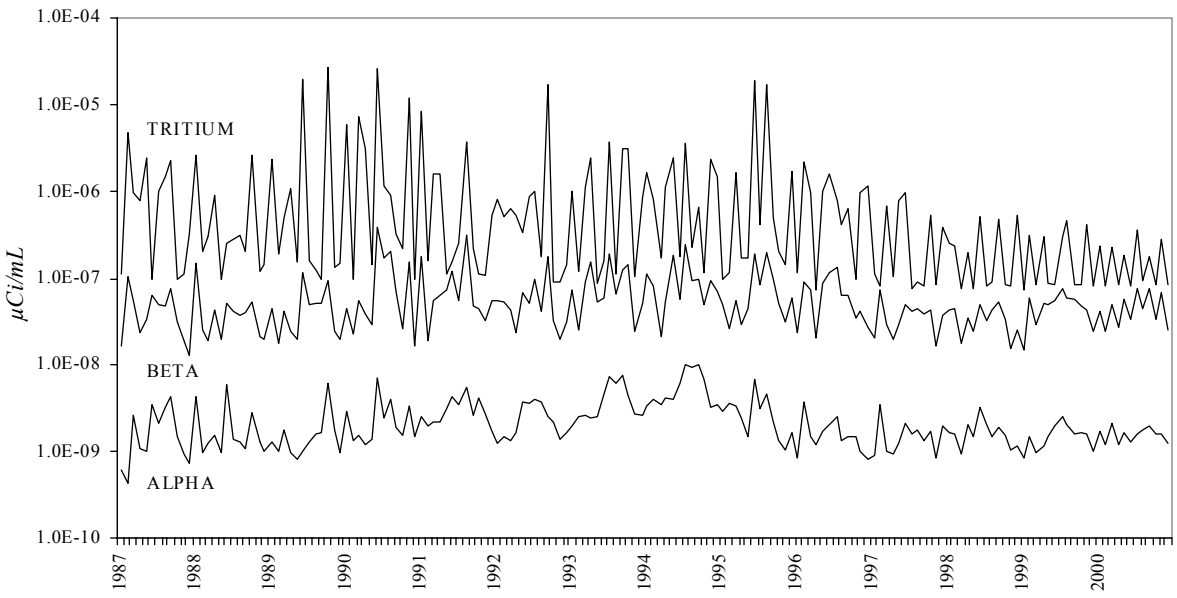


Figure 2-1. Fourteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNSP006

site, continue to be close to or indistinguishable from background.

WNSP005 and WNCOOLW. Sampling point WNSP005, which monitors drainage from land on the east side of the main plant, and WNCOOLW, which monitors facility coolant water, are sampled monthly for gross alpha, gross beta, and tritium concentrations. WNCOOLW also is sampled quarterly for gamma isotopes, including cesium-137. Radiological data for WNSP005 and WNCOOLW are found in Tables C-3 and C-11 (pp.C-5 and C-11).

Average gross alpha and tritium concentrations for both locations were below detection levels in 2000. Average gross beta concentrations at WNSP005 and WNCOOLW were considerably lower than the strontium-90 DCG (<16% and <1% respectively). Average cesium concentrations at WNCOOLW were below detection levels in 2000.

WN8D1DR. This sampling point is at the access to a storm sewer manhole that originally collected surface and shallow groundwater flow from the high-level waste tank farm area. (Notable increases in gross beta and tritium activity at this location, attributable to historical site contamination, have been described in previous annual site environmental reports.) In July 1993 the access was valved off from the original high-level waste tank farm drainage area to prevent collected waters from rising freely to the surface. Although samples from this location are thought to be not representative of either local groundwater or surface water, weekly sampling for gross alpha, gross beta, and tritium continues at this point. A monthly composite is analyzed for gamma radionuclides and strontium-90.

Average gross alpha, tritium, and cesium-137 concentrations from WN8D1DR were all below detection levels in 2000. Gross beta concentrations, attributable largely to strontium-90, averaged less than 1% of the applicable DCG. Radiological data for WN8D1DR are found in Table C-13 (p.C-12).

NDA and SDA Sampling Locations. Two inactive underground disposal areas, the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) and the state-licensed disposal area (SDA), lie on the south plateau of the site. (The SDA is managed by the New York State Energy and Research Development Authority [NYSERDA].) The drum cell, an aboveground structure used to store approximately 19,000 drums of processed low-level radioactive waste, is located nearby. Surface waters, which flow from the south to the north, are routinely monitored at several points around these sites. (See Fig.A-2 [p.A-4].) In addition to the routine samples collected by the WVDP, samples are collected and analyzed by the New York State Department of Health (NYSDOH) at the two stream sampling points that receive drainage from the south plateau, WNFRC67 and WNERB53.

NRC-licensed Disposal Area (NDA). Sampling point WNNDATR is a sump at the bottom of a steep-sided trench immediately downgradient of the NDA that intercepts groundwater from the NDA. If radiological or nonradiological contamination were to migrate through the NDA, it would most likely be first detected in samples from WNNDATR. Monthly samples from WNNDATR are taken under the auspices of the environmental monitoring program and quarterly samples under the auspices of the groundwater monitoring program.

Surface water drainage downstream of the NDA is monitored at WNNDADR, and water from sampling point WNERB53 in Erdman Brook, which represents surface waters further down-

stream from the NDA before they join with drainage from the main plant and lagoon areas, also is monitored. Some drainage from western and northwestern portions of the SDA also passes through sampling points WNNDADR and WNERB53.

Results from WNNDATR, the sump in the interceptor trench, are in Table C-20 (p.C-17). Results from WNNDADR, surface water drainage downstream of the NDA, are in Table C-19 (p.C-16), and results from WNERB53, the sampling location even further downstream of the NDA, are in Table C-10 (p.C-10). Parameters monitored at these three NDA sampling locations include gross alpha, gross beta, tritium, iodine-129, and cesium-137.

Gross alpha and gross beta results from WNNDADR are included in Tables 2-1 and 2-2 (p.2-5) for comparison with results from other surface water locations. In addition, fourteen-year trends of gross alpha, gross beta, and tritium concentrations at WNNDADR are plotted in Figure 2-2 (*below*).

Gross alpha. Gross alpha results from water samples taken at WNNDATR, WNNDADR, and WNERB53 in 2000 were indistinguishable from background results (WFBCBKG).

Gross beta. Gross beta results at all three locations were elevated with respect to background, but even the maximum concentrations were well below 1E-06 µCi/mL, the DCG for strontium-90 in water, at about 10%, 20%, and 2% respectively. Gross beta activity at these locations is attributable largely to strontium-90. Residual contamination from past waste burial activities in soils outside the NDA is thought to be the source of the activity.

Over the last ten years annual average gross beta concentrations at WNNDADR (surface water drainage downstream of the NDA) have generally decreased while those at WNNDATR (the sump in the interceptor trench) have generally increased. However, results in 2000 from both locations were within the range of historical values. No evident cause of these trends has been noted.

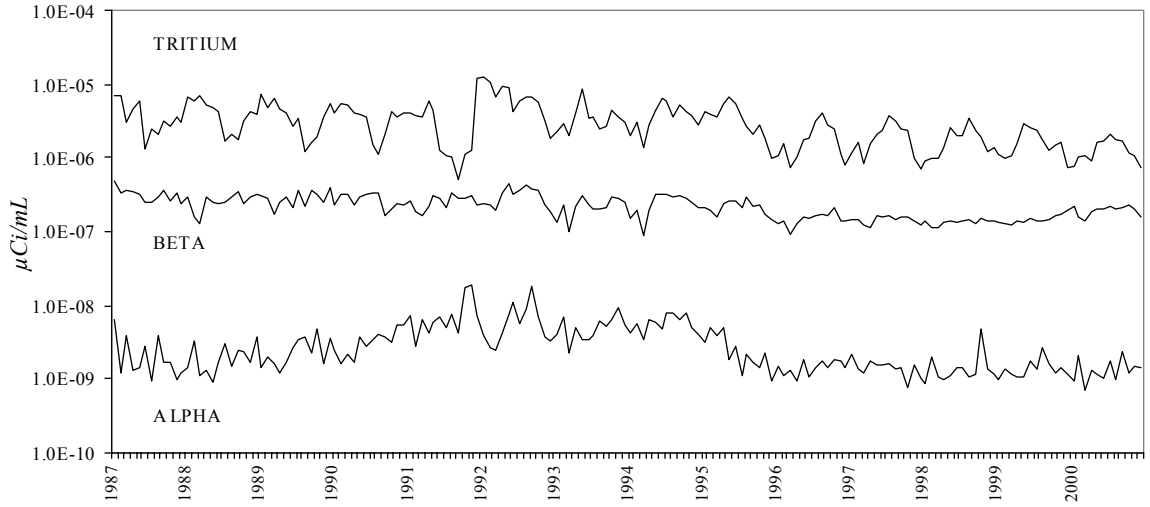


Figure 2-2. Fourteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNNDADR

Tritium. Although tritium concentrations at WNNDATR and WNNDADR were also elevated with respect to background values (those from WNERB53 were not), the maximum concentrations from both WNNDATR and WNNDADR were less than 1% of the DCG for tritium in water (2E-03 µCi/mL). Allowing for seasonal variations, tritium concentrations seem to be generally decreasing at both WNNDATR and WNNDADR. Since the half-life of tritium is slightly longer than twelve years, decreasing tritium concentrations may be partially attributable to radioactive decay.

