
ENVIRONMENTAL MONITORING

Pathway Monitoring

The effluent and environmental monitoring program provides data on surface waters, soils, sediments, food and produce, and on the effluent air and liquids that could provide pathways for the movement of radionuclides or hazardous substances from the WVDP to the public. Both radiological and nonradiological parameters are monitored in order to ascertain the effect of Project activities.

Stream sediments are sampled upstream and downstream of the West Valley Demonstration Project (WVDP). The food pathway is monitored by collecting samples of beef, hay, milk, and produce at both near-site and remote locations, samples of fish upstream and downstream of the site, and venison samples from the on-site deer herd and

The radionuclides present at the WVDP site are residues from the reprocessing of commercial nuclear fuel during the 1960s and early 1970s. A very small fraction of these radionuclides is released off-site during the year through ventilation systems and liquid discharges and makes a negligible contribution to the radiation dose to the surrounding population through a variety of exposure pathways. (See Chapter 4, Table 4-2.)

from background locations. Direct radiation on-site, at the perimeter of the site, in communities near the site, and at background locations is also monitored to provide additional data.

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

Air and Water Pathways

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

Surface water samples are collected from the tributaries of Cattaraugus Creek that flow through the Western New York Nuclear Service Center (WNYNSC) and from drainage channels within the Project site.

Both air and water 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.

Sampling Codes

The complete environmental monitoring schedule and maps are located in *Appendix A* (pp. A-i through A-53). 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 A* (p. A-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.

Air Sampler Location and Operation

Air samplers are located at points remote from the WVDP, at the perimeter of the site, and on the site itself. Figure 2-1 (p. 2-4) shows the locations of the on-site air effluent monitors and samplers and the on-site ambient air samplers; Figure 2-2 (p. 2-5) and Figure A-9 in *Appendix A* (p. A-53) show the locations of the perimeter and remote air samplers, respectively.

Air samples are collected by drawing air through a very fine filter with a vacuum pump. The total volume of air drawn through the filter is measured and recorded. The filter traps particles of dust that are then tested in the laboratory for radioactivity. At the Rock Springs Road, Great Valley, and New York State-licensed disposal area (SDA) ambient air locations samples are also collected for iodine-129 and tritium analyses. (A more detailed description of the air sampling program follows below.)

Water Sampler Location and Operation

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 and at a background station upstream of the site. (Grab samples are collected at several other surface water locations both on- and off-site.) Figure 2-3 (p. 2-6) shows the location of the on-site surface water monitoring points. (On-site automatic samplers operate at locations WNSP006, WNNADR, WNSW74A, and WNSWAMP.) Figure 2-4 (p. 2-7) shows the location of the off-site automatic surface water monitoring points. (Off-site locations are WFBCTCB, WFFELBR, and the background location, WFBCBKG.)

Water samplers draw water through a tube extending to an intake below the stream surface. An electronically controlled battery-powered pump first blows air through the sample line to clear any residual water or debris. The pump then reverses to collect a sample, reverses again to clear the line, then resets for the next sampling event. The cycle is repeated after a preset interval. The pump and sample container are housed in an insulated and heated shed to allow sampling throughout the year. (A more detailed description of the water sampling program follows below.)

Radiological Monitoring

Surface Water and Sediment Monitoring

On-site Surface Water Sampling

A map of on-site surface water sampling locations is found on Figure 2-3 (p. 2-6).

Low-level Waste Treatment Facility Sampling Location

The largest single source of radioactivity released to surface waters from the Project is the discharge from the low-level waste treatment facility through the lagoon 3 weir (WNSP001 on Fig. 2-3 [p. 2-6]) into Erdman Brook, a tributary of Frank's Creek. There were seven batch releases totaling about 50.6 million liters (13.4 million gal)

in 1996. In addition to composite samples collected near the beginning and end of each discharge, a total of fifty-five effluent grab samples, one for each day of discharge, were collected and analyzed.

The total amounts of radioactivity from specific radionuclides in the lagoon 3 effluent are listed in *Appendix C-1*, Table C-1.1 (p. C1-3). The observed annual average concentration of each radionuclide released is divided by its corresponding Department of Energy 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 B* [p. B-3].) As a DOE policy, the sum of the percentages calculated for all radionuclides released should not exceed 100%. In 1996 the annual average isotopic concentrations from the lagoon 3 effluent discharge weir combined to be approximately 35% of the DCGs, compared to about 43% in 1995. (See *Appendix C-1*, Table C-1.2 [p. C1-4].)

Variations in liquid effluent isotopic ratios continued to reflect the dynamic nature of the waste streams being processed through the low-level waste treatment facility (LLWTF) and of the process itself.

Frank's Creek Sampling Location

A water sampling station (WNSP006) is located on Frank's Creek where Project site drainage leaves the security-fenced area, more than 4.0 kilometers (2.5 mi.) from the nearest public access point. (See Fig. 2-3 [p. 2-6].) This sampler collects a 50-mL aliquot (a small volume of water) every half-hour. Samples are retrieved weekly and composited both monthly and quarterly. (Data are found in Table C-1.4 [p. C1-6].) Weekly samples are analyzed for tritium and gross alpha and beta radioactivity as well as pH and conductivity. The monthly composite is analyzed for strontium-90 and gamma-emitting isotopes. (See *Glossary*, "gamma isotopic.") A quarterly composite is ana-

lyzed for carbon-14, iodine-129, technetium-99, alpha-emitting radionuclides, and total uranium.

The most significant beta-emitting radionuclides at WNSP006 were cesium-137 at $3.48\text{E-}08$ $\mu\text{Ci/mL}$ (1.29 Bq/L) and strontium-90 at $3.61\text{E-}08$ $\mu\text{Ci/mL}$ (1.34 Bq/L) during the months of highest concentration. This corresponds to less than 1.2% of the DCG for cesium-137 and 3.6% of the DCG for strontium-90. The annual average concentration of cesium-137 at WNSP006 was less than 0.5% of the DCG, and the strontium-90 concentration was 2.2% of the strontium-90 DCG. Tritium, at an annual average of $8.17\text{E-}07$ $\mu\text{Ci/mL}$ ($3.05\text{E+}01$ Bq/L), was 0.04% of the DCG value. The annual gross alpha average was less than $1.26\text{E-}09$ $\mu\text{Ci/mL}$ ($4.66\text{E-}02$ Bq/L), or less than 4.2% of the DCG for americium-241. The 1996 data are comparable to 1995 data.

The ten-year trends of gross alpha, gross beta, and tritium concentrations at location WNSP006 are shown on Figure 2-5 (p. 2-8). The long-term trend plot for WNSP006 is dominated by fluctuations related to treated WVDP liquid effluent discharges into the creek. Concentrations observed farther downstream at the Felton Bridge sampling location, the first point of public access to surface waters leaving the WVDP site, continue to be nearly indistinguishable from background.

North Swamp and Northeast Swamp Sampling Locations

The north and northeast swamp drainages on the site's north plateau are two major channels collecting surface water and emergent groundwater. Samples from the north swamp drainage at location WNSW74A and from the northeast swamp drainage at sampling point WNSWAMP are collected from the automated sampler every week. (See Fig. 2-3 [p. 2-6].) Samples from both locations are analyzed weekly for gross alpha, gross beta, tritium, pH, and conductivity. Composites

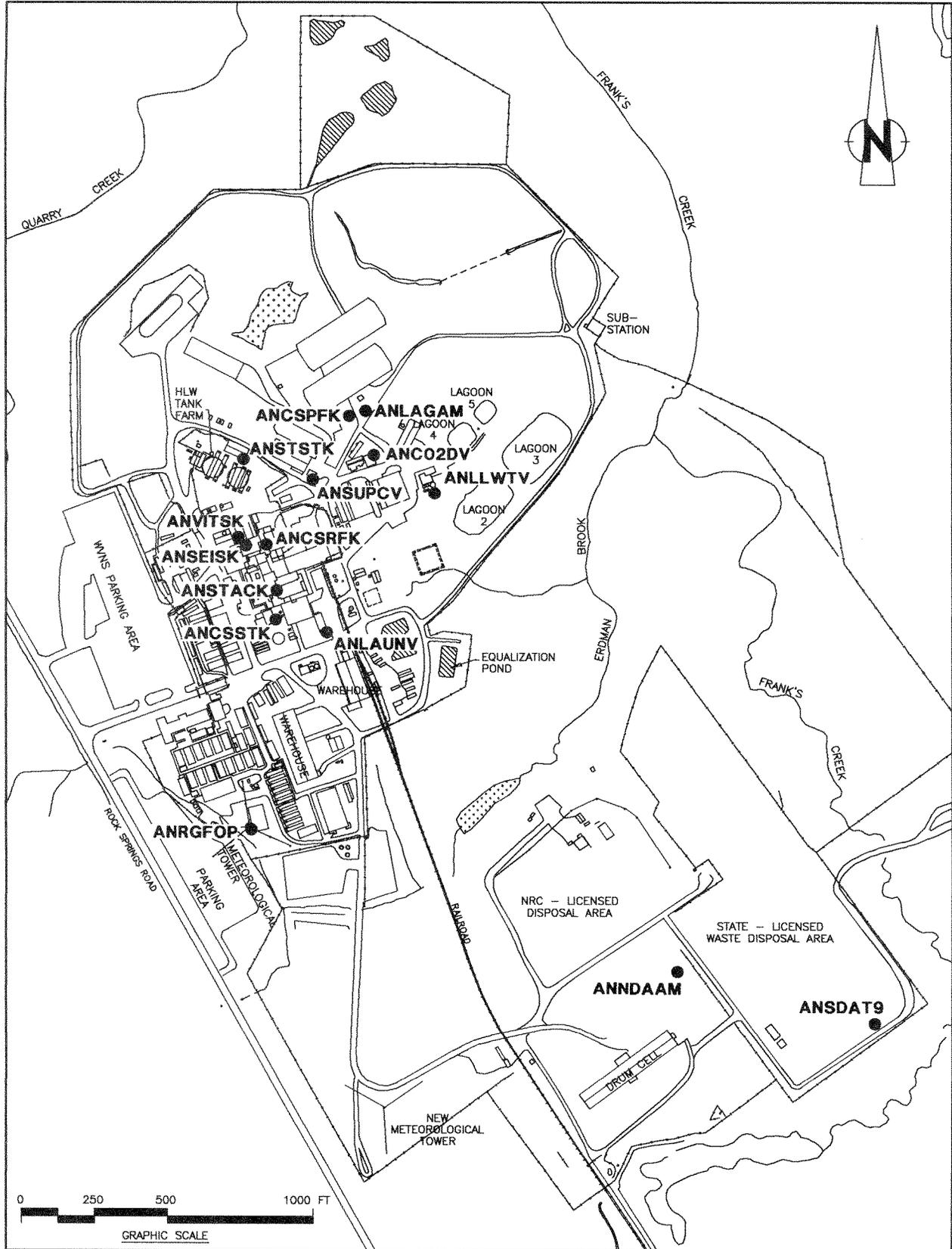


Figure 2-1. On-site Air Monitoring and Sampling Points.

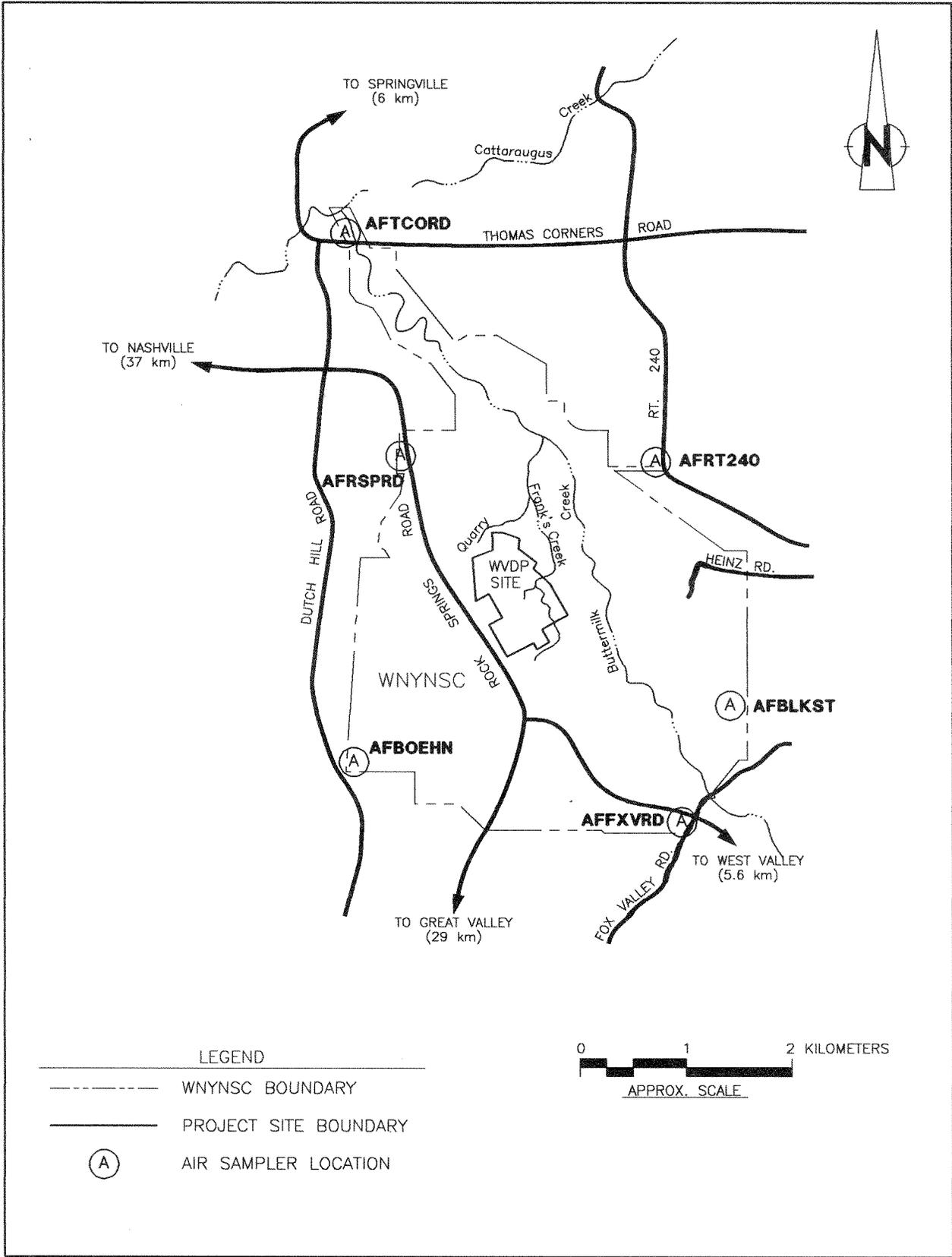


Figure 2-2. Location of Perimeter Air Samplers.

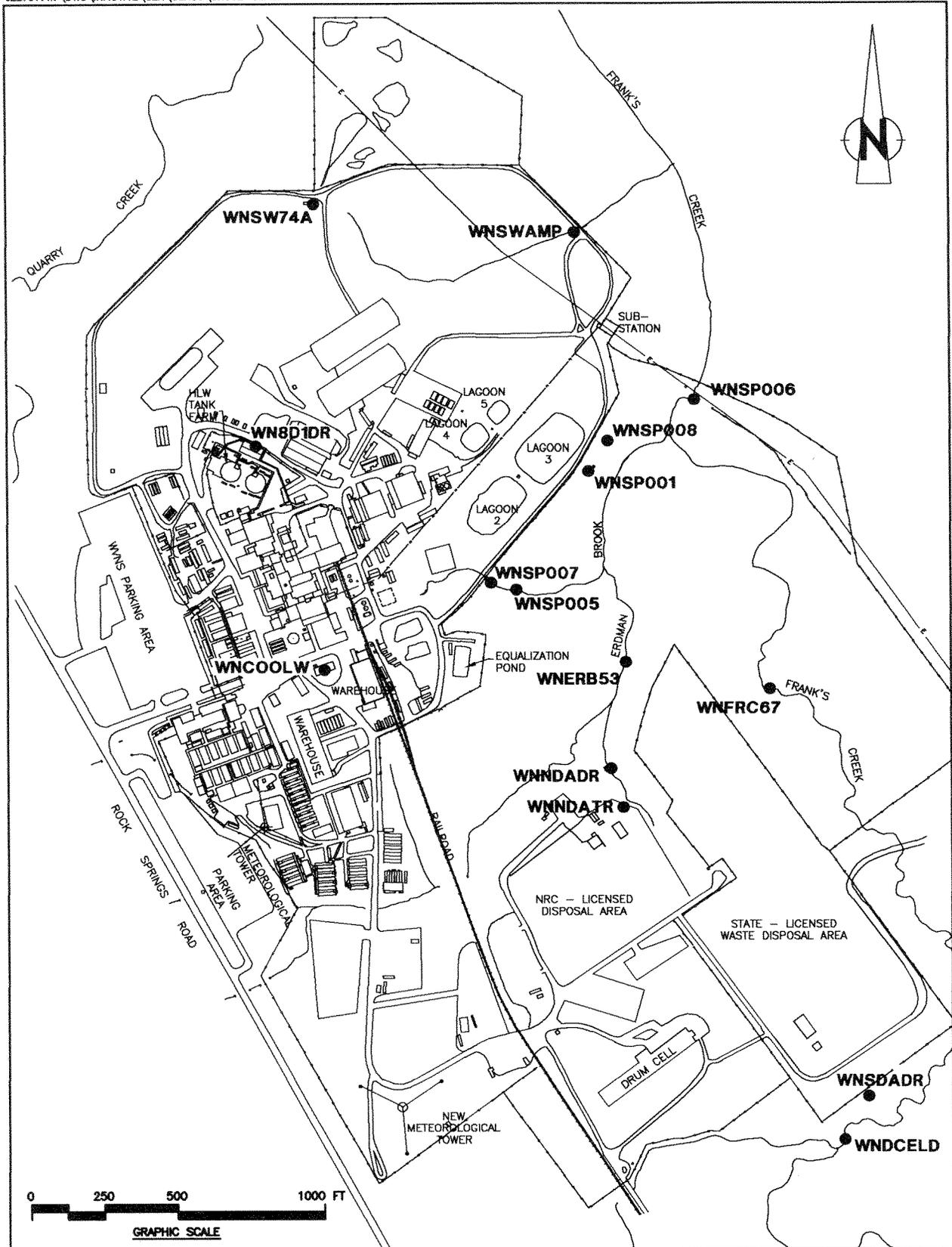


Figure 2-3. On-site Surface Water Sampling Locations.

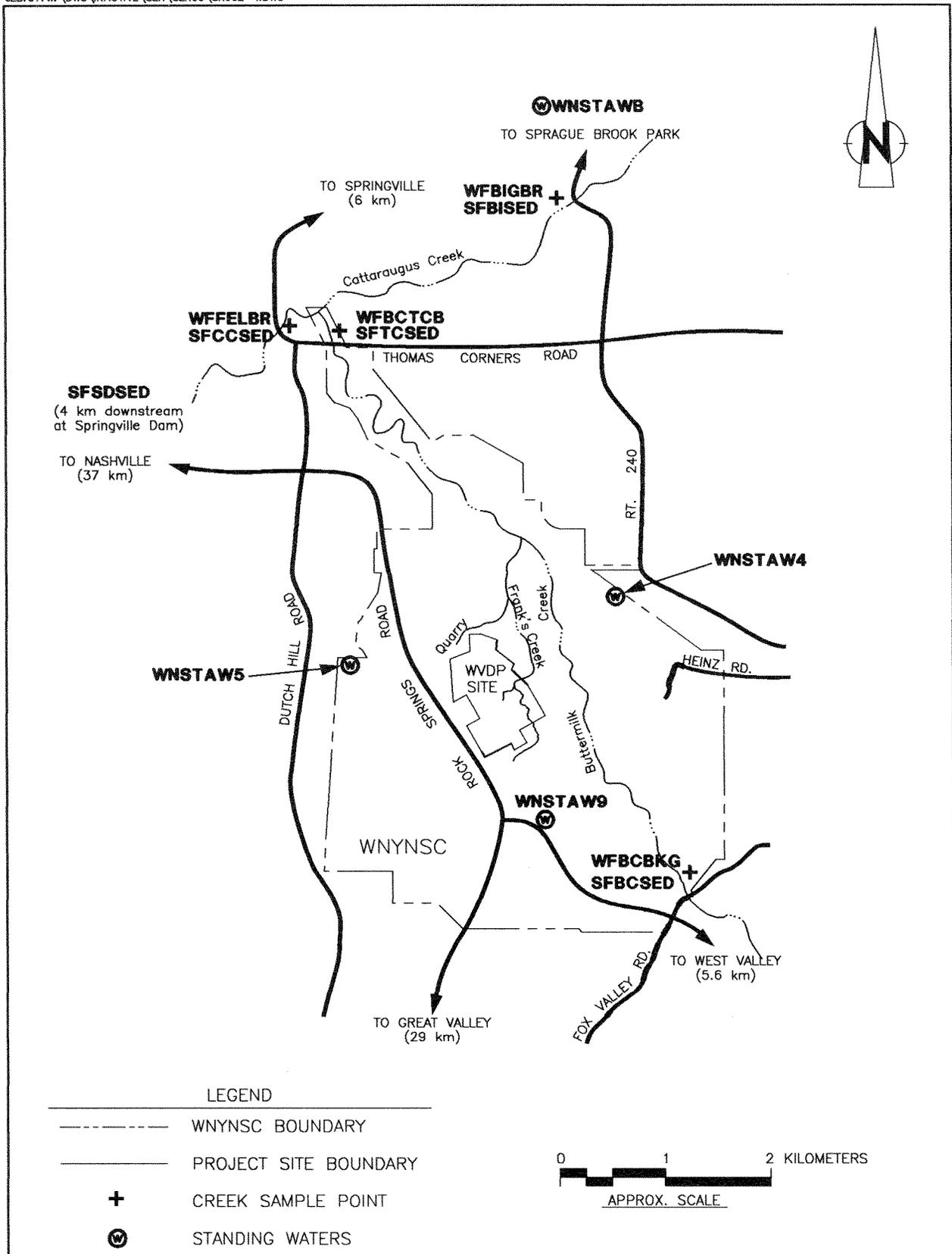


Figure 2-4. Off-site Surface Water and Sediment Sampling Locations.

of weekly samples are also analyzed for a full range of specific radionuclides. Semiannual grab samples from these locations are analyzed for additional chemical parameters.

Results for samples collected at location WNSW74A, which monitors drainage to Quarry Creek from the northern end of the Project premises, are summarized in *Appendix C-1*, Table C-1.8 (p. C1-9). The highest monthly strontium-90 result at WNSW74A was less than 1.6% of its DCG. The highest monthly tritium result at WNSW74A was only 0.006% of its DCG. Tritium at this location typically is below the detection limit.

Sampling point WNSWAMP also monitors surface water drainage from the site's north plateau. (See Tables 2-1 and 2-2 and *Appendix C-1*, Table C-1.7 [p.C1-8].) Waters from this drainage run into Frank's Creek downstream of location WNSP006. An upward trend in gross beta concentration from 1993 through 1996 at location WNSWAMP is discussed later in this chapter under **Special Monitoring, Northeast Swamp Drain-**

age Monitoring (p. 2-32). The average monthly tritium concentration at this location in 1996 was $2.57E-07 \mu\text{Ci/mL}$, which is above that observed at the background location WFBCBKG but below the $2E-03 \mu\text{Ci/mL}$ DCG for tritium.

Other Surface Water Sampling Locations

Sampling point WNSP005, which monitors drainage from the east side of the main plant, and WNFRC67, which monitors surface waters draining from the east side of the SDA, are both grab-sampled on a monthly basis. Samples are analyzed for pH, gross alpha, gross beta, and tritium.

Another sampling point, WN8D1DR, is at a storm sewer manhole access 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, were described in the 1993 and 1994 annual site environmental reports. Since July 1993 the access has been valved off from the original high-

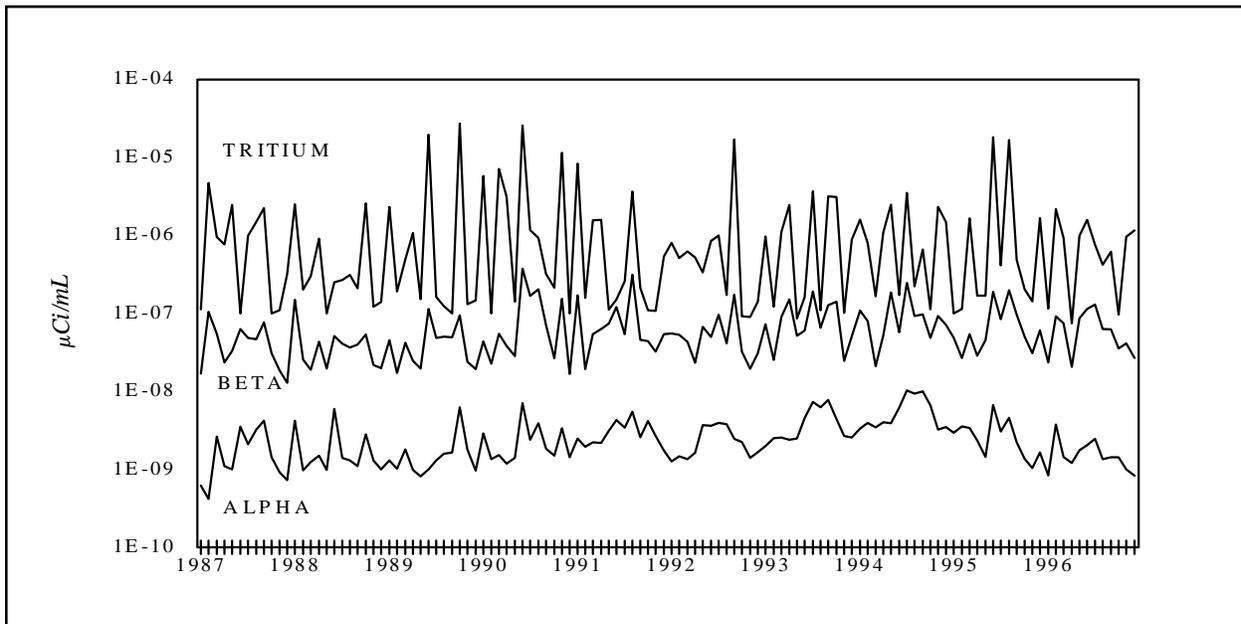


Figure 2-5. Ten-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNSP006

Table 2-1
1996 Gross Alpha Concentrations at Surface Water Sampling Locations

Location	Number of Samples	Range		Annual Average	
		($\mu\text{Ci/mL}$)	(Bq/L)	($\mu\text{Ci/mL}$)	(Bq/L)
OFF-SITE					
WFBIGBR	12	<5.66E-10 – 2.09E-09	<2.09E-02 – 7.74E-02	6.79±7.30E-10	2.51±2.70E-02
WFBCBKG	12	4.04E-10 – 2.48E-09	1.49E-02 – 9.18E-02	1.08±0.74E-09	3.99±2.73E-02
WFBCTCB	12	<4.64E-10 – 1.71E-09	<1.72E-02 – 6.33E-02	6.98±7.23E-10	2.58±2.67E-02
WFFELBR	52	5.41E-10 – 4.97E-09	2.00E-02 – 1.84E-01	1.12±1.00E-09	4.13±3.69E-02
ON-SITE					
WNNDADR	12	<1.10E-09 – 1.85E-09	<4.07E-02 – 6.85E-02	0.68±1.62E-09	2.52±5.99E-02
WNSWAMP	52	<7.90E-10 – 3.25E-09	<2.92E-02 – 1.20E-01	0.54 ±1.53E-09	2.00±5.65E-02
WNSW74A	52	<7.40E-10 – 4.54E-09	<2.74E-02 – 1.68E-01	0.48 ±1.38E-09	1.79±5.12E-02
WNSP006	52	<5.22E-10 – 1.19E-08	<1.93E-02 – 4.40E-01	1.23 ±1.26E-09	4.56±4.67E-02

Table 2-2
1996 Gross Beta Concentrations at Surface Water Sampling Locations

Location	Number of Samples	Range		Annual Average	
		($\mu\text{Ci/mL}$)	(Bq/L)	($\mu\text{Ci/mL}$)	(Bq/L)
OFF-SITE					
WFBIGBR	12	1.84E-09 – 4.14E-09	6.81E-02 – 1.53E-01	2.33±0.94E-09	8.61±3.47E-02
WFBCBKG	12	<1.31E-09 – 4.39E-09	<4.85E-02 – 1.62E-01	2.18±1.24E-09	8.07±4.59E-02
WFBCTCB	12	4.39E-09 – 1.44E-08	1.62E-01 – 5.33E-01	7.98±1.51E-09	2.95±0.56E-01
WFFELBR	52	<1.22E-09 – 2.62E-08	<4.51E-02 – 9.69E-01	3.75±1.48E-09	1.39±0.55E-01
ON-SITE					
WNNDADR	12	9.24E-08 – 2.09E-07	3.42E+00 – 7.73E+00	1.49±0.07E-07	5.51 ±0.25E+00
WNSWAMP	52	8.23E-07 – 4.80E-06	3.05E+01 – 1.78E+02	2.63±0.03E-06	9.75 ±0.10E+01
WNSW74A	52	7.54E-09 – 2.62E-08	2.79E-01 – 9.69E-01	1.37±0.25E-08	5.07 ±0.94E-01
WNSP006	52	1.38E-08 – 3.34E-07	5.11E-01 – 1.23E+01	6.43±0.46E-08	2.38 ±0.17E+00

level waste tank farm drainage area to prevent collected waters from draining freely to the surface. A sample is taken from the access point and is analyzed weekly for gross alpha and beta, tritium, and pH. A monthly composite is analyzed for gamma radionuclides and strontium-90. However, samples collected from this location are not thought to be indicative of either local groundwater or surface water conditions.