Iodine-129. A key indicator of possible migration of nonradiological organic contaminants from the NDA would be iodine-129, which is known to travel with the organic contaminants present in the NDA and is soluble in water. Although iodine-129 has been detected upon occasion at WNNDADR and WNNDATR in previous years, none was detected in 2000.

Cesium-137. No cesium-137 activity was detected at either location in 2000.

Total organic halides.Total organic halides (TOX) measurements are used to detect the presence of certain organic compounds and associated radionuclides. (See also Results of Monitoring at the NDA in Chapter 3, p. 3-14.) Average TOX concentrations were higher at WNNDATR in 2000 than in 1999, but average concentrations at WNNDADR were lower in 2000 than in 1999. However, at both locations TOX sampling results were within the range of historical values.

New York State-licensed Disposal Area (SDA). Point WNSDADR is used to monitor drainage from trench covers on the southwestern area of the SDA. Immediately south of the SDA, and upstream of WNSDADR, sampling point WNDCELD is used to monitor surface drainage from the area around the drum cell. (See Fig.A-2 [p.A-4].) To the northeast, sampling point WNFRC67, in Frank's Creek, is used to monitor drainage downstream of the drum cell and the eastern and southern borders of the SDA. Results from WNSDADR, WNDCELD, and WNFRC67 are in Tables C-12 (p.C-11), C-14 (p.C-12), and C-9 (p.C-10) respectively.

With the exception of tritium at WNSDADR, all radiological results in calendar year 2000 at sampling points WNSDADR, WNDCELD, and WNFRC67 were statistically indistinguishable from background surface water results at WFBCBKG. Tritium concentrations at WNSDADR were slightly higher than background values, but even the highest result — 2.92E-07µCi/mL (10.8 Bq/L) — was less than 0.02% of the tritium DCG — 2E-03µCi/mL (7.4E+4 Bq/L).

Standing Pond Water Sampling Locations. In addition to samples from moving water (streams or seeps), samples from ponds within the retained premises (WNYNSC) are also collected and tested annually for various radiological and water quality parameters to confirm that no major changes are occurring in standing water within the Project environs.

Four ponds near the site were tested in 2000. For comparison, a background pond 14.1 kilometers (8.8 mi) north of the Project was also tested. (See Figs.A-2 and A-3 [pp.A-4 and A-5] for the locations of the five ponds and Table C-21 [p.C-18] for a summary of sampling results.) Gross alpha, gross beta, and tritium concentrations in samples from all on-site ponds were statistically the same as concentrations at the background pond.

Off-site Surface Water Sampling Locations. Samples of surface water are collected at four off-site locations, two on Buttermilk Creek and

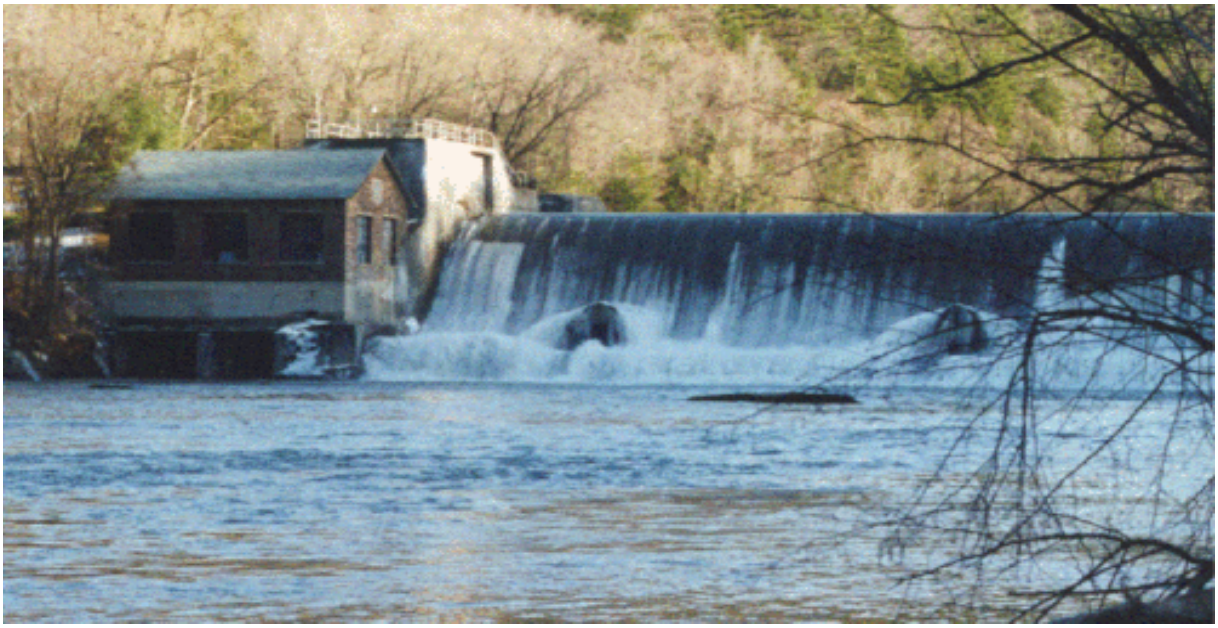
two on Cattaraugus Creek. Off-site surface water and sediment sampling locations are shown on Fig.A-3 (p.A-5). Tables 2-1 and 2-2 (p.2-5) list the ranges and annual averages for gross alpha and gross beta activity at off-site surface water locations, which may be compared with data from on-site locations.

Fox Valley Road and Thomas Corners Bridge Sampling Locations. Buttermilk Creek is the major surface drainage from the WNYNSC. Two surface water monitoring stations are located on Buttermilk Creek, one upstream of the WVDP at Fox Valley Road (WFBCBKG) and one downstream of the WVDP at Thomas Corners bridge (WFBCTCB). The Thomas Corners bridge sampling location is also upstream of Buttermilk Creek's confluence with Cattaraugus Creek. The Thomas Corners bridge sampling location represents an important link in the pathway to humans because dairy cattle have access to the water here.

Samples collected every week are composited monthly and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite is analyzed for gamma-emitting radionuclides and strontium-90. Quarterly samples from WFBCBKG, the background location, also are analyzed for specific radionuclides as noted in Appendix B, p.B-29, and the results are used as a base for comparison with results of samples from site effluents.

Table C-22 (p.C-19) lists radionuclide concentrations at the Fox Valley Road background location; Table C-23 (p.C-20) lists radionuclide concentrations downstream of the site at Thomas Corners bridge.

Gross alpha and gross beta. Gross alpha and gross beta concentrations at Thomas Corners bridge were slightly higher than background concentrations in 2000. Because the monitoring point in Frank's Creek (WNSP006), which is upstream of Thomas Corners and much closer to the site, did not show elevated gross alpha concentrations, it is suspected that the elevated gross alpha concentrations at Thomas Corners were due to natural radioactivity in suspended



Springville Dam on Cattaraugus Creek

sediments. Gross beta concentrations, however, were elevated at both WNSP006 and Thomas Corners bridge and may be attributed to small amounts of radioactivity moving from the site, principally during periods of lagoon discharge, via Frank's Creek.

The highest gross alpha concentration noted at Thomas Corners bridge was 4.64E-09 µCi/mL (0.17 Bq/L); the highest gross beta concentration was 2.21E-08 µCi/mL (0.82 Bq/L). If compared to the most conservative guidelines for alpha and beta emitters in water (americium-241 at 3E-08µCi/mL [1.1Bq/L] and strontium-90 at 1E-06µCi/mL [37 Bq/L]), these gross alpha and gross beta concentrations at Thomas Corners bridge would be about 15% and 2% of the respective DCGs.

Tritium, strontium-90, and cesium-137 concentrations were not significantly different from background results.

Cattaraugus Creek at Felton Bridge and Bigelow Bridge Sampling Locations. Buttermilk Creek flows through the WNYNSC and then off-site, where it flows into Cattaraugus Creek. An automated sampler is located on Cattaraugus Creek at Felton Bridge (WFFELBR), just downstream of the point where Buttermilk Creek enters. Samples are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. A chart recorder registers the stream depth during the sampling period so that a flow-weighted weekly sample can be proportioned into a monthly composite, which is analyzed for gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-24 [p.C-20].)