NDA Sampling Locations

The surface water drainage path downstream of the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) is monitored at location WNNADR using an automated sampler. Weekly samples are analyzed for tritium. Samples also are analyzed for nonpurgeable organic carbon (NPOC) and total organic halogens (TOX). Samples are composited and analyzed on a monthly basis for gross alpha, gross beta, tritium, and gamma-emitting radionuclides. Quarterly composites are analyzed for strontium-90 and iodine-129.

Gross beta concentrations at location WNNADR averaged $1.49\text{E-}07 \mu\text{Ci/mL}$ in 1996. (See Table 2-2 and Table C-1.19 [p. C1-15] in *Appendix C-1*.) Concentrations at this location were above the average measured at background location WFBCBKG but are all well below the DCG for strontium-90 in water ($1\text{E-}06 \mu\text{Ci/mL}$). In fact, the highest quarterly composite isotopic strontium-90 result was only 8.4% of its DCG. The overall trend for gross beta concentrations at this location has remained relatively constant or shown a slight decrease (Fig. 2-6). Except for seasonal variations, the same is true of tritium.

A key indicator of any possible migration of nonradiological organic contaminants from the NDA would be the presence of significant iodine-129 in samples from WNNADR. Iodine-129 is known to travel with the organic contaminants present in the NDA, but it is typically more soluble in water. In 1996 there were no positive detections of iodine-129 in water samples collected at this location. In addition, although NPOC and TOX

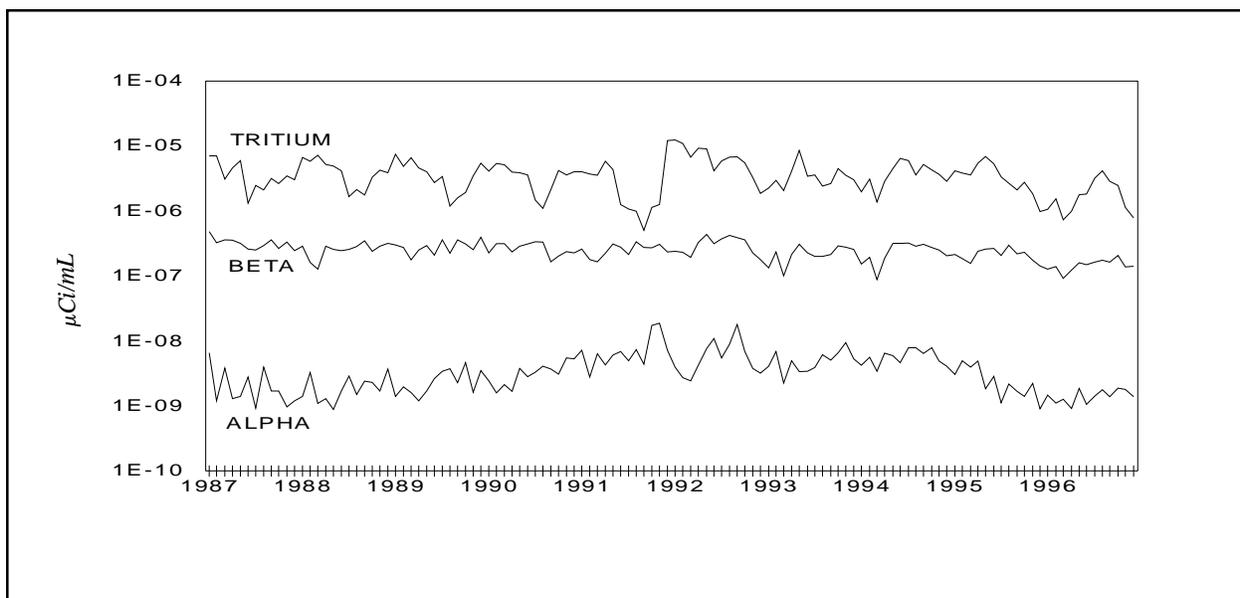


Figure 2-6. Ten-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNNADR

values are elevated slightly above background surface water (WFBCBKG) values, it is believed that NPOC and TOX values observed at WNNDADR reflect only seasonal variations.

Iodine-129 values obtained from waters collected from the NDA interceptor trench (WNNDATR), closer to the NDA, were all below the analytical detection limit as well. (See *Appendix C-1*, Table C-1.20 [p. C1-16].) It should be noted that while tritium activity in trench waters is generally higher than that measured at WNNDADR farther downstream, gross beta activity is actually higher downstream at WNNDADR than in waters from the interceptor trench. Residual contamination from past waste burial activities in soils outside the NDA are the likely source of gross beta activity in samples from WNNDADR.

Downstream of WNNDADR, on Erdman Brook and to the west of the SDA, is sampling point WNERB53. Weekly samples collected from this point are analyzed for pH, gross alpha, gross beta, and tritium. In addition to samples collected by the WVDP, independent samples are collected and analyzed by the New York State Department of Health (NYSDOH) at this location and at WNFRC67, which monitors waters draining from the east side of the SDA. Although radiological samples collected at WNERB53 and WNFRC67 do reflect, in some cases, historical waste disposal activities, none of the observed concentrations exceed or even approach the most conservative DCG.

Near-site Standing Pond Water

In addition to sampling water from flowing streams, samples from ponds and lakes within the retained premises (WNYNSC) also are collected. Tests for various radiological and water quality parameters are performed annually to verify that no major changes in standing water within the Project facility environs are occurring.

Four on-site ponds were tested in 1996; values for gross alpha, gross beta, and tritium were not significantly different from historical background values. The background samples are collected from a pond 14 kilometers (8.7 mi) north of the Project (WNSTAWB, Fig. 2-4 [p. 2-7]. See Table C-1.21 [p. C1-17].)

Off-site Surface Water Sampling

A map showing off-site surface water and sediment sample locations is found on Figure 2-4 (p. 2-7). Data from off-site sample points show that average gross beta radioactivity concentrations in Buttermilk Creek downstream of the WVDP site generally tend to be higher than concentrations upstream of the site, because small amounts of radioactivity from the site enter Buttermilk Creek via Frank's Creek. This is particularly observable during periods of lagoon 3 discharge. Tables 2-1 and 2-2 (p. 2-9) list the ranges and annual averages for gross alpha and gross beta activity at surface water locations. Additional information is available in the *Appendix C-1* tables for all off-site surface water monitoring locations.

Cattaraugus Creek at the Felton Bridge Sampling Location

An off-site sampler (WFFELBR) is located on Cattaraugus Creek at Felton Bridge just downstream of Cattaraugus Creek's confluence with Buttermilk Creek, which is the major surface drainage from the WNYNSC. (See Fig. 2-4 [p. 2-7].) The sampler collects a 50-mL aliquot from the creek every half-hour. 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. The weekly samples are analyzed for gross alpha, gross beta, tritium, and pH, and the sample composite is analyzed for gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides.

The highest concentrations in monthly composite water samples from Cattaraugus Creek during 1996 show strontium-90 to be only 0.5% of the DCG for strontium-90 in water. There were no positive detections of cesium-137 in Cattaraugus Creek during 1996. (See Table C-1.24 [p. C1-19].) Although gross beta levels at the Felton Bridge sampling location are elevated slightly during months of lagoon 3 discharge, overall, the yearly average gross beta activity for Cattaraugus Creek at Felton Bridge is nearly indistinguishable from background. Figure 2-7 shows the ten-year trends for Cattaraugus Creek samples analyzed for gross alpha, gross beta, and tritium. Note that for the most part, tritium concentrations represent method detection limits and not detected radioactivity. Gross beta activity appears to have remained constant at this location since 1987.

Fox Valley Road and Thomas Corners Bridge Sampling Locations

In addition to the Cattaraugus Creek sampler, two surface water monitoring stations are located on Buttermilk Creek, one upstream and one down-

stream of the WVDP. (See Fig. 2-4 [p. 2-7].) Samplers collect water from a background location upstream of the Project at Fox Valley Road (WFBCBKG) and from a location at Thomas Corners Road that is downstream of the plant and upstream of Buttermilk Creek's confluence with Cattaraugus Creek (WFBCTCB).

These samplers collect a 50-mL aliquot every half-hour. Samples are retrieved weekly and analyzed for pH and conductivity. Samples 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 composite samples from the Fox Valley Road location also are analyzed for carbon-14, iodine-129, technetium-99, alpha radionuclides, and total uranium. (Table C-1.22 [p. C1-18] shows monthly and quarterly radioactivity concentrations upstream of the site at Fox Valley; Table C-1.23 [p. C1-19] shows monthly and quarterly radioactivity concentrations downstream of the site at Thomas Corners.)

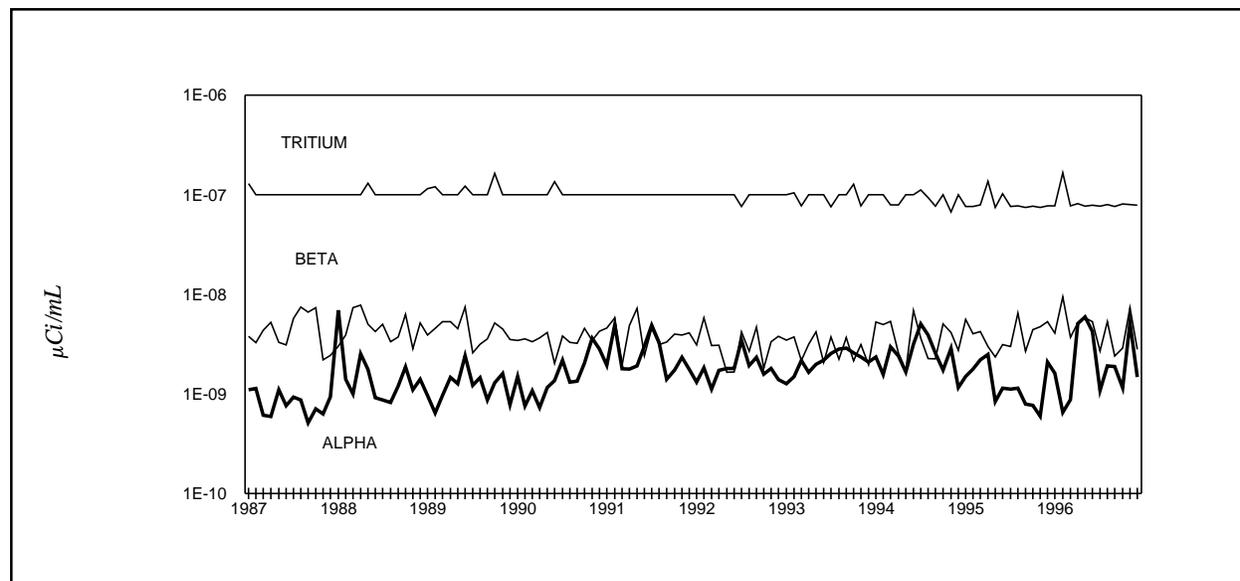


Figure 2-7. Ten-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WFFELBR

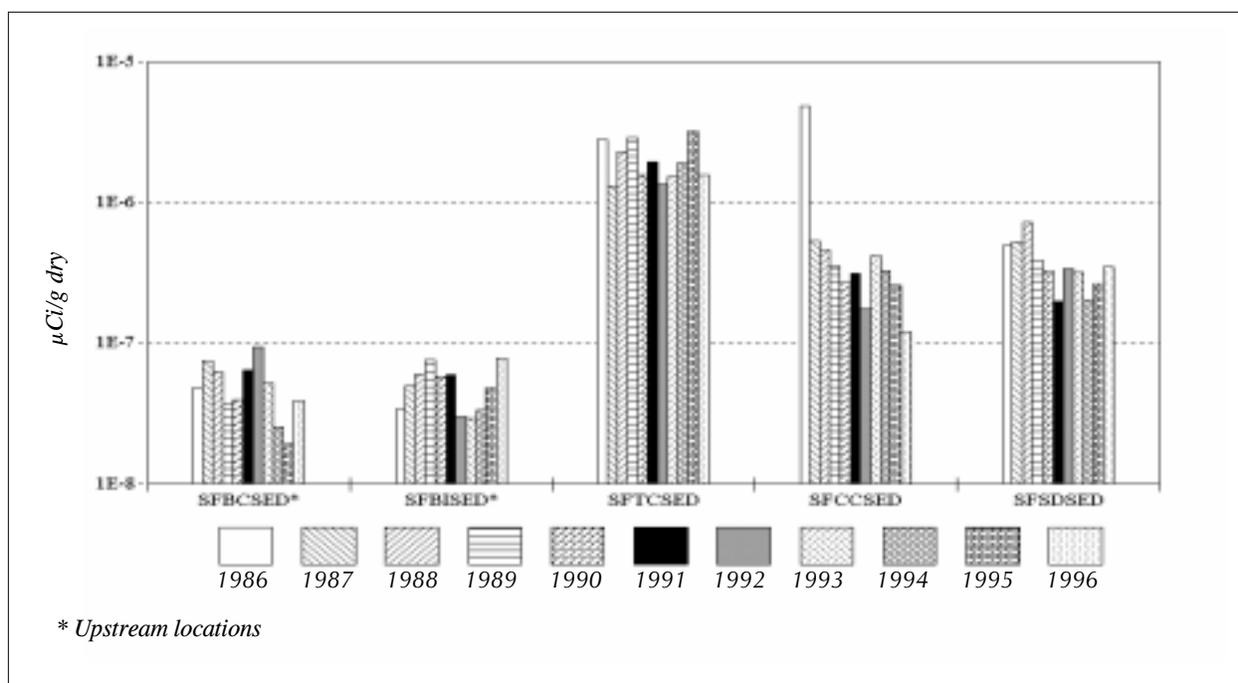


Figure 2-8. Eleven-Year Trends of Cesium-137 in Stream Sediment at Two Locations Upstream and Three Locations Downstream of the WVDP

The data from these locations show that tritium and gross beta concentrations downstream of the site are only marginally higher than background concentrations upstream of the site.