Background samples are collected monthly from Cattaraugus Creek at Bigelow Bridge (WFBIGBR), which is upstream of the point where Buttermilk Creek enters Cattaraugus Creek. These samples are analyzed for concentrations of gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-25 [p.C-21].)

No statistically significant differences were noted between results of analyses for gross alpha, tritium, strontium-90, and cesium-137 at either the upstream or downstream sampling locations. However, gross beta concentrations at Felton Bridge (WFFELBR) were higher than those at the background location at Bigelow Bridge (WFBIGBR). The highest gross beta concentration at Felton Bridge in 2000 was 1.06E-08 µCi/mL (0.39 Bq/L), which is about 1% of the DCG for strontium-90. Figure 2-3 (p. 2-12) shows gross alpha, gross beta, and tritium results over the past fourteen years in Cattaraugus Creek samples taken at Felton Bridge. For the most part, tritium concentrations represent method detection limits and not detected radioactivity. (Method detection limit values are levels below which the analytical measurement could not detect any radioactivity. [See Data Reporting in Chapter 1, p.1-5.]) Taking into account seasonal fluctuations, gross beta activity appears to have remained relatively constant at this location since 1987.

Drinking Water Sampling Locations. Drinking water (potable water) is sampled both off-site (near the WVDP) and on-site. Off-site drinking water samples are taken from wells that represent the nearest unrestricted use of groundwater near the Project; none of these wells draw from groundwater units underlying the site. Drinking water and utility water for the Project are drawn from two on-site surface water reservoirs.

Off-site wells. Nine off-site private, residential wells between 1.5 kilometers (0.9 mi) and 7 kilometers (4.3 mi) from the facility were sampled for radiological parameters in 2000.

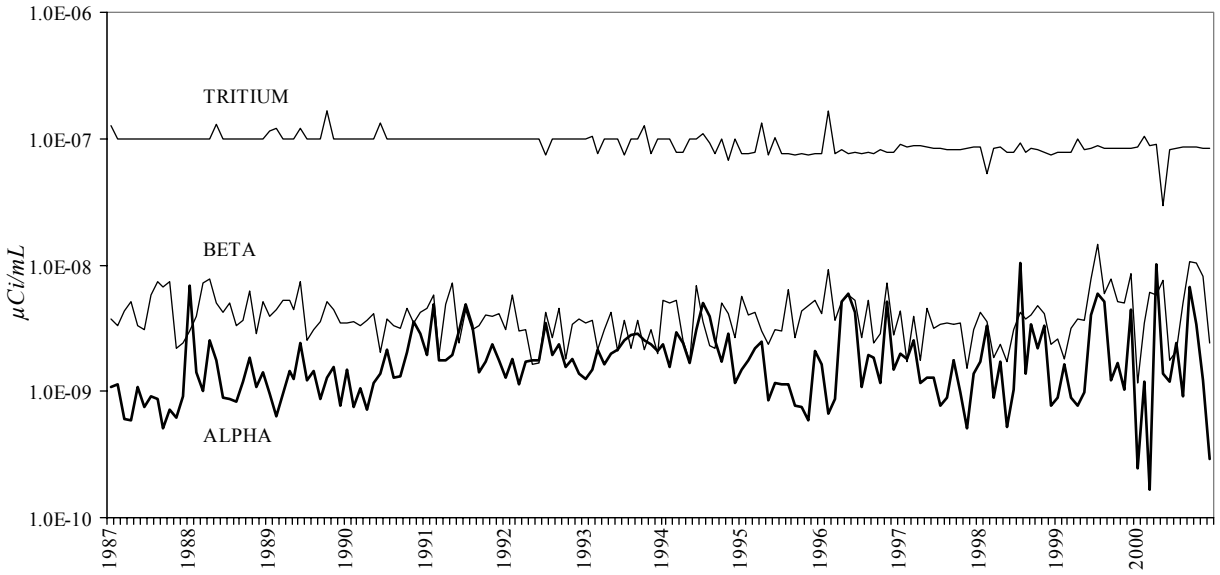


Figure 2-3. Fourteen-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WFFELBR

A tenth private well, 29 kilometers (18 mi) south of the site, provides a background sample. Sampling locations are shown in Figures A-9 and A-12 (pp.A-11 and A-14) in Appendix A. Results from the sampling are presented in Table C-26 (p.C-21). Radiological results in 2000 were within the range of historical values.

On-site drinking and utility water. On-site drinking water sources were also monitored for radionuclides at four locations: the Environmental Laboratory (WNDNKEL); the maintenance shop (WNDNKMS); the main plant (WNDNKMP); and the utility room (WNDNKUR). Monthly samples were analyzed for gross alpha, gross beta, and tritium concentrations. Results of analyses of samples from site locations were compared with those from the entry point location at the utility room, which serves as a background sampling location for these drinking water samples. No differences between background values and those from site locations were noted. (See Appendix C, Tables C-15 through C-18 [pp.C-13 through C-15].)

Radiological Monitoring: Sediments

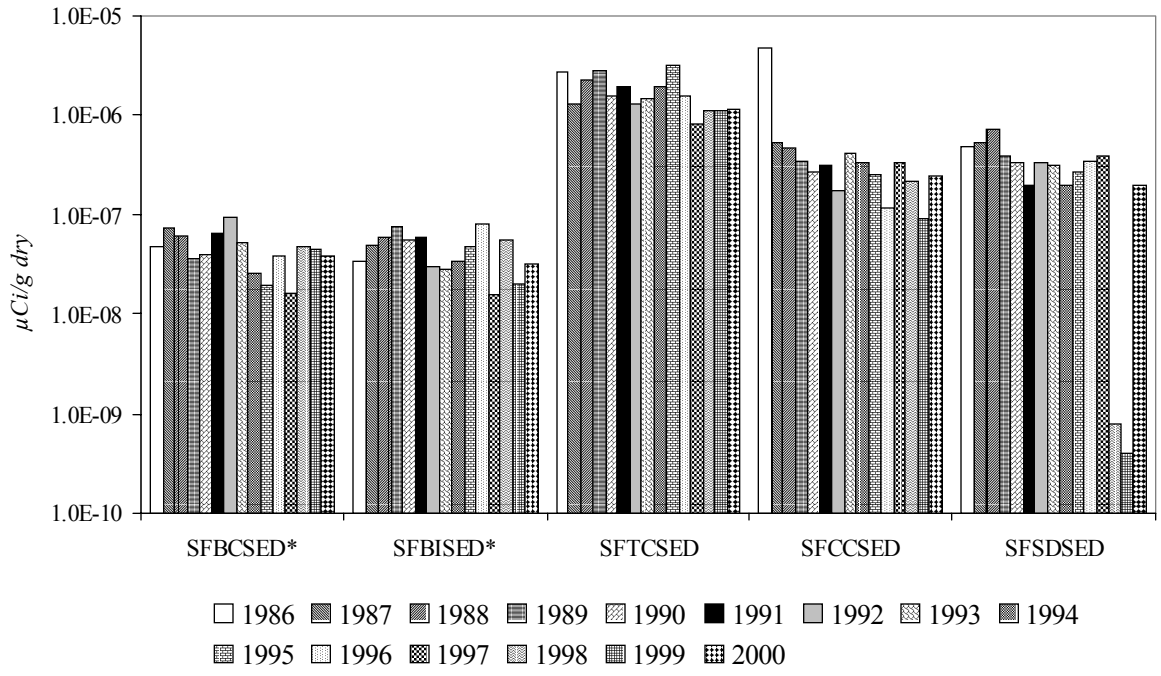
Particulate matter in streams can adsorb radiological constituents in liquid effluents, settle on the bottom of the stream as sediment, and subsequently be eroded or resuspended, especially during periods of high stream flow. These resuspended sediments may provide a pathway for radiological constituents to reach humans either directly via exposure or indirectly through the food pathway.

On-site sediments. Sediment samples are taken from the same locations as surface water samples and are identified as sediment samples by the "SNS" or "SFS" prefix. (See Appendix B, p. B-iii.) Sediments are collected on-site at the three points where liquid effluents leaving the site are most likely to be radiologically contaminated: Frank's Creek where it leaves the security fence (SNSP006); the north swamp (SNSW74A); and the northeast swamp (SNSWAMP). Figure A-2 (p.A-4) shows the on-

site sediment sampling locations. (Note that swamp sediment samples may be partially composed of soils.) Results from radiological analyses of these samples are listed in Table C-28 (p.C-23). As expected, gross beta, cesium-137, and strontium-90 results were higher at the on-site sediment sampling points than at the off-site background sampling points; gross alpha concentrations were similar to background values.