Because dairy cattle have access to waters at the Thomas Corners Bridge sampling point, this sample point represents an important link in the pathway to humans. In actuality, gross beta includes other radionuclides from naturally occurring sources as well as from manmade sources. If the maximum beta concentration in Buttermilk Creek downstream of the Project at Thomas Corners Bridge were, however, attributable entirely to strontium-90, then the radioactivity would represent only 1.4% of the DCG.

Sediment Sampling

A map showing sediment sampling locations is found on Figure 2-4 (p. 2-7). Sediments are grab-sampled annually at or near three of the automatic water sampling locations and at two additional points.

Downstream locations are Buttermilk Creek at Thomas Corners Road (SFTCSSED), Cattaraugus Creek at Felton Bridge (SFCCSED), and Cattaraugus Creek at the Springville dam (SFSDSED). Upstream background locations are Buttermilk Creek at Fox Valley Road (SFBCSED) and Cattaraugus Creek at Bigelow Bridge (SFBISED).

A comparison of annual averaged cesium-137 concentrations from 1986 through 1996 for these five sampling locations is illustrated in Figure 2-8. As reported in previous years, cesium-137 concentrations in sediments collected downstream of the WVDP are higher than those observed in samples collected from background locations (SFBCSED or SFBISED). As the figure indicates, concentrations appear to be staying constant with time at the downstream locations. While the cesium-137 activity in downstream Cattaraugus Creek sediments (at locations SFCCSED and SFSDSED) is elevated relative to upstream values, it is comparable to or less than historical background concentrations (as mea-

sured at SFGRVAL and SFNASHV) in surface soil in Western New York. (See *Appendix C-1*, Table C-1.30 [p.C1-23])

A comparison of cesium-137 to the naturally occurring gamma-emitter potassium-40 (Fig. 2-9) for the downstream location nearest the Project (Buttermilk Creek at Thomas Corners Road — SFTCSED) indicates that cesium-137 is present at levels lower than naturally occurring gamma emitters. Results of sediment sampling upstream and downstream of the Project are tabulated in *Appendix C-1*, Table C-1.31 (p. C1-24). When alpha isotopic results for background location SFBCSED are compared to those for SFTCSED, downstream of the site, no significant differences are observed.

Air Monitoring

On-site Ventilation Systems

Permits obtained from the U.S. Environmental Protection Agency (EPA) allow air with small amounts

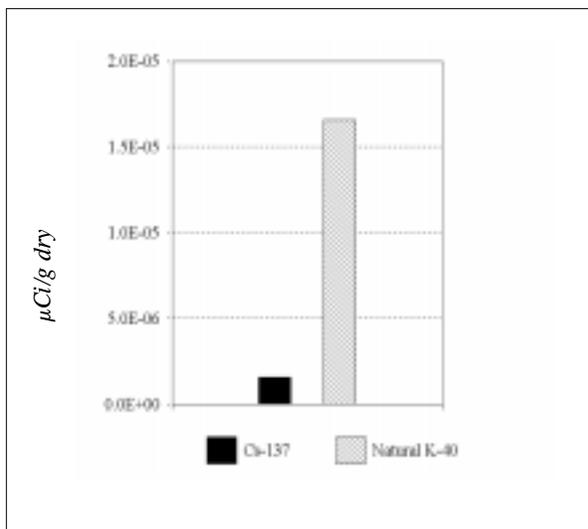


Figure 2-9. Comparison of Cesium - 137 with Naturally Occurring Potassium-40 Concentrations in 1996 at Downstream Sampling Location SFTCSED

of radioactivity to be released from plant ventilation stacks during normal operations. The air released must meet criteria specified in the NESHAP regulations to ensure that the environment and the public’s health and safety are not adversely affected. Dose-based comparisons of WVDP emissions against NESHAP criteria are presented in Chapter 4. Although generally less stringent than NESHAP criteria, DOE DCGs are more conducive to concentration-based comparisons and are used in this chapter for evaluating concentrations of radionuclides in WVDP emissions. Parameters measured include gross alpha and gross beta, tritium, and various radionuclides such as cesium-137 and strontium-90. 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. (DOE standards and DCGs for radionuclides of interest at the WVDP are found in *Appendix B* [p.B-3])

The exhaust from each permitted fixed ventilation system on-site is continuously filtered, monitored, and sampled as it is released to the atmosphere. Specially designed isokinetic sampling nozzles continuously remove a representative portion of the exhaust air, which is then drawn through very fine glass fiber filters to trap any particles. Sensitive detectors continuously monitor the radioactivity on these filters and provide readouts of alpha and beta radioactivity levels.

A separate sampling unit on the ventilation stack of the permitted systems contains another filter that is removed every week and tested in the laboratory. This sampling system also may contain an activated carbon cartridge used to collect a sample that is analyzed for iodine-129. Iodine-129 is not detected in measurements of gross alpha and gross beta on the particulate matter captured on the glass fiber filter.

In addition to these samples, water vapor from the main plant ventilation stack (ANSTACK) and the supernatant treatment system (ANSTSTK) is collected by trapping moisture in silica gel desiccant columns. The trapped water is distilled from the silica gel desiccant and analyzed for tritium.

Because tritium, iodine, and other isotopic concentrations are quite low, the large-volume samples collected weekly from the main plant stack and from other emission-point samplers provide the only practical means of determining the amount of specific radionuclides released from the facility. In addition to scheduled sampling and analysis of ANSTACK filters for those parameters defined in *Appendix A* of this report, filters are routinely analyzed for strontium-89 and cesium-137 as part of operational monitoring.

The Main Plant Ventilation Stack

Figure 2-1 (p. 2-4) shows the locations of on-site air monitoring and sampling points.

The main ventilation stack is potentially the greatest contributor to airborne releases. The main stack sampling system collects a continuous air sample

from this emission point. A high sample-collection flow rate through multiple intake nozzles ensures a representative sample for both the weekly sample and the on-line monitoring system. The total quantity of gross alpha, gross beta, and tritium released each month from the main stack, based on weekly measurements, is shown in *Appendix C-2*, Table C-2.1 (p. C2-3).

Figure 2-10 shows the ten-year trends in main stack samples analyzed for gross alpha and gross beta activity. The figure indicates a steady five-year downward trend in activity observed for both gross alpha and gross beta from 1987 to mid-1992. From mid-1992 throughout mid-1995 both gross alpha and beta activities rose slightly and then leveled off. During the third and fourth quarters of 1995, concentrations of gross alpha, gross beta, and gamma-emitting radionuclides in ventilated air increased because of transfers of cesium-loaded zeolite from waste tank 8D-1 to 8D-2.

During the first two quarters of 1996 the concentrations returned to levels observed before the zeolite transfer period. As expected, increases were observed during the third and fourth quarters of the year, coinciding with the start-up of high-level waste vitrification.

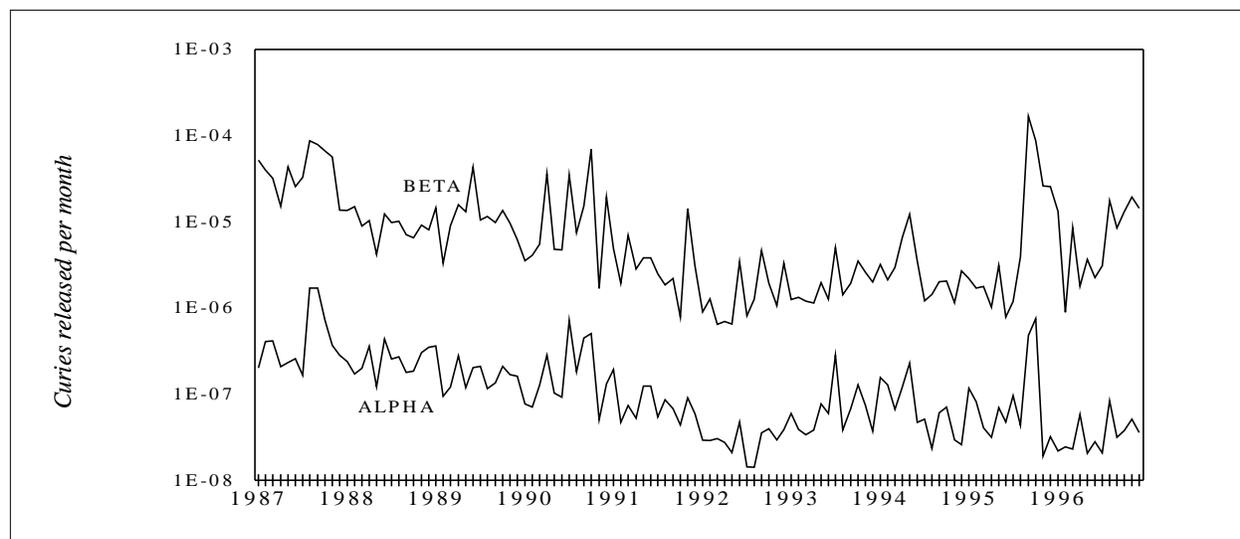


Figure 2-10. Ten-Year Trends of Gross Alpha and Gross Beta Activity at the Main Stack Sampling Location (ANSTACK)

A comparison of airborne radioactivity concentrations released from the main plant ventilation in 1996 with the DOE DCGs in Table C-2.2 (p. C2-4) indicates that at the point of stack discharge, average radioactivity levels were already below concentration guidelines for airborne radioactivity in an unrestricted environment. Airborne concentrations from the stack to the site boundary are further reduced by dilution by an average factor of about 200,000. Samples from ambient air perimeter monitors at the site boundary confirm that site operations had no discernible effect on air quality at these perimeter locations.

Vitrification Facility Sampling System

In November 1995 new sampling and monitoring equipment was brought on-line to monitor emissions from the vitrification heating, ventilation, and air conditioning (HVAC) system. The primary sampling point — ANVITSK — and the seismically protected backup sample point — ANSEISK — monitor ventilation releases from the facility. The vitrification off-gas ventilation is emitted through the main plant stack. Air exhausted to the environment is monitored for radioactivity. Results gathered before July 1996 (Tables C-2.3 and C-2.4 [pp. C2-5 and C2-6]) represent initial pre-vitrification baseline or background levels. Data obtained from July 1996 through the end of 1996 were collected during actual operation of the vitrification facility. A comparison of the two sets of data show almost no discernible difference in concentrations in emissions from this facility.

Other On-site Sampling Systems

Sampling systems similar to those of the main stack monitor airborne effluents from the 01-14 building (formerly housing the cement solidification system ventilation stack [ANCSSTK]), the contact size-reduction facility ventilation stack

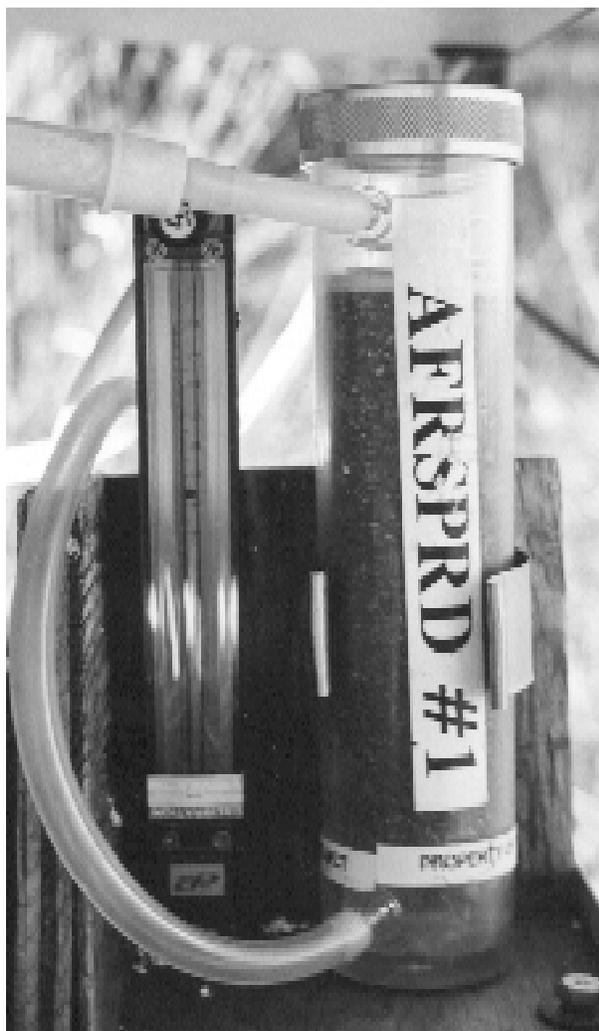
[ANCSRFK], and the supernatant treatment system ventilation stack [ANSTSTK]).

A temporary monitoring system was brought on-line at the container sorting and packaging facility ventilation stack (ANCSPFK) in March 1996. The container sorting and packaging facility (CSPF) is a self-contained room within lag storage area #4. Containers of radioactively contaminated materials are opened and hand-sorted in the CSPF before compaction and storage or decontamination. (Durable items such as metal piping can be reused after decontamination.) The CSPF is constantly ventilated during use. The temporary stack monitoring system operated from March 1996 to March 1997 while a permanent system was being designed and installed. The permanent system was brought on-line in March 1997.

The 1996 samples from ANCSSTK, ANCSRFK, ANSTSTK, and ANCSPFK showed detectable gross radioactivity in some cases as well as specific beta- and alpha-emitting radionuclides, but did not approach any Department of Energy effluent limitations. Tables C-2.5 through C-2.8 (pp. C2-7 through C2-10) show monthly totals of gross alpha and beta radioactivity and quarterly total radioactivity released for specific radionuclides for each of these sampling locations.

In addition, a temporary demonstration decontamination facility using carbon dioxide (CO₂) cleaning technology was brought on-site in 1996 and operated during the last two weeks of the year. Results of sampling from that facility in 1996 are included in Table C-2.15 (p. C2-16).

Three other operations are routinely monitored for airborne radioactive releases: the supercompactor volume-reduction ventilation system (ANSUPCV), the low-level waste treatment facility ventilation system (ANLLWTVH), and the contaminated clothing laundry ventilation system (ANLAUNV).



Silica Gel Column from the Rock Springs Road Ambient Air Sampler

The supercompactor ventilation (ANSUPCV) did not operate in 1996. Routine supercompactor system operation was curtailed in April 1994 because of reduced operational needs.

The low-level waste treatment facility ventilation system and the contaminated clothing laundry ventilation system are sampled for gross alpha and

gross beta radioactivity. Data for these two facilities are presented in Tables C-2.9 and C-2.10 (pp. C2-11 and C2-12). These emission points are not permitted because the potential magnitude of the emissions is so low. Although only semi-annual sampling is required to verify the low emissions, the laundry emissions were sampled every week and the low-level waste treatment facility emissions were sampled from May through December.

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.

In 1996 average discharges at the point of release from portable outdoor ventilation units were well below DOE guidelines for alpha and beta radioactivity in an unrestricted environment. Dilution from the point of release to the site boundary would further reduce these concentrations.

In February 1995 ambient air monitors were installed near the lag storage area (ANLAGAM) and near the NDA (ANNDAAM). The 1996 monitoring data are presented in *Appendix C-2*, Tables C-2.11 and C-2.12 (pp. C2-13 and C2-14).

An ambient air sampler (ANSDAT9) monitors potential diffuse releases of radioactivity associated with the SDA, which is managed by the New York State Energy and Research Development Authority (NYSERDA). The ANSDAT9 sampler could also detect site-wide releases to ambient air. Radiological results for this location are all either below analytical detection limits or are no different

statistically than those observed at the background air monitoring location AFGRVAL. Results of this monitoring are presented in *Appendix C-2*, Table C-2.13 (p.C2-15).

Perimeter and Remote Air Sampling

Maps of perimeter and remote air sampling locations may be found on Figure 2-2 (p. 2-5) and Figure A-9 (p. A-53).

As in previous years, airborne particulate samples for radiological analysis were collected continuously at six locations around the perimeter of the site and at four remote locations at Great Valley, West Valley, Springville, and Nashville, New York. Perimeter locations — on Fox Valley Road, Rock Springs Road, Route 240, Thomas Corners Road, Dutch Hill Road, and at the site’s bulk storage warehouse — were chosen to provide historical continuity or because the location would best represent the highest potential off-site airborne concentration of radioactivity. The ten-year trends of gross alpha and gross beta concentrations at the Rock Springs Road location are shown in Figure 2-11. The remote

locations provide data from nearby communities — West Valley and Springville — and from more distant background areas. Concentrations measured at Great Valley (AFGRVAL, 29 km south of the site) and Nashville (AFNASHV, 37 km west of the site in the town of Hanover) are considered representative of regional natural background radiation.

The six perimeter samplers and the four remote samplers maintain an average flow of about 40 L/min (1.4 ft³/min) through a 47-millimeter glass fiber filter. The sampler heads for each of the locations are set at 1.7 meters above the ground, the height of the average human breathing zone. Filters from off-site and perimeter samplers are collected weekly and analyzed after a seven-day “decay” period to remove interference from short-lived naturally occurring radionuclides.

Gross alpha and gross beta measurements of each filter are made weekly using a low-background gas proportional counter. The gross alpha and gross beta ranges and annual averages for each of the ambient sampling points are provided in Tables 2-3 and 2-4. The 1996 concentration ranges are similar to those

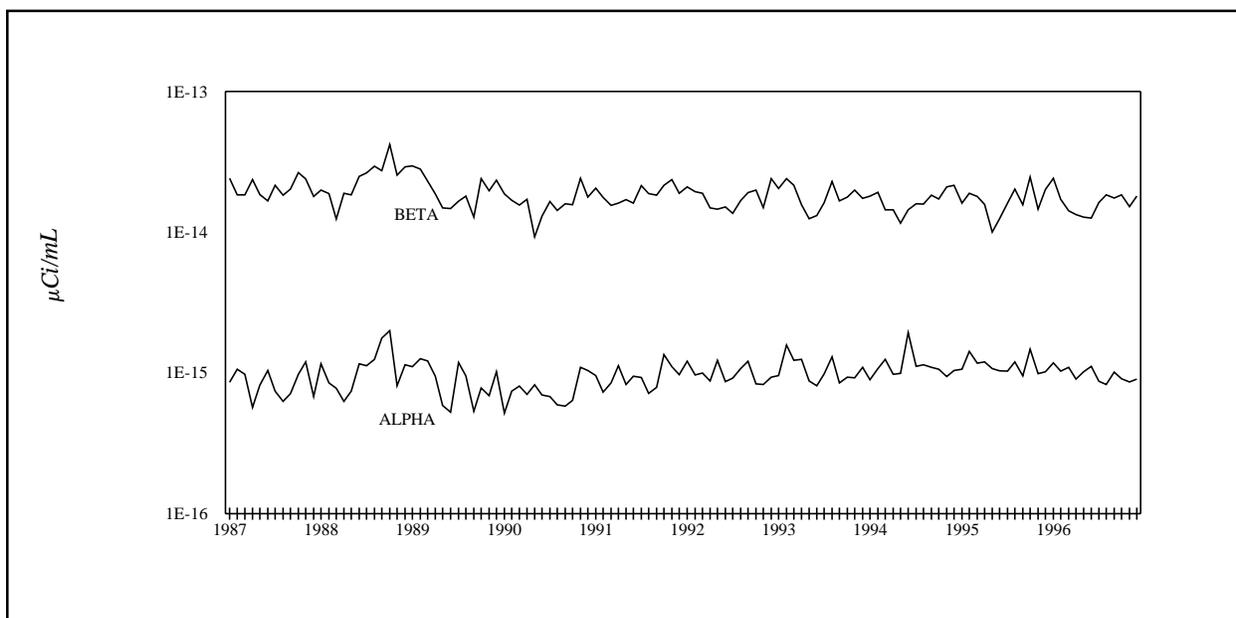


Figure 2-11. Ten-Year Trends of Gross Alpha and Gross Beta Concentrations at the Rock Springs Road Sampling Location (AFRSPRD)

Table 2-3**1996 Gross Alpha Concentrations at Off-Site, Perimeter, and On-site Ambient Air Sampling Locations**

Location	Number of Samples	Range		Annual Average	
		($\mu\text{Ci/mL}$)	(Bq/m^3)	($\mu\text{Ci/mL}$)	(Bq/m^3)
AFFXVRD	52	<4.94E-16 – 2.67E-15	<1.83E-05 – 9.88E-05	0.87±1.01E-15	3.21±3.73E-05
AFRSPRD	52	<6.02E-16 – 3.65E-15	<2.23E-05 – 1.35E-04	7.48±9.81E-16	2.77±3.63E-05
AFRT240	52	<4.83E-16 – 3.02E-15	<1.79E-05 – 1.12E-04	0.98±1.04E-15	3.63±3.86E-05
AFSPRVL	52	<6.06E-16 – 1.90E-15	<2.24E-05 – 7.03E-05	6.60±9.58E-16	2.44±3.55E-05
AFTCORD	52	<5.52E-16 – 3.40E-15	<2.04E-05 – 1.26E-04	7.98±9.92E-16	2.95±3.67E-05
AFWEVAL	52	<6.50E-16 – 2.40E-15	<2.41E-05 – 8.88E-05	0.95±1.13E-15	3.53±4.18E-05
AFGRVAL	52	<5.42E-16 – 2.16E-15	<2.01E-05 – 7.99E-05	7.45±9.72E-16	2.76±3.60E-05
AFBOEHN	52	<7.01E-16 – 2.94E-15	<2.59E-05 – 1.09E-04	0.92±1.03E-15	3.42±3.81E-05
AFNASHV	52	<6.48E-16 – 2.79E-15	<2.40E-05 – 1.03E-04	8.07±9.93E-16	2.99±3.67E-05
AFBLKST	52	<4.90E-16 – 4.22E-15	<1.81E-05 – 1.56E-04	8.22±9.83E-16	3.04±3.64E-05
ANLAGAM	52	<3.81E-16 – 1.97E-15	<1.41E-05 – 7.29E-05	7.60±8.93E-16	2.81±3.30E-05
ANNDAAAM*	51	<4.63E-16 – 2.26E-15	<1.71E-05 – 8.36E-05	8.91±7.77E-16	3.30±2.87E-05

Table 2-4**1996 Gross Beta Concentrations at Off-Site, Perimeter, and On-Site Ambient Air Sampling Locations**

Location	Number of Samples	Range		Annual Average	
		($\mu\text{Ci/mL}$)	(Bq/m^3)	($\mu\text{Ci/mL}$)	(Bq/m^3)
AFFXVRD	52	9.93E-15 – 3.93E-14	3.67E-04 – 1.45E-03	1.82±0.34E-14	6.75±1.25E-04
AFRSPRD	52	8.76E-15 – 3.69E-14	3.24E-04 – 1.37E-03	1.64±0.33E-14	6.07±1.21E-04
AFRT240	52	1.05E-14 – 3.86E-14	3.89E-04 – 1.43E-03	1.87±0.34E-14	6.91±1.27E-04
AFSPRVL	52	7.46E-15 – 2.70E-14	2.76E-04 – 9.99E-04	1.47±0.32E-14	5.45±1.18E-04
AFTCORD	52	9.72E-15 – 3.38E-14	3.60E-04 – 1.25E-03	1.67±0.33E-14	6.17±1.21E-04
AFWEVAL	52	7.66E-15 – 3.53E-14	2.83E-04 – 1.31E-03	1.80±0.35E-14	6.64±1.31E-04
AFGRVAL	52	9.28E-15 – 3.57E-14	3.43E-04 – 1.32E-03	1.65±0.32E-14	6.10±1.20E-04
AFBOEHN	52	1.08E-14 – 3.32E-14	4.00E-04 – 1.23E-03	2.01±0.35E-14	7.45±1.30E-04
AFNASHV	52	8.68E-15 – 3.79E-14	3.21E-04 – 1.40E-03	1.81±0.34E-14	6.69±1.25E-04
AFBLKST	52	8.29E-15 – 3.25E-14	3.07E-04 – 1.20E-03	1.66±0.32E-14	6.16±1.20E-04
ANLAGAM	52	1.46E-15 – 3.94E-14	5.40E-05 – 1.46E-03	1.64±0.31E-14	6.08±1.16E-04
ANNDAAAM*	51	<1.70E-15 – 3.23E-14	<6.29E-05 – 1.20E-03	1.65±0.26E-14	6.11±0.96E-04

* Any sample deemed unreliable during the data validation process is not included here.

Global Fallout Sampling

Global fallout is sampled at four of the perimeter air sampler locations and at the base of the original on-site meteorological tower. Precipitation from all of the locations is collected and analyzed every month. Monthly gross alpha and gross beta results from these measurements are reported in nCi/m² and tritium results are reported in μCi/mL. (The 1996 data from these analyses and precipitation pH measurement data are found in Appendix C-2, Tables C-2.26 and C-2.27 [pp. C2-24 and C2-25]).

Fallout pot data indicate short-term effects. Long-term deposition is measured by surface soil samples collected annually near each air sampling station. Soil sample data are found in Table C-1.30 [p. C1-23] of Appendix C-1.

measured in 1995. Near-site sample concentrations are indistinguishable from background, and all reflect normal seasonal variations.

In addition, quarterly composites, which consist of filters collected each week for thirteen weeks from each sample station, are analyzed. Data from these samplers are provided in Appendix C-2, Tables C-2.16 through C-2.25 (pp. C2-17 to C2-23). Although tritium (as hydrogen-tritium oxide [HTO]) was positively detected on a number of occasions at the Rock Springs Road location near the site, those concentrations were the same as positive concentrations observed at the Great Valley background location. A single strontium-90 value statistically above values observed at background air sampling stations (AFNASHV and AFGRVAL) was observed at Rock Springs Road during the third quarter of 1996. It is believed that this value is a laboratory anomaly: it did not continue into the fourth quarter; it was not accompanied by an increase in other radio-

nuclides measured at the same location; and there was no increase in airborne radioactive emissions of sufficient magnitude at any on-site effluent monitoring location to explain it.

The gross beta concentrations in air data for the three samplers that have been in operation since before 1982 — Fox Valley, Thomas Corners, and Route 240 — averaged about 1.77E-14 μCi/mL (6.56E-04 Bq/m³) in 1995, and in 1996 averaged 1.79E-14 μCi/mL (6.62E-04 Bq/m³). The average gross beta concentration at the two background sampling locations — Great Valley and Nashville — was 1.73E-14 μCi/mL (6.40E-04 Bq/m³) in 1996.

Off-site Surface Soil Sampling

Maps of off-site surface soil sampling locations may be found on Figures A-6 and A-9 (pp.A-50 and A-53).

Soil from the upper two inches of the ground near the perimeter air samplers is collected annually to measure the radioactivity deposited by worldwide fallout. Samples were collected in 1996 from ten locations: six points on the perimeter of the retained premises (WNYNSC), two in nearby communities, and two in locations 30 to 50 kilometers distant from the Project. Analyses for cesium-137, strontium-90, plutonium-239/240, and americium-241 at all ten locations and analyses for uranium radionuclides at three points were compared among the sample locations.

The measured concentrations are typical of normal background concentrations in the region, with two exceptions: Soil from the Rock Springs Road air sampler location has consistently shown a higher-than-background cesium-137 concentration. This sampler is known to be within an extended area of elevated cesium activity that was identified by a 1979 survey, well before the Project was initiated. Strontium-90 data for the Rock Springs Road and Route 240 sampling points

seemed to be elevated in 1996 in comparison with previous years and with other perimeter and background locations. Repeat analyses of these samples suggested that the original high values may be the result of analytical uncertainties. In addition, these results were not accompanied by air effluent releases of significant magnitude to explain them.

The 1996 results (Table C-1.30 [p. C1-23]) show that detectable concentrations of strontium-90, cesium-137 (both present in worldwide fallout), cobalt-60, and manmade alpha-emitting radionuclides were generally within the same range of uncertainty as background samples. The slightly higher cesium-137 result remained within the range observed at background locations during the past six years.

Radioactivity in the Food Chain

Maps showing biological sampling points are found on Figures 2-12 (p. 2-22) and A-9 (p.A-53).

Each year food samples are collected from locations near the site and from remote locations

(Fig. 2-12). Fish and deer are collected during periods when they would normally be taken by sportsmen for consumption. In addition, milk is collected monthly and beef semiannually from cows that graze near the site and at remote locations. Hay, corn, apples, and beans are collected at the time of harvest.