Off-site sediments. Sediments are collected off-site at three locations downstream of the WVDP: Buttermilk Creek at Thomas Corners Road (SFTCSED), Cattaraugus Creek at Felton Bridge (SFCCSED), and Cattaraugus Creek at the Springville dam (SFSDSED). The first two sampling points are located at automatic water samplers. The other is behind the Springville dam, where water would be expected to transport and deposit sediments that had adsorbed radionuclides from the site. Locations upstream of the WVDP are Buttermilk Creek at Fox Valley Road (SFBCSED) and Cattaraugus Creek at Bigelow Bridge (SFBISED). The two upstream locations provide background data for comparison with downstream points. Figure A-3 (p.A-5) shows the off-site sediment sampling locations.

Although gross alpha, gross beta, and strontium-90 concentrations in sediments downstream of the WVDP were not statistically different from background concentrations, cesium-137 concentrations in downstream sediments were higher, as they have been historically. A comparison of annual averaged cesium-137 concentrations from 1986 through 2000 for the five off-site sampling locations is illustrated in Figure 2-4 (*below*). As the figure indicates, cesium-137 concentrations are relatively stable



* *Background (upstream) location*

Figure 2-4. Fifteen-year Trends of Cesium-137 in Stream Sediments at Two Locations Upstream and Three Locations Downstream of the WVDP

at the two background locations (SFBCSED and SFBISED) and are either stable or declining at the three locations downstream of the WVDP (SFTCSED, SFCCSED, and SFSDSED). As noted in the 1999 Site Environmental Report, the level of cesium-137 observed behind the Springville dam (SFSDSED) was noticeably lower in 1998 and 1999 than in the past, and this may have been associated with the scouring of sediments during a flood on June 26, 1998. In 2000 the concentration of cesium-137 in samples from this same location rebounded to pre-flood levels. The rebound probably is attributable to upstream sediments being transported to and deposited at this location. The cesium-137 concentrations at the two other downstream locations (SFTCSED and SFCCSED) remained near historical levels.

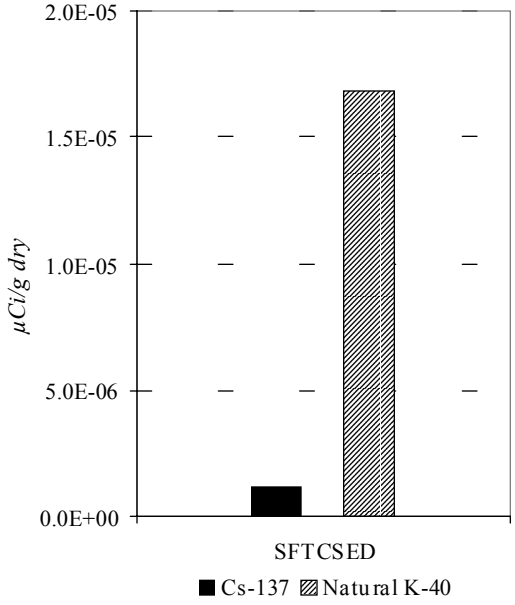


Figure 2-5. Comparison of Cesium-137 with Naturally Occurring Potassium-40 Concentrations in 2000 at Downstream Sampling Location SFTCSED

Although cesium-137 activity historically is elevated in downstream Cattaraugus Creek sediments, relative to upstream sediments (see Appendix C, Table C-30 [p.C-25]), the levels are far lower than those of naturally occurring gamma emitters such as potassium-40. (See Fig. 2-5 [*this page*], which is a graphic comparison of cesium-137 to potassium-40 at the downstream location nearest the WVDP, i.e., Buttermilk Creek at Thomas Corners Road — SFTCSED.) Moreover, these downstream-sediment cesium-137 concentrations are still within the historical range of cesium-137 concentrations in background surface soil (Great Valley [SFGRVAL] and Nashville [SFNASHV]. See Appendix C, Table C-29 [p.C-24].)

Radiological Monitoring: Air

Permits obtained from the U.S. Environmental Protection Agency (EPA) allow air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. The air released must meet criteria specified in the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations to ensure that the environment and the public's health and safety are protected. Dose-based comparisons of WVDP emissions against NESHAP criteria are presented in Chapter 4, Radiological Dose Assessment.

Unlike NESHAP dose criteria, the DOE DCGs are expressed in units of µCi/mL and therefore can be directly compared with concentrations of radionuclides in WVDP air emissions. DOE standards and DCGs for radionuclides of interest at the WVDP are found in Appendix K, Table K-1 (p.K-3).

Radiological parameters measured in air emissions include concentrations of gross alpha and gross beta, tritium, strontium-90, cesium-137,

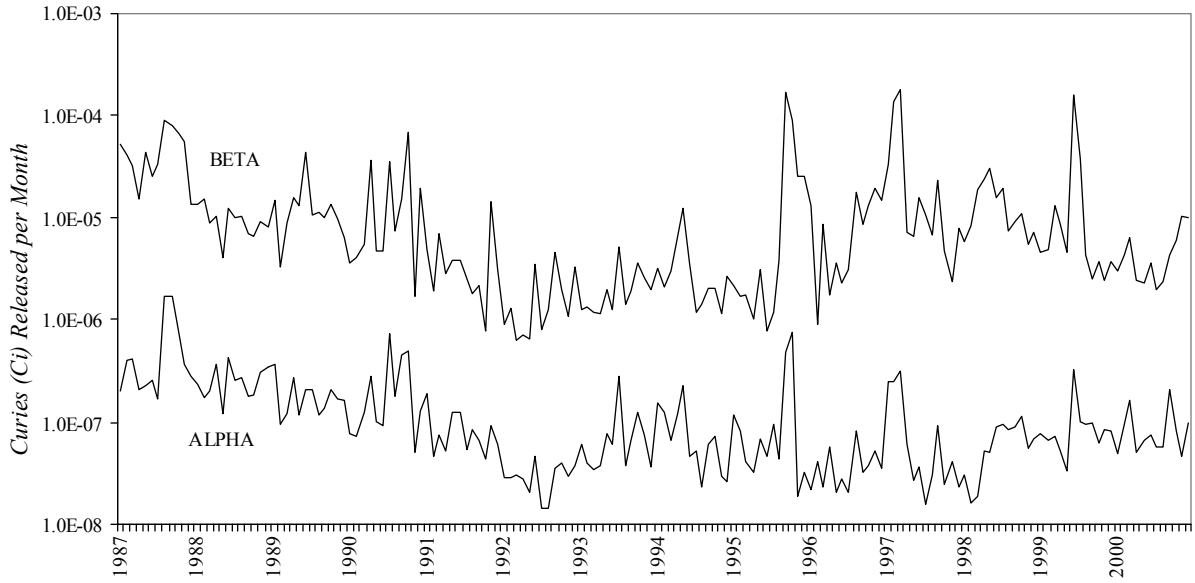


Figure 2-6. Fourteen-year Trends of Gross Alpha and Gross Beta Activity at the Main Stack Sampling Location (ANSTACK)

and other radionuclides. When comparing concentrations with dose limits for screening purposes, gross alpha and beta radioactivities are assumed to come from americium-241 and strontium-90, respectively, because the dose effects for these radionuclides are the most limiting for major particulate emissions at the WVDP.

On-site Ventilation Systems. The exhaust from each EPA-permitted fixed ventilation system on-site is continuously filtered, monitored, and sampled as it is released to the atmosphere. Because concentrations of radionuclides in air emissions are quite low, a large volume of air must be sampled at each point in order to measure the quantity of specific radionuclides released from the facility. Specially designed sampling nozzles continuously remove a representative portion of the exhaust air, which is then drawn through very fine glass fiber or membrane filters to trap particulates. Sensitive detectors continuously monitor these filters and provide readouts of alpha and beta radioactivity levels.

Separate sampling units on the ventilation stacks of the permitted systems contain another glass fiber filter that is removed every week and tested in the laboratory. These filters are analyzed routinely for the parameters delineated in Appendix B of this report.

Special samples also are collected in order to monitor gaseous (non-particulate) emissions of radioactivity. For example, six of the sampling systems contain an activated carbon cartridge that collects gaseous iodine-129, and at two locations water vapor is collected by trapping moisture in silica gel desiccant columns. The trapped water is distilled from the silica gel desiccant and analyzed for tritium. Figure A-4 (p.A-6) shows the locations of on-site air monitoring and sampling points.

The Main Plant Ventilation Stack. The main ventilation stack (ANSTACK) is the primary source of airborne releases at the WVDP. This stack, which vents to the atmosphere at a height of more than 60 meters (more than 200 ft), releases filtered ventilation from several facilities, including the liquid waste treatment system, the analytical laboratories, and off-gas from the vitrification system.

Samples from the main plant stack are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. Weekly filters are composited quarterly and analyzed for strontium-90, gamma-emitting radionuclides, total uranium, uranium isotopes, plutonium isotopes, and americium-241. Charcoal cartridges collected weekly are composited quarterly and analyzed for iodine-129. In addition, filters from the main plant ventilation stack are routinely analyzed for strontium-89 and cesium-137 as part of operational-safety monitoring.