Fish

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

Twenty fish samples are collected every year (ten semiannually) above the Springville dam from the portion of Cattaraugus Creek that is downstream of WNYNSC drainage (BFFCATC). Ten fish samples also are collected annually from Cattaraugus

Creek below the dam (BFFCATD), including species that migrate nearly forty miles upstream from Lake Erie. These specimens are representative of sport fishing catches in the creek downstream of the Springville dam.

Twenty control fish are taken every year (ten semiannually) from waters that are not influenced by site runoff (BFFCTRL). These



Electrofishing in Cattaraugus Creek

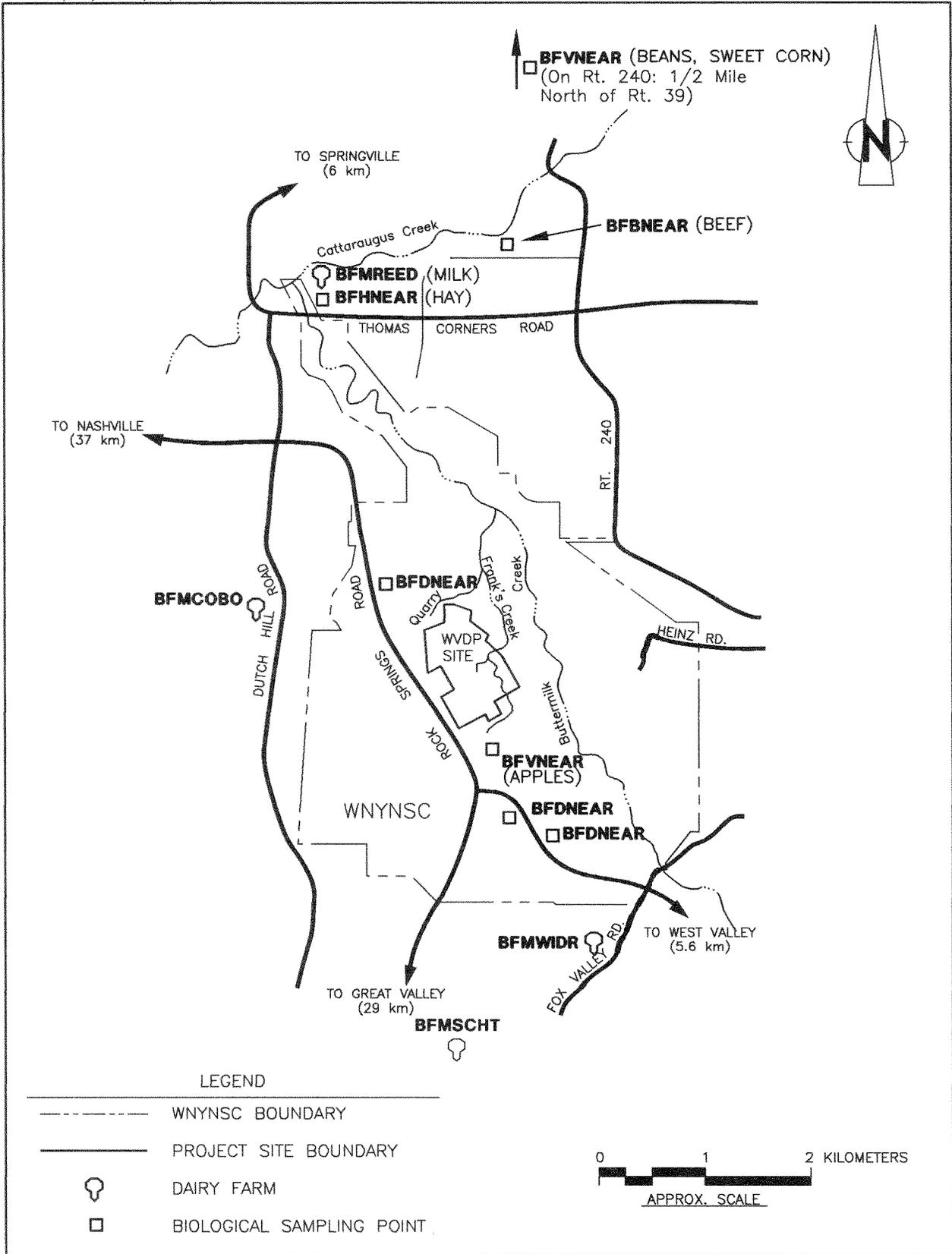


Figure 2-12. Near-site Biological Sampling Points.



Springville Dam on Cattaraugus Creek

control samples, containing no radioactivity from WVDP effluents, allow comparisons with the concentrations found in fish taken from site-influenced waters. The control samples are representative of the species collected in Cattaraugus Creek downstream from the WVDP. A combined total of fifty fish were collected from these locations.

The edible portion of each individual fish was analyzed for strontium-90 content and the gamma-emitting radionuclides cesium-134 and cesium-137. (See Table C-3.4 [p.C3-6] in *Appendix C-3* for a summary of the results.) Throughout the year concentrations of strontium-90 ranged from below the minimum detectable concentration (see *Glossary*) to a maximum of $7.93 \text{ E-}08 \text{ } \mu\text{Ci/g}$ at BFFCATC and from below the minimum detectable concentration to $1.56 \text{ E-}08 \text{ } \mu\text{Ci/g}$ at the control location (BFFCTRL). In both locations

bottom-feeding fish tended to contain higher detectable activity, while sport fish such as trout did not. These levels are very similar to the levels observed in fish collected during 1995. All downstream fish concentrations are within the range of historical Project background values. The dose value from the consumption of fish is discussed in *Chapter 4, Radiological Dose Assessment*, p. 4-9.

Only three fish collected downstream of the site showed marginally positive detections for cesium-137. These cesium -137 concentrations were all within the range of those measured at the background location.

One downstream fish sample showed a positive detection of cesium-134 but this was not statistically different from concentrations in background fish.

Venison

Specimens from an on-site deer herd also are analyzed for radioactive components. Historically, concentrations of radioactivity in deer flesh have been very low and Project activities have not been shown to affect the local herd.

For the third 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 the New York State Energy Research and Development Authority (NYSERDA). Of the 149 deer collected during this program, forty were antlered and 109 were antlerless.

Venison from three deer salvaged from vehicle-deer accidents around the WNYNSC was analyzed and the data compared to that from deer collected far from the site in the towns of Franklinville and Portville, New York. Low levels of radioactivity from cesium-137 and naturally occurring potassium-40 were detected in both near-site and control samples. Results for these samples are shown in Table C-3.2 (p.C3-4) in *Appendix C-3*.

Concentrations in near-site deer were at or below background levels for those radionuclides in 1996. The range in concentrations observed was similar to previous years. Cesium-134 was not detected in any near-site or control deer during 1996.

Tritium concentrations in near-site deer were elevated compared to previous years. However, the presence of elevated tritium concentrations in both near-site and control deer samples may be indicative of a laboratory analysis problem.

There was one positive detection of strontium-90 in near-site deer in 1996, although the value observed was still within the range of historical control values. Even if all isotopic analysis re-

sults were used as is to assess the dose to the maximally exposed individual, this dose would still be small in comparison to that received on a yearly basis from natural background radiation. (See **Environmental Media Concentrations, Venison**, in Chapter 4 [p. 4-10].)

Beef

In 1996, as in previous years, very little difference in isotopic concentration was observed between near-site and control herds. Beef samples taken semiannually from near-site and remote locations were analyzed for tritium, strontium-90, and gamma-emitting radionuclides such as cesium-134 and cesium-137.

In 1996 there was one marginally positive detection for strontium-90 in a control beef sample. There were no positive detections of strontium-90 in near-site beef. Results for all near-site and control samples were below the minimum detectable concentrations for cesium-134. There was one positive detection of tritium in a near-site beef sample, although the value obtained is close to the method detection limit. Two positive cesium-137 results were obtained, one from a control sample and one from a near-site sample. Both values overlap statistically. These results are presented in Table C-3.2 (p.C3-4) in *Appendix C-3*.

Milk

Monthly milk samples were taken in 1996 from dairy farms near the site and from control farms at some distance from the site. (See Fig. 2-12 [p. 2-22].) Quarterly composites of monthly samples from the maximally exposed herd to the north (BFMREED) and from a nearby herd to the northwest (BFMCOBO) were prepared. Single annual samples were taken from herds near the WVDP to the southeast (BFMWIDR) and the south (BFMSCHT). Monthly samples from control herds (BFMCTLN and BFMCTLS) were also prepared

as quarterly composites. (See Fig. A-9 in *Appendix A* [p. A-53] for control sample locations.) Each milk sample was analyzed for strontium-90, iodine-129, gamma-emitting radionuclides (naturally occurring potassium-40, cesium-134, and cesium-137), and tritium. In all cases, radioisotopic concentrations, even when positive, were either still within the range of historical background values or statistically overlapped results observed at control locations. See Table C-3.1 (p. C3-3).

Fruit and Vegetables

Results from the analysis of beans, apples, sweet corn, and hay collected during 1996 are presented in Table C-3.3 (p. C3-5) in *Appendix C-3*. Tritium was not detected in near-site corn and bean samples although it does appear in the background samples at levels just above the detection limit.

In 1995 and 1996 positive strontium-90 results were obtained in all samples. Of these positive results, the near-site apple sample, collected from on-site trees not used for human consumption, indicated strontium at a concentration statistically above the 1996 control value. This value was slightly higher than that observed in 1995 but was still within the range of other biological matrix control values. The strontium-90 value in near-site corn also was statistically higher than the control sample but below other matrix control sample concentrations (e.g., beans and apples).

Near-site hay manifested the highest concentration of strontium-90 at levels three times the control level. Although high, this value was not corroborated by increases at the closest air sampling station (AFTCORD), surface soil sampling location (SFTCORD), or water sampling station (WFBCTCB). Subsequent analysis of the original sample suggested that this high value was an artifact of sample analysis.

Neither cesium-137 nor cobalt-60 were detected in these samples.

Direct Environmental Radiation Monitoring

The current monitoring year, 1996, was the thirteenth full year in which direct penetrating radiation was monitored at the WVDP using TLD-700 lithium fluoride thermoluminescent dosimeters (TLDs). These dosimeters, used solely for environmental monitoring, consist of five TLD chips laminated on a card bearing the location identification and other information. The cards are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure.

This was the first full year in which TLD packages were processed by an independent off-site contractor. (See *Appendix C*, Tables C-4.1 and C-4.2 [pp. C4-3 and C4-4]). During the analyses of the fourth-quarter TLD packages, the vendor laboratory instruments showed random interference. Many of the initial TLD readouts were obviously biased when compared to historical data and to known facility operations. An attempt to correct for these biases was made and the final data appear very similar to historical values. Since the cause of the bias cannot be attributed to a systematic fault with the instrumentation, it was not possible to adequately validate the fourth-quarter results. Therefore, only the TLD data from the first three quarters of 1996 are presented in this report. Similarly, annual averages and hourly exposure rates discussed here were calculated using only the first three quarters of data and extrapolating for the fourth quarter. The co-located NRC TLD data for the fourth quarter were comparable to previous years' fourth-quarter data. (See *Appendix D*, Table D-4 [p.D-9].)

Monitoring points are located around the WNYNSC perimeter and the access road, at the

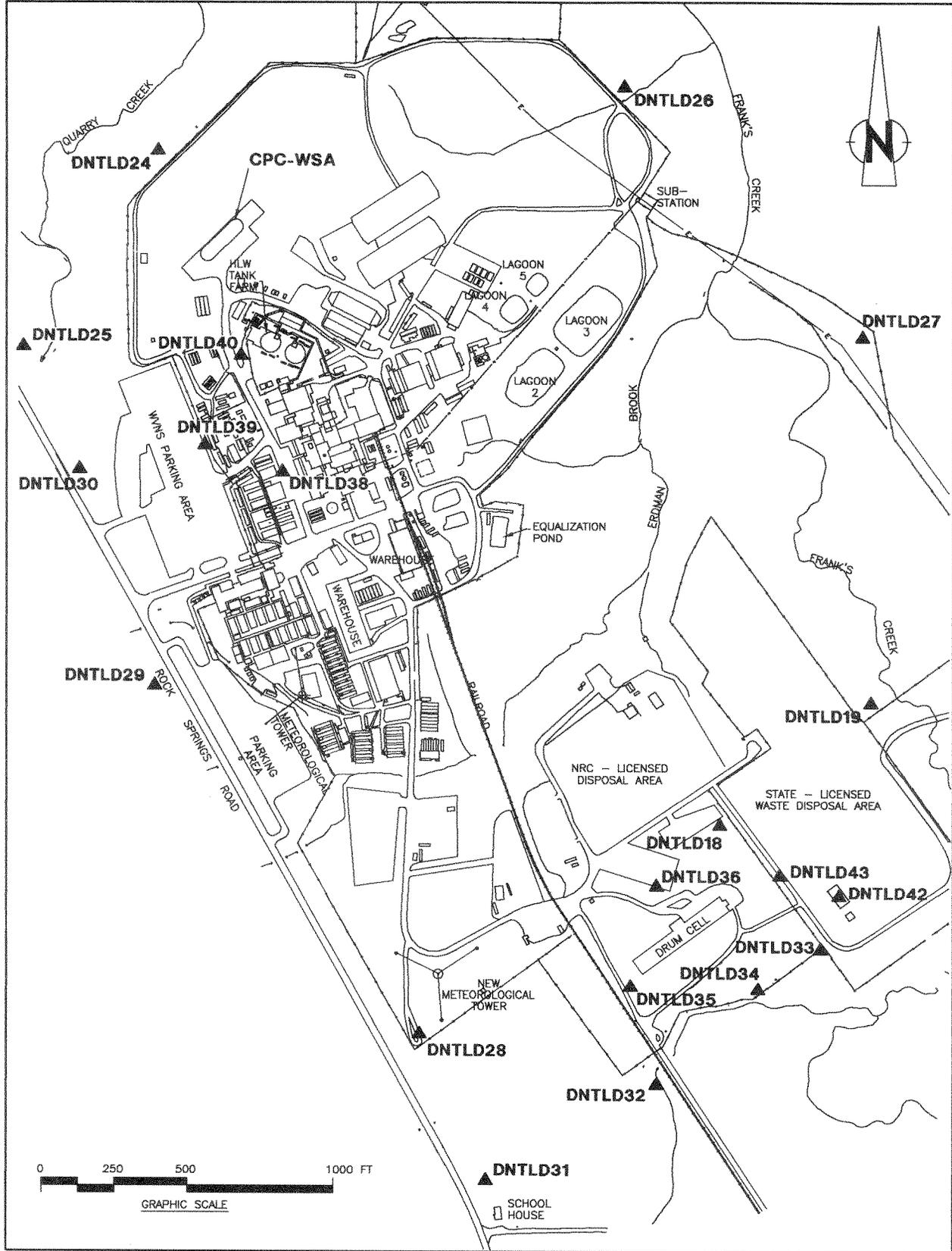


Figure 2-13. Location of On-site Thermoluminescent Dosimeters (TLDs).