Monthly and quarterly total curies released from the main stack in 2000 are summarized in Table D-1 (p.D-3). Total curies released, annual averages, and a comparison of total curies released with the applicable DCGs are summarized in Table D-2 (p.D-4). As in previous years, 2000 results show that average radioactivity levels at the point of discharge from the stack were already below concentration guidelines for airborne radioactivity in an unrestricted environment. Airborne concentrations from the stack to the site boundary are further reduced via dispersion by a factor of more than 200,000. Results from air samples taken just outside the site boundary confirm that WVDP operations had no discernible effect on off-site air quality. (See Perimeter and Remote Air Sampling, p.2-18.)

Figure 2-6 (p. 2-15) shows the gross alpha and gross beta curies released per month from the main stack during the past fourteen years. The figure indicates a steady five-year downward trend in both gross alpha and gross beta activity from 1987 to mid-1992 and a stabilization through mid-1995. Previtrification transfers of cesium-loaded zeolite from waste tank 8D-1 to 8D-2 began in late 1995, and releases increased.

In June 1998 the WVDP completed the first phase of high-level waste vitrification, processing the bulk of the waste in tank 8D-2. In the latter part of 1998 the focus of the vitrification program shifted to the second phase, vitrifying waste from the high-level waste residuals in the tank. Phase II vitrification continued throughout 2000. Forty-four glass canisters have been filled during this phase of vitrification, nine of them in 2000.

Since radioactive vitrification operations began in mid-1996 both gross alpha and gross beta releases have fluctuated while generally remaining higher than previtrification levels. In general, concentrations of gross beta, tritium, strontium-90, iodine-129, and cesium-137 have decreased during the second phase of vitrification. Gross alpha concentrations, on the other hand, have remained at relatively steady levels.

Vitrification HVAC Sampling System. Sampling point ANVITSK and the seismically protected backup sample point ANSEISK monitor emissions from the vitrification heating, ventilation, and air conditioning (HVAC) system. (Off-gas ventilation from the vitrification system itself is released through the main plant stack.)

Radioactivity concentrations were monitored at ANVITSK and ANSEISK before actual radioactive vitrification began in July 1996. The previtrification levels provide a baseline for comparison with concentrations of radionuclides in emissions during vitrification. Results

from 2000 are found in Tables D-3 and D-4 (pp.D-5 and D-6).

With the exception of iodine-129, concentrations of radionuclides measured during 2000 were indistinguishable from baseline values. Concentrations of iodine-129 increased during the fourth quarter of 1999 and remained elevated in 2000. Elevated results were thought to be associated with the maintenance of ventilation systems, in-cell waste storage activities, or wear of various components of the vitrification system (which was expected). Even so, the highest concentration observed in calendar year 2000 (4.70E-15 µCi/mL [1.74E-07 Bq/L]) was less than 0.01% of the DCG for iodine-129 (7E-11µCi/mL [2.59E-03 Bq/L]).

Other On-site Air Sampling Systems. Sampling systems similar to those of the main stack monitor airborne effluents from the 01-14 building ventilation stack (ANCSSTK), the contact size-reduction facility ventilation stack (ANCSRFK), the supernatant treatment system ventilation stack (ANSTSTK), and the container sorting and packaging facility ventilation stack (ANCSPFK). (See Fig.A-4 [p.A-6].)

Tables D-5 through D-8 (pp.D-7 through D-10) show monthly totals of gross alpha and beta radioactivity and quarterly total radioactivity released for specific radionuclides at each of these sampling locations. Samples from these locations (ANCSSTK, ANCSRFK, ANSTSTK, and ANCSPFK) showed detectable concentrations of gross radioactivity in some cases as well as specific beta- and alpha-emitting radionuclides, but none approached any DOE effluent limitations.

Three other operations are routinely monitored for airborne radioactive releases: the new low-level waste treatment facility ventilation system (ANLLW2V), which came on-line in 1998; the old low-level waste treatment facility ventilation (ANLLWTVH); and the contaminated clothing laundry ventilation system (ANLAUNV).

The old and new low-level waste treatment facility ventilation points and the laundry ventilation system are sampled for gross alpha and gross beta radioactivity. These emission points are not required to be permitted because the potential magnitude of the emissions is so low. Although only semiannual grab sampling is required to verify the low level of emissions, all three points are sampled continuously while discharging to the environment. Data for these three facilities are presented in Tables D-9 through D-11 (pp.D-11 and D-12). Results from these calendar year 2000 samples were well below DOE effluent limitations.

Permitted portable outdoor ventilation enclosures (OVEs) are used occasionally to provide the ventilation necessary for the safety of personnel working with radioactive materials in areas outside permanently ventilated facilities. Air samples from OVEs are collected continuously while those emission points are discharging, and data from these units are included in annual airborne emission evaluations. (See Table D-15 [p.D-16].) Average discharges from OVEs were well below DOE guidelines for alpha and beta radioactivity in an unrestricted environment.

Three on-site air samplers collect samples of ambient air in the vicinity of three on-site waste storage units — the lag storage area (ANLAGAM), the NDA (ANNDAAM), and the SDA (ANSDAT9). (See Fig.A-4 [p.A-6].) These samplers were put in place to monitor potential diffuse releases of radioactivity. Monitoring data from these locations are presented in Appendix D, Tables D-12 through D-14 (pp. D-13 through D-15).

Radiological data sets for these locations are statistically indistinguishable from background air monitoring location AFGRVAL, with the exception of tritium results at ANSDAT9. However, even the highest weekly tritium result from ANSDAT9 (2.61E-12 µCi/mL [9.66E-05 Bq/L]) was less than 0.003% of the DOE DCG for tritium in air (1E-07µCi/mL).

Perimeter and Remote Air Sampling. Samples for radionuclides in air are collected continuously at six locations around the perimeter of the site and at four remote locations. Maps of perimeter and remote air sampling locations are found on Figure A-5 (p.A-7) and Figure A-12 (p.A-14).

The perimeter locations on Fox Valley Road (AFFXVRD), Rock Springs Road (AFRSPRD), Route 240 (AFRT240), Thomas Corners Road (AFTCORD), Dutch Hill Road (AFBOEHN), and at the site's bulk storage warehouse (AFBLKST) were chosen because they provide historical continuity (as former NFS sampling locations) or because they represent the most likely locations for detecting off-site airborne concentrations of radioactivity.

Changing an Air Filter at an Air Sampling Station

The remote locations provide data from nearby communities — West Valley (AFWEVAL) and Springville (AFSPRVL) — and from more distant background areas. Concentrations measured at Great Valley (AFGRVAL, 30.9 km south of the site) and Nashville (AFNASHV, 39.8 km west of the site in the town of Hanover) are considered representative of regional background air.

At all locations airborne particulates are collected on filters for radiological analysis. Samplers maintain an average flow of approximately 40 L/min (1.4 ft^3/min) through a 47-millimeter glass fiber filter. The sampler heads are set above the ground at the height of the average human breathing zone. Filters are collected weekly and analyzed after a seven-day "decay" period to remove interference from short-lived naturally occurring radionuclides. After weekly sample filters are measured for gross alpha and gross beta concentrations, they are combined in a quarterly composite consisting of thirteen weekly filters. The composite is analyzed for specific alpha-emitting, beta-emitting, and gamma-emitting radionuclides.

At two locations, the nearest perimeter location in the predominant downwind direction (Rock Springs Road) and the farthest background location (Great Valley), desiccant columns are used to collect airborne moisture for tritium analysis and charcoal cartridges are used to collect samples for iodine-129 analysis.

Figure 2-7. Fourteen-year Trends of Gross Alpha and Gross Beta Concentrations at the Rock Springs Road Sampling Location (AFRSPRD)

Trends of gross alpha and gross beta concentrations at the Rock Springs Road location are shown in Figure 2-7 (*above*). Within a range of seasonal and weekly fluctuations, the concentrations have been relatively constant over the past fourteen years. The gross alpha and gross beta ranges and annual averages for each of the off-site sampling points are noted on Tables 2-3 and 2-4 (p.2-20). All gross alpha averages were below detection levels. Gross beta results from samples taken at two near-site communities and from the site perimeter were similar to those from the background samplers, suggesting that there is no adverse site influence on the air quality at these near-site locations. Gross beta concentrations at all off-site and perimeter locations averaged about 1.84E-14µCi/mL, which is about 0.2% of the DCG for strontium-90 in air (9E-12 µCi/mL). The highest average gross beta concentration (1.90E-14µCi/mL) was at Fox Valley Road. This represents less than 0.3% of the DCG. Additional radionuclide data from these samplers are provided in Tables D-16 through D-25 (pp. D-17 to D-23).

Although low levels of tritium, strontium-90, iodine-129, and cesium-137 were detected in emissions from the main stack on-site, average results for these radionuclides at near-site locations were indistinguishable from background values, confirming that site releases have a negligible effect on near-site air quality.

Fallout Pot Sampling. Short-term global fallout is sampled for radionuclide concentrations each month at four of the perimeter air sampler locations and at one on-site location near the rain gauge outside the Environmental Laboratory. (See Figs.A-4 and A-5 [pp.A-6 and A-7].) Monthly gross alpha, gross beta, potassium-40, and cesium-137 results are reported in nCi/m^2 and tritium results are reported in µCi/mL. Results from on-site and perimeter

Table 2-3
2000 Gross Alpha Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	Number of Samples	Range		Annual Average	
		(µCi/mL)	*(Bq/m³)*	*(µCi/mL)*	*(Bq/m³)*
AFBLKST	52	<7.56E-16 to 2.85E-15	<2.80E-05 to 1.05E-04	0.79±1.17E-15	2.93±4.34E-05
AFBOEHN	52	<5.86E-16 to 2.22E-15	<2.17E-05 to 8.20E-05	0.73±1.17E-15	2.71±4.34E-05
AFFXVRD	52	<7.53E-16 to 2.31E-15	<2.78E-05 to 8.56E-05	0.84±1.19E-15	3.10±4.39E-05
AFGRVAL	52	<7.00E-16 to 2.04E-15	<2.59E-05 to 7.54E-05	0.74±1.14E-15	2.74±4.20E-05
AFNASHV	52	<7.57E-16 to 2.24E-15	<2.80E-05 to 8.27E-05	0.70±1.18E-15	2.57±4.36E-05
AFRSPRD	52	<7.78E-16 to 2.08E-15	<2.88E-05 to 7.71E-05	0.72±1.16E-15	2.65±4.31E-05
AFRT240	52	<8.23E-16 to 2.05E-15	<3.05E-05 to 7.58E-05	0.76±1.17E-15	2.81±4.34E-05
AFSPRVL	52	<7.55E-16 to 2.42E-15	<2.79E-05 to 8.97E-05	0.77±1.18E-15	2.87±4.37E-05
AFTCORD	52	<7.99E-16 to 2.62E-15	<2.96E-05 to 9.70E-05	0.74±1.21E-15	2.73±4.48E-05
AFWEVAL	52	<7.58E-16 to 2.76E-15	<2.80E-05 to 1.02E-04	0.84±1.20E-15	3.10±4.43E-05
ANLAGAM	52	<4.96E-16 to 2.20E-15	<1.83E-05 to 8.15E-05	0.87±0.90E-15	3.22±3.28E-05
ANNDAAM	52	<6.26E-16 to 1.89E-15	<2.32E-05 to 6.98E-05	0.78±0.90E-15	2.89±3.34E-05
ANSDAT9	52	<6.69E-16 to 7.24E-15	<2.47E-05 to 2.68E-04	0.67±1.50E-15	2.46±5.55E-05

Table 2-4
2000 Gross Beta Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	Number of Samples	Range		Annual Average	
		(µCi/mL)	*(Bq/m³)*	*(µCi/mL)*	*(Bq/m³)*
AFBLKST	52	7.94E-15 to 3.33E-14	2.94E-04 to 1.23E-03	1.83±0.33E-14	6.78±1.22E-04
AFBOEHN	52	2.79E-15 to 4.04E-14	1.03E-04 to 1.49E-03	1.87±0.33E-14	6.91±1.24E-04
AFFXVRD	52	6.28E-15 to 3.59E-14	2.32E-04 to 1.33E-03	1.90±0.33E-14	7.02±1.24E-04
AFGRVAL	52	7.42E-15 to 3.42E-14	2.75E-04 to 1.27E-03	1.68±0.32E-14	6.21±1.17E-04
AFNASHV	52	6.72E-15 to 3.76E-14	2.49E-04 to 1.39E-03	1.89±0.34E-14	6.98±1.25E-04
AFRSPRD	52	5.86E-15 to 3.35E-14	2.17E-04 to 1.24E-03	1.74±0.33E-14	6.43±1.21E-04
AFRT240	52	7.27E-15 to 3.62E-14	2.69E-04 to 1.34E-03	1.82±0.33E-14	6.75±1.23E-04
AFSPRVL	52	7.95E-15 to 3.64E-14	2.94E-04 to 1.35E-03	1.84±0.33E-14	6.80±1.23E-04
AFTCORD	52	9.79E-15 to 3.81E-14	3.62E-04 to 1.41E-03	1.86±0.34E-14	6.90±1.26E-04
AFWEVAL	52	7.02E-15 to 3.57E-14	2.60E-04 to 1.32E-03	1.75±0.33E-14	6.47±1.22E-04
ANLAGAM	52	7.32E-15 to 3.66E-14	2.71E-04 to 1.35E-03	1.84±0.26E-14	6.82±0.96E-04
ANNDAAM	52	8.54E-15 to 3.87E-14	3.16E-04 to 1.43E-03	1.94±0.27E-14	7.18±1.02E-04
ANSDAT9	52	8.22E-15 to 3.58E-14	3.04E-04 to 1.32E-03	1.79±0.37E-14	6.64±1.36E-04

locations were similar to each other and to results noted in previous years. The small levels of tritium and cesium-137 detected in main stack emissions did not measurably affect on-site or perimeter fallout pot samples in 2000. The data from these analyses and the pH in precipitation are summarized in Tables D-26 through D-30 (pp.D-24 through D-26).

Off-site Surface Soil Sampling. In order to assess long-term fallout deposition, surface soil near the off-site air samplers is collected annually and analyzed for radioactivity. Samples were collected from ten locations: six near-site points on the perimeter of the WNYNSC, two in nearby communities, and two in locations 30 to 40 kilometers distant from the Project. Maps of the off-site surface soil sampling locations are on Figures A-3 and A-12 (pp.A-5 and A-14).

Concentrations of gross alpha and beta radioactivity, strontium-90, cesium-137, plutonium-239/240, and americium-241 were determined at all ten locations; concentrations of uranium radionuclides and total uranium were determined at two perimeter locations and one background location. The measured concentrations of most site-related radionuclides in soils from the perimeter and community locations (Table C-29 [p.C-24]) were statistically indistinguishable from normal regional background concentrations. However, cesium-137 concentrations from the Rock Springs Road location — northwest of the site — remained marginally higher than background concentrations. Soils collected near the Rock Springs Road air sampler have consistently shown higher than background cesium-137 concentrations.

Historically, cesium-137 concentrations at background locations SFGRVAL and SFNASHV have ranged from 6.54E-08 to 4.38 E-06 µCi/g. The results for calendar year 2000 at these two locations were 5.20E-07 and 6.54E-08 µCi/g respectively. Annual cesium-137 concentrations at SFRSPRD have ranged from 1.06E-06 to 2.08E-06 µCi/g. The result for calendar year 2000 was 1.06E-06 µCi/g, higher than background results for 2000 but well within the historical range at background locations.

Radiological Monitoring: Food Chain

Each year food and forage samples are collected from locations near the site (Fig. A-9 [p.A-11]) and from remote locations (Fig.A-12 [p.A-14] in Appendix A). Fish and deer are collected during periods when they would normally be taken by sportsmen for consumption. Most milk samples are collected monthly; beef is collected semiannually. Hay, corn, apples, and beans are collected at the time of harvest.

Fish. Fish are obtained under a collector's permit by electrofishing, a method that temporarily stuns the fish, allowing them to be netted for collection. Electrofishing allows a more species-selective control than sport fishing, with unwanted fish being returned to the creek essentially unharmed.

Fish are collected from three locations in Cattaraugus Creek: Two locations are downstream of WNYNSC drainage — one above the Springville dam (BFFCATC) and one below the Springville dam (BFFCATD) — and one location is upstream of the site (BFFCTRL). (See Fig.A-12, p.A-14.)

Twenty fish samples were collected in 2000 (ten the first half of the year and ten the second half of the year) immediately downstream (above the Springville dam at BFFCATC), and another twenty were collected from the control location upstream of the site (BFFCTRL). Ten fish

Electrofishing in Cattaraugus Creek

samples were collected from Cattaraugus Creek below the dam (BFFCATD), including species that migrate more than 60 kilometers (nearly 40 mi) upstream from Lake Erie.

The edible portion of each fish was analyzed for strontium-90 content and the gamma-emitting radionuclide cesium-137. (See Table F-4 [pp. F-6 through F-8] in Appendix F for a summary of the results.) Although many of the strontium-90 results, especially at sampling location BFFCATD below the dam, were lost because of analytical problems at the vendor laboratory, two results from BFFCATD were available. These results were within the historical range at this location.

Strontium-90 results from fish above the Springville dam (at BFFCATC) were elevated in comparison with the background samples (from BFFCTRL), but these results also were within the range of historical results.