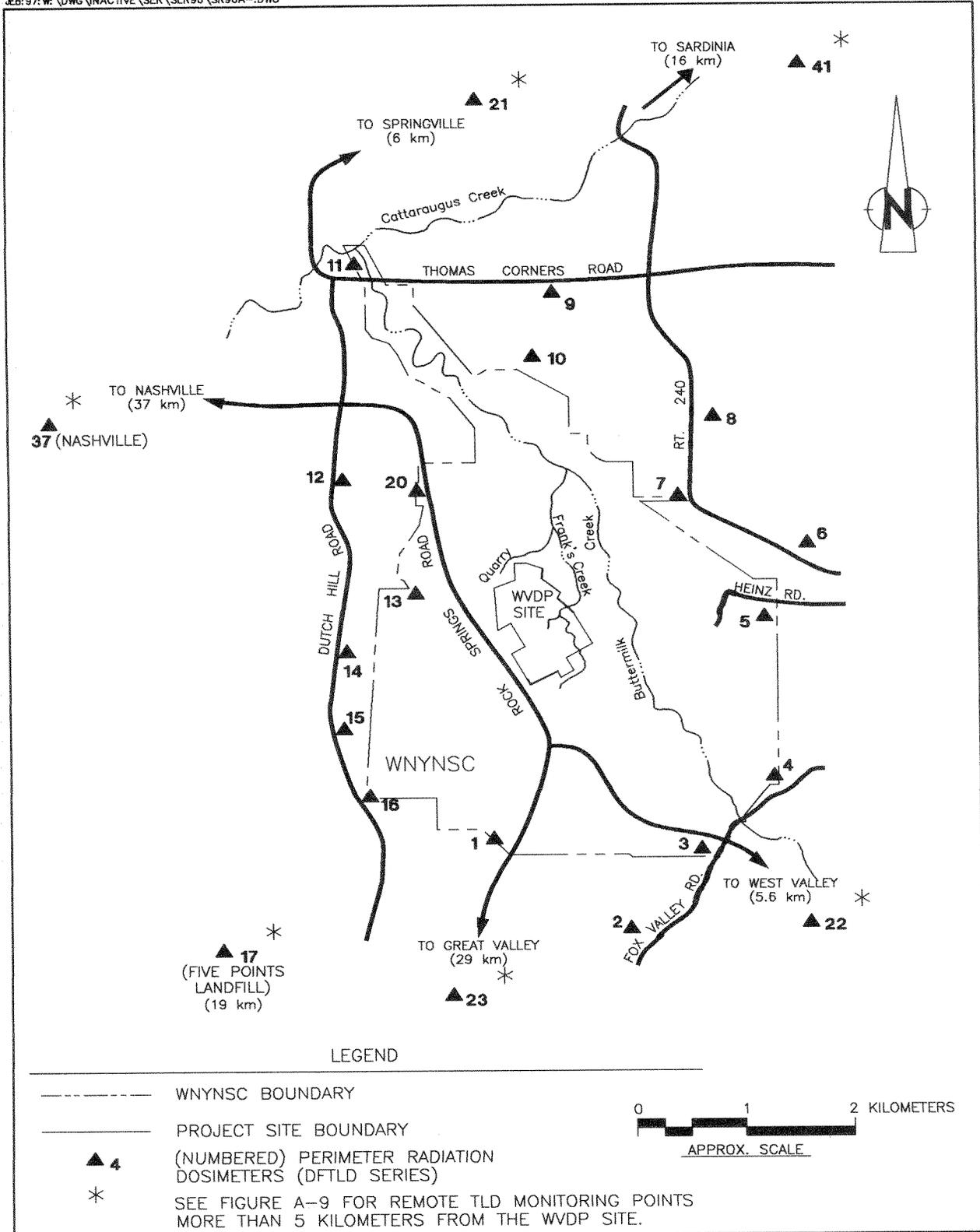


Figure 2-14. Location of Off-site Thermoluminescent Dosimeters (TLDs).

waste management units, at the site security fence, and at background locations remote from the WVDP site (Figs. 2-13 and 2-14 [pp. 2-26 and 2-27] and Fig. A-9 [p. A-53]). The TLDs are numbered in order of their installation. The monitoring locations are as follows:

THE PERIMETER OF THE WNYNSC: TLDs #1-16, #20

THE PERIMETER OF THE SITE SECURITY FENCE: TLDs #24, #26-34

ON-SITE SOURCES OR SOLID WASTE MANAGEMENT UNITS: TLDs #18, #32-36, and #43 (RTS drum cell); #18, #19, #33, #42, and #43 (SDA); #24 (component storage, near the WVDP site security fence); #25 (the maximum measured exposure rate at the closest point of public access); #38 (main plant and the previous cement solidification system); #39 (parking lot security fence closest to the vitrification facility); #40 (high-level waste tank farm).

NEAR-SITE COMMUNITIES: TLDs #21 (Springville); #22 (West Valley)

BACKGROUND: TLDs #17 (Five Points Landfill in Mansfield); #23 (Great Valley); #37 (Nashville); #41 (Sardinia).

Measured exposure rates were comparable to those of 1995. There was no significant difference between the pooled quarterly average background TLDs (#17, #23, #37, and #41) and the pooled average for the WNYNSC perimeter locations for the 1996 reporting period.

Tables C-4.1 and C-4.2 (pp. C4-3 through C4-4) provide a summary of the results by calendar quarter for each of the environmental monitoring locations along with averages for comparison. The quarterly averages and individual location results show differences due to seasonal variation. The data obtained for all four calendar quarters compared favorably to the respective quarterly data in

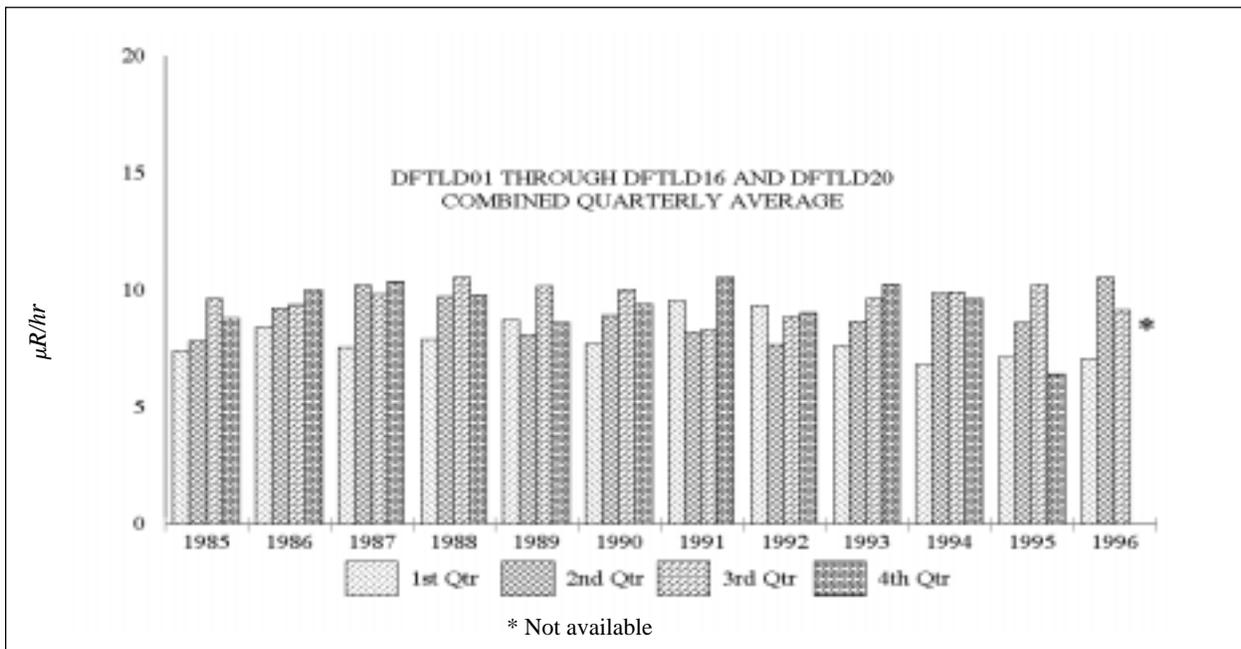


Figure 2-15. Twelve-Year Trend of Environmental Radiation Levels

1995. The quarterly average of the seventeen WNYNSC perimeter TLDs was 19.6 milliroentgen (mR) per quarter (18.7 mrem per quarter) in 1996.

The perimeter TLD quarterly averages since 1985, expressed in microroentgen per hour ($\mu\text{R/hr}$), are shown in Figure 2-15.

On-Site Radiation Monitoring

Locations #25, #29, and #30 on the public access road west of the facility, #26 at the east security fence, and #19 near the SDA showed small elevations above background. Although above background, the readings are relatively stable from year to year. (See *Appendix C-4*, Table C-4.2 [p. C4-4].)

Location #24 on the north inner facility fence is a co-location site for one NRC TLD. (See *Appendix D*, Table D-4 [p. D-9].) This point received an average exposure of 0.38 milliroentgens (mR) per hour during 1996, as opposed to 0.39 mR/hr in 1995, 0.47 mR/hr in 1994, 0.48 mR/hr in 1993, and 0.52 mR/hr in 1992. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby. The decline in exposure rate over time is due to radioactive decay of the materials stored within. The storage area is well within the WNYNSC boundary and is not accessible by the public.

Locations around the integrated radwaste treatment storage building — the drum cell — for the most part stayed the same or decreased slightly during the 1996 calendar year. The average dose rate at TLDs #18, #32, #33, #34, #35, #36, and #43 was 0.023 mR/hr in 1996, similar to the level observed in 1995. These exposure rates, which are above background levels, reflect the placement in the building of drums containing decontaminated supernatant mixed with cement. The drum cell and the surrounding TLD locations are well

within the WNYNSC boundary and are not accessible by the public.

Results from locations #27, #28, and #31 at the security fence are near background. These locations are more distant from on-site radioactive waste storage areas.

Results for TLD #42 are above background, reflecting its location close to a waste tank that stores SDA leachate.

Perimeter and Off-site Radiation Monitoring

The perimeter TLDs (TLDs #1-16 and #20) are located in the sixteen compass sectors around the facility near the WNYNSC boundary. The quarterly averages for these TLDs (Fig. 2-15) indicate no trends other than normal seasonal fluctuations. TLDs #17, #21-23, #37, and #41 monitor near-site community and background locations. The results from these monitoring points are essentially the same as the perimeter TLDs. Figure C-4.1 in *Appendix C-4* (p. C4-6) shows the average quarterly exposure rate at each off-site TLD location. Figure C-4.2 (p. C4-6) shows the average quarterly exposure rate at each on-site TLD.

Confirmation of Results

The performance of the environmental TLDs is confirmed periodically using a portable high-pressure ion chamber (HPIC) detection system. In August 1996 the HPIC was transported to each of the forty-three environmental TLD locations and three instantaneous dose readings were obtained. The three readings were averaged to determine the dose rate (in $\mu\text{R/hr}$) at each location. Statistical testing showed no difference between HPIC and TLD results for forty-one of forty-three locations surveyed. Two locations showing greater variability were located near active waste management areas and would

have been expected to change during the study period. Results of this study are provided in *Appendix C-4*, Table C-4.3 (p. C4-5).

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 nonroutine releases of airborne radioactive materials and 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 indicated by the difference in temperature between the 10-meter and 60-meter 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. 2-1 [p. 2-4]) continuously monitors wind speed and wind direction. Temperatures are measured at both 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-9 [p. A-53].) Dewpoint, precipitation, and barometric pressure are also monitored at the on-site meteorological tower location.

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 1996 the on-site system data recovery rate (time valid data were logged versus total elapsed time) was 97.9%. Figures C-6.1 and



Checking Data from the Meteorological Tower

C-6.2 in *Appendix C-6* (pp. C6-3 and C6-4) illustrate 1996 mean wind speed and wind direction at the 10-meter and 60-meter elevations. Regional data at the 10-meter elevation are shown in Figure C-6.3 (p. C6-5).

Weekly and cumulative total precipitation data are illustrated in Figures C-6.4 and C-6.5 in *Appendix C-6* (p. C6-6). Precipitation in 1996 was approximately 114.5 centimeters (45 in), 10% above the annual average of 104 centimeters (41 in).

Information such as meteorological system calibration records, site log books, and analog strip

charts are stored in protected archives. Electronic files containing meteorological data are copied (downloaded) weekly and stored off-site. 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.

Special Monitoring

Radon Evaluation

Increased radon-220 emissions from the main stack ventilation system were observed shortly after the start-up of operations in the vitrification facility. (The possibility of increased emissions had been anticipated before vitrification start-up although the exact magnitude could not have been predicted.) Upon evaluation it was found that the emissions corresponded to the time during which high-level waste was concentrated in the concentrator feed make-up tank (CFMT) before being mixed with glass formers. During concentration excess water is evaporated and the waste material is prepared for the final glass-making steps. Such concentration processes are scheduled to occur about thirty-six times per year. The average duration of each CFMT operational cycle is about three days.

The radon-220 emission rate associated with thorium-232 and uranium-232 high-level waste was estimated to be less than 30 curies (Ci) per day, up from the typical 3 Ci emitted per day when the CFMT is not operating. To gauge the potential effect of elevated radon-220 emissions on human health and the environment, data from the main stack sampler (ANSTACK) were used to calculate theoretical doses to the maximally exposed off-site individual. These doses were then compared to the NESHAP (40 CFR Part 61 Subpart H) standard of 10 mrem annual exposure limit for non-radon emissions. This comparison was

made only to provide a frame of reference, given that no NESHAP standard exists for radon-220 emissions from facilities such as those at the WVDP. The comparison indicated a 0.05 mrem per year effective dose to the maximally exposed off-site individual. This dose is only 0.5% of the 10 mrem standard. (See *Chapter 4, Radiological Dose Assessment*, for a detailed explanation of dose factors.)