No differences in cesium-137 concentrations in fish collected above and below the point at which site effluents enter Cattaraugus Creek were noted.

Venison. Venison from vehicle-deer accidents around the WNYNSC and from deer collected far from the site in the towns of Little Genesee, Alexander, and Portville, New York was analyzed for tritium, potassium-40, strontium-90, and cesium-137 concentrations. (See Figs.A-9 and A-12 [pp.A-11 and A-14].) Results from these samples are shown in Table F-2 (p.F-4) in Appendix F.

Low levels of radioactivity from cesium-137, strontium-90, and naturally occurring potassium-40 were detected in both near-site and control samples. Although results vary from year to year, data from the last ten years show no statistical differences between radionuclide concentrations in near-site and control samples.

For the seventh year, during the large-game hunting season, hunters were allowed access to the WNYNSC, excluding the WVDP premises, in a controlled hunting program established by

NYSERDA. There were no requests from hunters to analyze deer from the 2000 hunt. However, data from previous hunts have shown that concentrations of radioactivity in deer flesh have been very low, indicating that Project activities have little or no effect on the local herd.

Beef. Beef samples are taken semiannually from both near-site and remote locations (Figs.A-9 and A-12 [pp.A-11 and A-14] in Appendix A) and are analyzed for tritium, potassium-40, strontium-90, and cesium-137. Results are presented in Table F-2 (p.F-4) in Appendix F. No significant differences were found between results from near-site and background samples.

Milk. Monthly milk samples were taken from dairy farms near the site to the north and west — downwind in the prevailing wind direction from the WVDP — and from farms more than 25 kilometers from the site and used as control locations. Annual milk samples were collected at two near-site farms to the south and east of the site. The locations of the near-site and remote sampling points are shown in Figure A-9 (p.A-11) and Figure A-12 (p.A-14) in Appendix A.

The monthly samples from each location were composited into single quarterly samples for analysis. These quarterly composites and annual samples were analyzed for tritium, potassium-40, strontium-90, iodine-129, and cesium-137. Results are presented in Table F-1 (p.F-3) in Appendix F. Near-site sample results were indistinguishable from background control sample results.

Vegetables, Fruit, and Forage. Sweet corn, beans, apples, and hay were collected at near-site and background locations at harvest time. Sampling locations are shown on Figures A-9 (p.A-11) and A-12 (p.A-14) in Appendix A. Samples were analyzed for tritium, potassium-40, cobalt-60, strontium-90, and cesium-137. Results are presented in Table F-3 (p.F-5) in Appendix F.

Low levels of radioactivity — in particular, strontium-90 — were noted in both background and near-site samples. However, none of the measurements of radionuclides in near-site samples, including strontium-90, were significantly higher than measurements from background samples.

Direct Environmental Radiation Monitoring

This was the seventeenth full year in which direct penetrating radiation was monitored at the WVDP. Thermoluminescent dosimeters (TLDs) are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure at that location.

Monitoring points are located on-site at the waste management units, at the site security fence, around the WNYNSC perimeter and the access road, and at background locations remote from the WVDP (Figs.A-10, A-11, and A-12 [pp.A-12, A-13, and A-14]). The identification numbers associated with each location were assigned in chronological order of original installation. (See TLD Locations and Identification Numbers on p.2-24.)

Quarterly and annual averages of TLD measurements at off-site and on-site locations are noted in Appendix H, Tables H-1 and H-2 (pp.H-3 and H-4). The results of measurements in 2000 show typical seasonal variations and are similar to results from previous years.

On-Site Radiation Monitoring. Table H-2 (p.H-4) shows the average quarterly exposure rate at each on-site TLD. The on-site monitor-

ing point with the highest dose readings was location #24. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby. This storage area is well within the WNYNSC boundary, just inside the WVDP fenced area, and is not accessible by the public.

The average exposure rate at location #24 was about 627 milliroentgens (mR) per quarter (0.29 mR/hr) during 2000, which is almost identical to the exposure rate noted at this location in 1999 (0.27 mR/hr). Exposure rates at this location are gradually decreasing because the radioactivity in the materials stored nearby is decaying. (The average mR/hr for the first two years that TLD measurements were taken — 1987 and 1988 — was about 0.8 mR/hr. See Fig. 1-1 [p.1-10] in Chapter 1.)

The average penetrating radiation exposure rate in 2000 at locations 100 to 400 feet (30 to 120m) distant from the integrated radwaste treatment storage building — the drum cell — including TLDs #18, #32, #34, #35, #36, and #43, was 0.02 mR/hr, about the same as in 1999. Exposure rates around the drum cell are above background levels (approximately 0.01 mR/hr) because the building contains drums filled with decontaminated supernatant mixed with cement. (See also Fig. 1-2 [p.1-10] in Chapter 1.) The drum cell and the surrounding TLD locations are well within the WNYNSC boundary and are not accessible by the public.

TLD Locations and Identification Numbers

Perimeter of the WNYNSC	1-16, 20
Perimeter of the WVDP security fence	24, 26-34
On-site sources or waste management units *(Note: some TLDs monitor more than one waste management unit)*	18, 32-36, 43 (drum cell) 18, 19, 33, 42, 43 (SDA) 24 (component storage, near WVDP security fence) 25 (maximum measured exposure rate at the closest point of public access) 38 (main plant and, in previous years, the cement solidification system) 39 (parking lot security fence closest to the vitrification facility) 40 (high-level waste tank farm)
Near-site communities	21 (Springville) 22 (West Valley)
Background	17 (Five Points Landfill in Mansfield) 23 (Great Valley) 37 (Nashville) 41 (Sardinia)

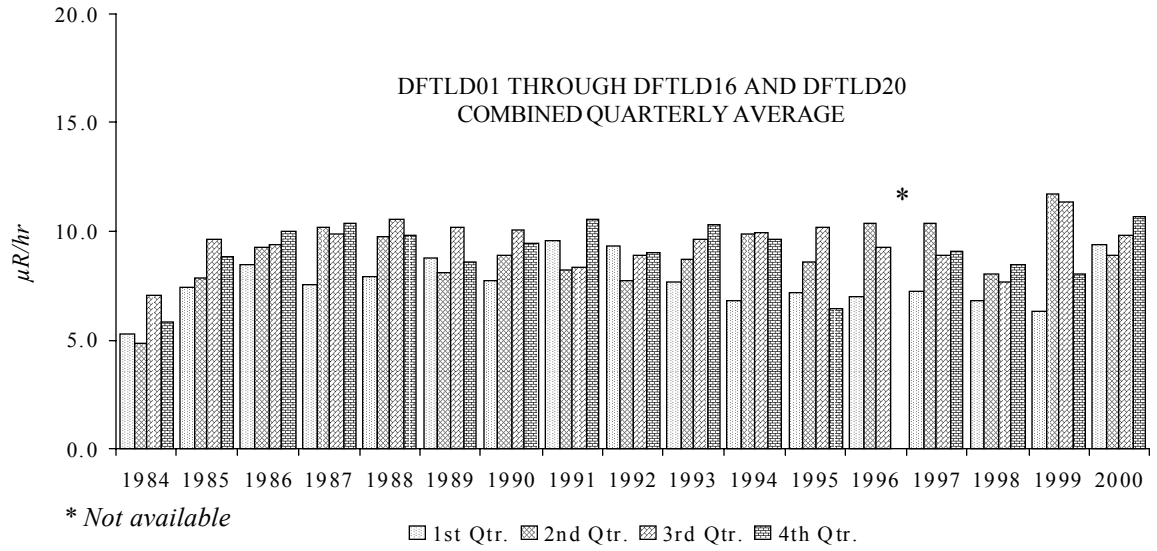


Figure 2-8. Seventeen-year Trend of Environmental Radiation Levels at Perimeter TLDs

Perimeter and Off-Site Radiation Monitoring. Table H-1 (p.H-3) lists the average quarterly exposure rate at each off-site TLD location. The perimeter TLDs (TLDs #1-16 and #20) are located in the sixteen compass sectors around the facility near the WNYNSC boundary. Results from the background and community TLDs were essentially the same as results from the perimeter TLDs. The perimeter TLD quarterly averages since 1985 (expressed in microroentgen per hour [µR/hr]) shown on Figure 2-8 (*above*) indicate seasonal fluctuations but no long-term trends. The quarterly average of the seventeen WNYNSC-perimeter TLDs was 21.4 mR per quarter (9.8 µR/hr) in 2000, slightly higher than in 1999.

Confirmation of Results. The performance of the environmental TLDs is confirmed periodically using a portable high-pressure ion chamber (HPIC) detection system. In the third quarter of 2000 the HPIC was taken to each of the forty-three environmental TLD locations and instantaneous dose readings (in µR/hr) were obtained. These readings and the comparable third-quarter environmental TLD results are listed in Table H-3 (p.H-5). The TLD results include the entire third quarter of 2000; the HPIC results were collected over a period of less than 30 minutes.

Because the measurements are made with different systems and over differing periods of time, they are not directly comparable. Even so, the average relative percent difference between the two sets of measurements was less than 12%, indicating good agreement between these two different measurement methods. (Guidance in ANSI N545-1975, the standard for environmental dosimetry, uses less than 30% total uncertainty as a performance specification for TLD measurements.)

Meteorological Monitoring

Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local and regional climatology of the site. These data are used primarily to assess potential effects of routine and nonrou-

On-site Meteorological Tower

tine releases of airborne radioactive materials and to develop dispersion models used to calculate the effective dose equivalent to off-site residents. Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which is 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.

The on-site 60-meter meteorological tower (Fig. A-1 [p.A-3]) continuously monitors wind speed, wind direction, and temperature at both the 60-meter and 10-meter elevations. In addition, an independent, remote 10-meter meteorological station located approximately 8 kilometers south of the site on a hillcrest on Dutch Hill Road continuously monitors wind speed and wind direction. (See Fig.A-12 [p.A-14].) Dewpoint, precipitation, and barometric pressure are also monitored on-site.

The two meteorological locations 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 case of site power failures. In 2000 the on-site system data recovery rate (time valid data were logged versus total elapsed time) was approximately 95.7%. Regional data at the 10-meter elevation are shown on Figure I-1 (p.I-3). Figures I-2 and I-3 (pp. I-4 and I-5) illustrate the mean wind speed and wind direction at the 10-meter and 60-meter elevations on the on-site tower during 2000.

Weekly and cumulative total precipitation data are illustrated in Figures I-4 and I-5 (p.I-6) in Appendix I. Precipitation in 2000 was about 96.6 centimeters (38 in), about 7.2% below the annual average of 104 centimeters (41 in).

Documentation such as meteorological system calibration records, site log books, and analog strip charts are stored in protected archives. Meteorological towers and instruments are examined three times per week for proper function and are calibrated semiannually and/or whenever instrument maintenance might affect calibration.

Nonradiological Monitoring: Surface Water

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook (Fig.A-2 [p.A-4]) and specifies the sampling and analytical requirements for each outfall. The cur-

rent SPDES permit (effective June 1995) was administratively renewed without changes by NYSDEC and was issued to the WVDP in September 1998 with an effective date of February 1, 1999 and an expiration date of February 1, 2004. The conditions and requirements of the SPDES permit are summarized in Table G-1 (pp.G-3 and G-4) in Appendix G. The permit identifies four outfalls:

• outfall WNSP001, discharge from the low-level waste treatment facility

• outfall WNSP007, discharge from the sanitary and industrial wastewater treatment facility

• outfall WNSP008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons

• outfall 116, a sampling location in Frank's Creek that represents the confluence of outfalls WNSP001, WNSP007, and WNSP008 as well as storm water runoff, groundwater surface seepage, and augmentation water. Samples from upstream sources (WNSP001, WNSP007, and WNSP008) are used to calculate total dissolved solids 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. [See p.7 in the Glossary.])

Some of the more significant features of the SPDES permit are the requirements to report five-day biochemical oxygen demand (BOD_5), total dissolved solids, iron, and ammonia data as flow-weighted concentrations and to apply a net discharge limit for iron. The net limit allows the Project to account for the iron that is naturally present in the site's incoming water. The flow-weighted limits apply to the flow-proportioned sum of the Project effluents.

The SPDES monitoring data for 2000 are displayed in Tables G-2 through G-10 (pp.G-5 through G-15). The WVDP reported no permit exceedances in 2000, the third consecutive year for which no exceedances were noted. (See also the Environmental Compliance Summary: Calendar Year 2000, SPDES-permitted Outfalls [pp. ECS-11 through ECS-12].)

Semiannual grab samples at WNSP006 (Frank's Creek at the security fence), WNSWAMP (northeast swamp drainage), WNSW74A (north swamp drainage), and WFBCBKG (Buttermilk Creek at Fox Valley) were taken in 2000. These samples are screened for organic constituents and selected anions, cations, and metals. Results of these measurements for all of these locations are found in Table C-27 (p.C-22).

Nonradiological Monitoring: Drinking Water

Site drinking water is monitored to verify compliance with EPA and NYSDOH regulations. (See Safe Drinking Water Act [p.ECS-13] in the Environmental Compliance Summary: Calendar Year 2000.) Samples are collected annually and analyzed for nitrate, fluoride, and metals concentrations. Sampling and analysis for copper and lead are conducted according to Cattaraugus County Health Department guidance. The 2000 monitoring results indicated that the Project's drinking water met NYSDOH, EPA, and Cattaraugus County Health Department drinking water quality standards.

Nonradiological Monitoring: Air

Nonradiological air emissions and plant effluents are permitted under NYSDEC and EPA regulations. (The regulations that apply to the WVDP are listed in Table K-2 [p. K-4] in

Appendix K. The New York State Facility Air Permit held by the WVDP is described in the West Valley Demonstration Project Environmental Permits table on p.ECS-22 in the Environmental Compliance Summary: Calendar Year 2000.)

The nonradiological air permits are for emissions of regulated pollutants that include particulates, ammonia, nitrogen oxides, and sulfur dioxide. Emissions of oxides of nitrogen and sulfur are each limited to 99 tons per year and are reported to NYSDEC annually. Nitrogen oxide emissions from the vitrification off-gas system are continuously monitored. All other nitrogen oxides and sulfur dioxide emissions data are calculated using process knowledge and fuel usage information. Nitrogen oxides emissions for 2000 were approximately 7.44 tons; sulfur dioxide emissions were approximately 0.77 tons, well below the 99-ton limit. Compliance with New York State and EPA opacity requirements is verified by certified visible-emissions observers.

Special Monitoring

Special monitoring comprises sampling and analyses not covered by the routine environmental monitoring program but that address items of environmental interest. Special monitoring programs are used to verify and/or track these items.

Iodine Emissions from the Main Stack. When radioactive vitrification operations began in 1996, emission rates of radioactive isotopes of iodine increased at the main stack. The increase occurred because gaseous iodine is not as efficiently removed by the vitrification process off-gas treatment system as are most other radionuclides.

Iodine-129 is a long-lived radionuclide that has always been present in main stack emissions, and in 1996 iodine-131 also was detected. Iodine-131, an isotope with a half-life of eight days, originates from the decay of curium-244, which is present in the high-level waste. Iodine-131 gas was not detectable until vitrification began because the previtrification storage and management of high-level waste had prevented detectable levels of iodine-131 from reaching the air effluent. In the process of preparing the high-level waste for vitrification, the quantities of iodine-129 increased compared to previtrification levels and a very small — yet detectable — quantity of iodine-131 was released.

Iodine-129 was monitored closely during 2000 and the results compared to the operation of the vitrification facility. Weekly iodine-129 concentrations were within the range of values observed since vitrification began. In 2000 the total quantity of iodine-129 decreased slightly from the 1999 total. (See Fig. 2-9 [*below*]. For more information on the off-site effective dose from airborne emissions see Predicted Dose from Airborne Emissions [p.4-7] in Chapter 4.)

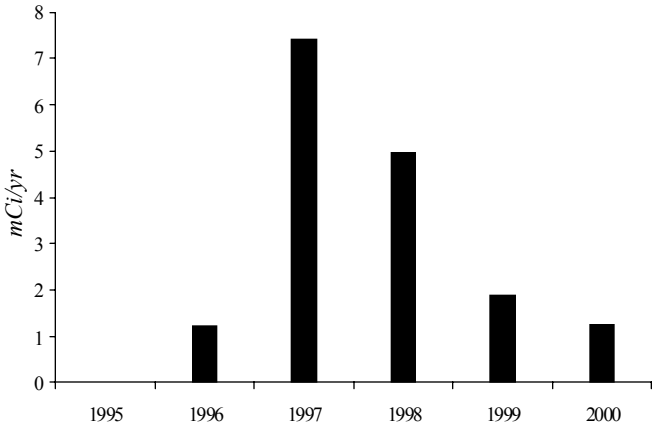


Figure 2-9. Estimated I-129 Releases from the WVDP

Mercury at the Low-level Waste Treatment Facility. Increasing concentrations of total mercury were observed in 1999 in process water collected in the low-level waste treatment facility. The source of the mercury was determined to be the evaporator effluent from the liquid waste treatment system.

At that time, New York State water quality standards were modified, defining toxicity-based standards that in some cases are several orders of magnitude lower than previous standards. Thus, in 2000, equipment was put in place to remove mercury from the process water to a greater extent. In addition, using EPA guidance on sampling techniques, procedures were developed and put into place to provide sampling for trace levels of mercury in site effluents, surface waters, and precipitation. New subcontracted analytical services were obtained to analyze for mercury to levels much lower than previously available. Sampling began in 2001.