A further evaluation to determine the maximum expected concentration of radon-220 in air downwind of the WVDP showed the concentration at the site boundary (at ground level) to be about $1\text{E-}12$ $\mu\text{Ci/mL}$ in air during periods of typical release. This is at least 100 times lower than natural levels of radon-220 and 3,000 times below the DOE DCG for radon-220 ($3\text{E-}09$ $\mu\text{Ci/mL}$).

In addition, lead-212 (a product of radon-220 decay) was evaluated. The maximum concentration of this isotope, at about $3\text{E-}13$ $\mu\text{Ci/mL}$ in air, is about 300 times lower than its DOE DCG of $8\text{E-}11$ $\mu\text{Ci/mL}$.

Investigation of Increased Iodine Emissions from the Main Stack

The start of radioactive vitrification operations resulted in an increase in the emission rate of radioactive isotopes of iodine from the main plant stack. The reason for the increase is that gaseous iodine is not as efficiently removed by the vitrification process off-gas treatment system as are most of the other radionuclides. (For more information on the off-site effective dose attributed to this increase see *Chapter 4, Radiological Dose Assessment*.)

Iodine-129 emitted from the main stack increased in 1996. Iodine-129 is a long-lived radionuclide that has always been present in main stack emissions. In addition, iodine-131 was detected in 1996. Iodine-131, an isotope with a half-life of eight days,

originates from the decay of curium-244. Curium-244 is present in the high-level waste. Iodine-131 was not detectable until vitrification processing began because the pre-vitrification storage and management of the high-level waste had prevented detectable levels of iodine-131 from reaching the air effluent. The process of preparing the high-level waste for vitrification increased quantities of iodine-129 and allowed a very small, yet detectable quantity of iodine-131 to be released to the main plant stack air effluent through the vitrification process off-gas treatment system.

Iodine-131 also was observed in sludge samples taken in September from the site's waste water treatment facility. There is no connection between the iodine-131 that was observed in the waste water treatment facility and the iodine-131 in the main plant stack ventilation system. The iodine-131 that was observed in the sludge samples was traced to the administration of this radionuclide to a site employee for a medical condition.

NRC-licensed Disposal Area (NDA) Interceptor Trench and Pretreatment System

Radioactively contaminated n-dodecane in combination with tributyl phosphate (TBP) was discovered at the northern boundary of the NDA in 1983, shortly after the Department of Energy assumed control of the WVDP site. Extensive sampling and monitoring through 1989 revealed the possibility that the n-dodecane/TBP could migrate. To contain this subsurface organic contaminant migration, an interceptor trench and liquid pretreatment system (LPS) were built.

The trench was designed to intercept and collect subsurface water, which could be carrying n-dodecane/TBP, in order to prevent the material from entering the surface water drainage ditch leading into Erdman Brook. The LPS was installed to decant the n-dodecane/TBP from the water and

to remove iodine-129 from the collected water before its transfer to the low-level waste treatment facility. The separated n-dodecane/TBP would be stored for subsequent treatment and disposal. As in previous years, no water containing n-dodecane/TBP was encountered in the trench and no water or n-dodecane/TBP was treated by the LPS in 1996.

Results of surface and groundwater monitoring in the vicinity of the trench are discussed under *NDA Sampling Locations*, p. 2-10, and **Long-term Trends of Gross Beta and Tritium at Selected Groundwater Monitoring Locations**, p. 3-15.

Northeast Swamp Drainage Monitoring

In 1993 trend analyses of surface and groundwater monitoring results indicated increasing gross beta concentrations in waters discharged through the northeast swamp drainage as monitored at sampling points WNDMPNE and WNSWAMP. (WNDMPNE and WNSWAMP monitored the same location; samples collected as part of the groundwater program were identified as WNDMPNE, since discontinued, and surface water samples were identified as WNSWAMP.)

Upon examination, a small seasonal groundwater seep was discovered that appeared to be a major contributor of strontium-90 to this drainage path. An investigation was initiated to characterize the source of this seep, its effect on surface water quality, and to provide information for mitigative action, if deemed necessary. A series of samples were collected throughout the north plateau area using a Geoprobe® unit. This truck-mounted unit drives a metal sampling rod into the ground to a predetermined depth. Using this method, groundwater and soil beneath and downgradient of the process building were sampled between July 14, 1994 and October 19, 1994. During this investigation, groundwater was collected from eighty locations, and soil samples were collected from four locations.

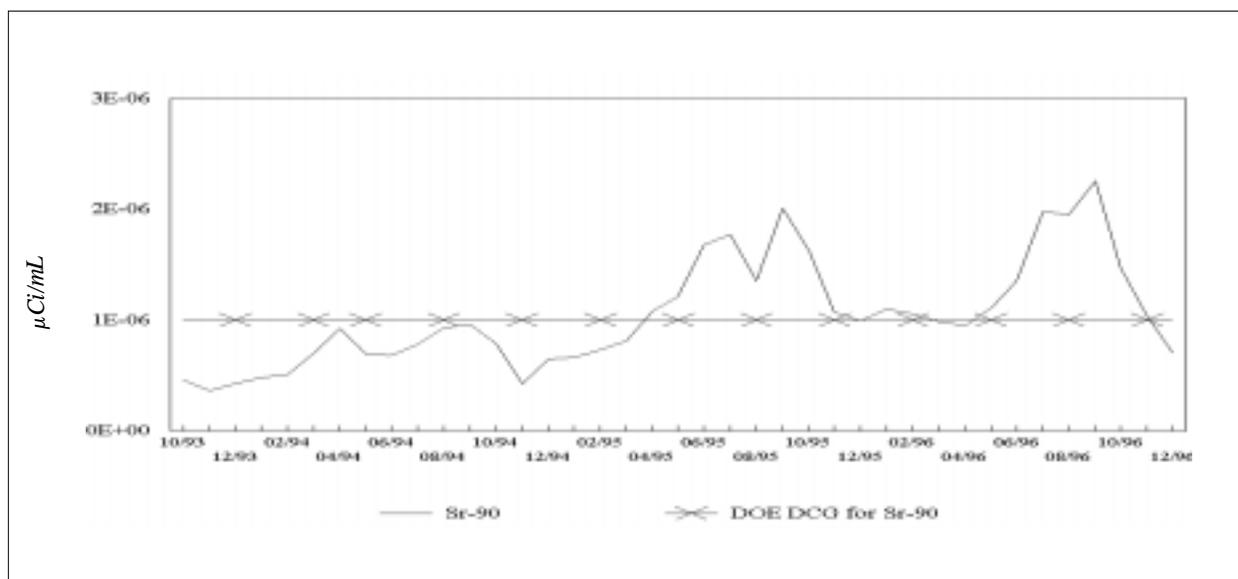


Figure 2-16. Strontium-90 Concentrations at Sampling Location WNSWAMP

Sampling results indicated that a narrow, elliptically shaped plume of elevated gross beta activity, extending northeastward from the south end of the process building to the construction and demolition debris landfill, was present in groundwater within the sand and gravel unit. The plume is approximately 300 feet wide and 800 feet long. The highest gross beta activities in groundwater and soil were measured at two locations near the south end of the process building. Isotopic characterization of the groundwater and soil suggests that strontium-90 and its daughter product, yttrium-90, contribute most of the gross beta activity in groundwater and soil beneath and downgradient of the process building. The primary source of contamination is believed to be an area in the southwest corner of the process building associated with acid recovery operations conducted by the previous site operator, Nuclear Fuel Services, Inc. (NFS), prior to any WVDP activities.

During 1996, routine surface water sampling continued to monitor radiological discharges through the northeast swamp drainage. (See *Appendix C-1*, Table C-1.7 [p. C1-8]). Overall, gross beta and strontium-90 concentrations continue to fluctuate

due to seasonal effects. WNSWAMP concentrations tend to decrease during periods of rainfall or snowmelt and to increase during dry weather.

The maximum average monthly gross beta concentration observed at WNSWAMP during 1996 was $4.16 \pm 0.04 \text{E-}06 \mu\text{Ci/mL}$ ($154 \pm 1.48 \text{ Bq/L}$) during September. The average minimum monthly gross beta concentration was $1.42 \pm 0.02 \text{E-}06 \mu\text{Ci/mL}$ ($53 \pm 0.7 \text{ Bq/L}$), observed in December. Strontium-90 values ranged from $6.96 \pm 0.24 \text{E-}07 \mu\text{Ci/mL}$ ($26 \pm 0.9 \text{ Bq/L}$) in December to $2.26 \pm 0.04 \text{E-}06 \mu\text{Ci/mL}$ ($84 \pm 1.5 \text{ Bq/L}$) in September. The DOE DCG of $1.0 \text{E-}06 \mu\text{Ci/mL}$ (37 Bq/L) for strontium-90 pertains to an annualized average, which currently (January 1996 to December 1996) is $1.33 \pm 0.02 \text{E-}06 \mu\text{Ci/mL}$ (133% of the DOE DCG). Although the annualized averaged concentration of strontium-90 in surface water exceeded the DOE DCG at sampling location WNSWAMP (on the WVDP premises), monitoring downstream at the first point of possible public access (WFFELBR) continued to show gross beta concentrations to be nearly indistinguishable from background (WFBIGBR). (See *Off-Site Surface Water Sampling* [p. 2-11] and Fig. 2-16.)

In November 1995, the WVDP installed and began operation of a groundwater recovery system. Recovered well water is treated and then directed to the site's low-level waste treatment facility for storage before it is discharged to the environment through the monitored lagoon system. To date the system has treated more than 5 million gallons of groundwater. (See p. 3-18 in *Chapter 3, Groundwater Monitoring* for a more detailed discussion.)

Drum Cell Monitoring

Through May 1995, when liquid pretreatment operations were completed, the integrated radwaste treatment system (IRTS) processed liquid high-level waste (the result of supernatant treatment and sludge wash) and produced 19,877 drums of low-level cement-solidified waste. Drums produced during all phases of liquid waste processing are currently being stored aboveground in the IRTS drum cell.

Most of the gamma radiation emitted from these drums is shielded by the configuration in which the drums are stacked. However, some radiation is emitted through the unshielded roof of the drum cell. Although this radiation scatters in air nearby, the amount added to the existing naturally occurring gamma-ray background at the nearest public access point is barely measurable.

Radiation exposure levels are monitored at various locations around the drum cell perimeter and at the closest location accessible by the public — approximately 300 meters (984 ft) west at the security fence along Rock Springs Road. Baseline measurements had been taken in 1987 and 1988 before the drums were placed. Two types of measurements were taken: instantaneous, using a high-pressure ion chamber (HPIC), and cumulative, using thermoluminescent dosimeters.

The strength of the gamma-ray field can vary considerably from day to day because of changes in

meteorological conditions. TLD measurements provide a more accurate estimate of long-term changes in the radiation field because they integrate the radiation exposure over an entire calendar quarter. Such quarterly readings show evidence of a seasonal cycle. Background radiation levels can vary annually depending on such factors as average temperature, air pressure, humidity, precipitation (including snow cover on the ground), and solar activity during a particular year. The TLD measurements at the Rock Springs Road location (TLDs #28 and #31) are presented in *Appendix C-4*, Table C-4.2 (p. C4-4).

The most recent data show that exposure rates at Rock Springs Road are the same as or only slightly greater than those seen before any drums were placed in the drum cell.

Closed Landfill Maintenance

Closure of the on-site nonradioactive construction and demolition debris landfill (CDDL) was completed in August 1986. The landfill area was closed in accordance with the New York State Department of Environmental Conservation (NYSDEC) requirements for this type of landfill, following a closure plan (Standish 1985) approved by NYSDEC. To meet routine post-closure requirements, the CDDL cover was inspected twice in 1996 and was found to be in generally good condition. Some minor repairs were made to maintain an adequate grass cover, and the grass planted on the clay and soil cap was cut. Adequate drainage was maintained to ensure that no obvious ponding or soil erosion occurred. Results of groundwater monitoring in the general area of the closed landfill, i.e., wells 803 and 8612, are presented in *Chapter 3, Groundwater Monitoring*. (See p. 3-14.)

Off-site Soil Sampling

The WVDP periodically is asked to support special studies by local communities. In August 1996

the Seneca Nation of Indians notified the WVDP that an elementary school was being built on the Cattaraugus Indian Reservation. A substantial amount of sand and gravel fill being used in the building foundation had been obtained from a location near the Cattaraugus Creek bed, and the Seneca Nation wanted to know if past site activities had contaminated the creek gravel with radioactive material.

Several representatives from the WVDP, led by a Seneca Nation summer intern working in the on-site Environmental Laboratory, traveled to the construction site and met with tribal leaders. A sample of the fill material was collected and returned to the WVDP for radiological analysis, which showed no radioactive contamination above background levels.

Nonradiological Monitoring

Air Monitoring

Nonradiological air emissions and plant effluents are permitted under NYSDEC and EPA regulations. The regulations that apply to the WVDP are listed in Table B-2 (p. B-4) in *Appendix B*. The individual air permits (certificates to operate) held by the WVDP are identified and described in Table B-3 (pp. B-5 through B-9).

The nonradiological air permits are for emissions of regulated pollutants that include particulates, ammonia, and nitric acid mist. Emissions of oxides of nitrogen and sulfur are each limited to 100 tons per year and are reported to NYSDEC every quarter. Nitrogen oxides emissions for 1996 were approximately 15 tons; sulfur dioxide emissions were approximately 0.5 tons. Monitoring of these parameters currently is not required.

The vitrification off-gas treatment system is equipped with a nitrogen oxides abatement and

monitoring system. A relative accuracy test audit performed by the WVDP and witnessed by NYSDEC on May 30, 1996, measured an 11.2% accuracy, well below the 20% standard.

Surface Water Monitoring

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. 2-17 [p. 2-36]) and specifies the sampling and analytical requirements for each outfall. This permit was modified in 1990 to include additional monitoring requirements at outfall WNSP001. The WVDP applied for a renewed SPDES permit in 1991. It was received in early January 1994 and went into effect on February 1, 1994 with the expanded monitoring requirements and, in some cases, more stringent discharge limitations. The permit was modified in April, November, and December 1994 and in June 1995. Four outfalls are identified in the 1995 permit:

- 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 point where compliance with the SPDES permit limit for total dissolved solids is maintained through calculation using monitoring data from upstream sources representing flows from Frank's Creek and Erdman Brook.

The conditions and requirements of the current SPDES permit are summarized in Table C-5.1 (p. C5-3) in *Appendix C-5*.

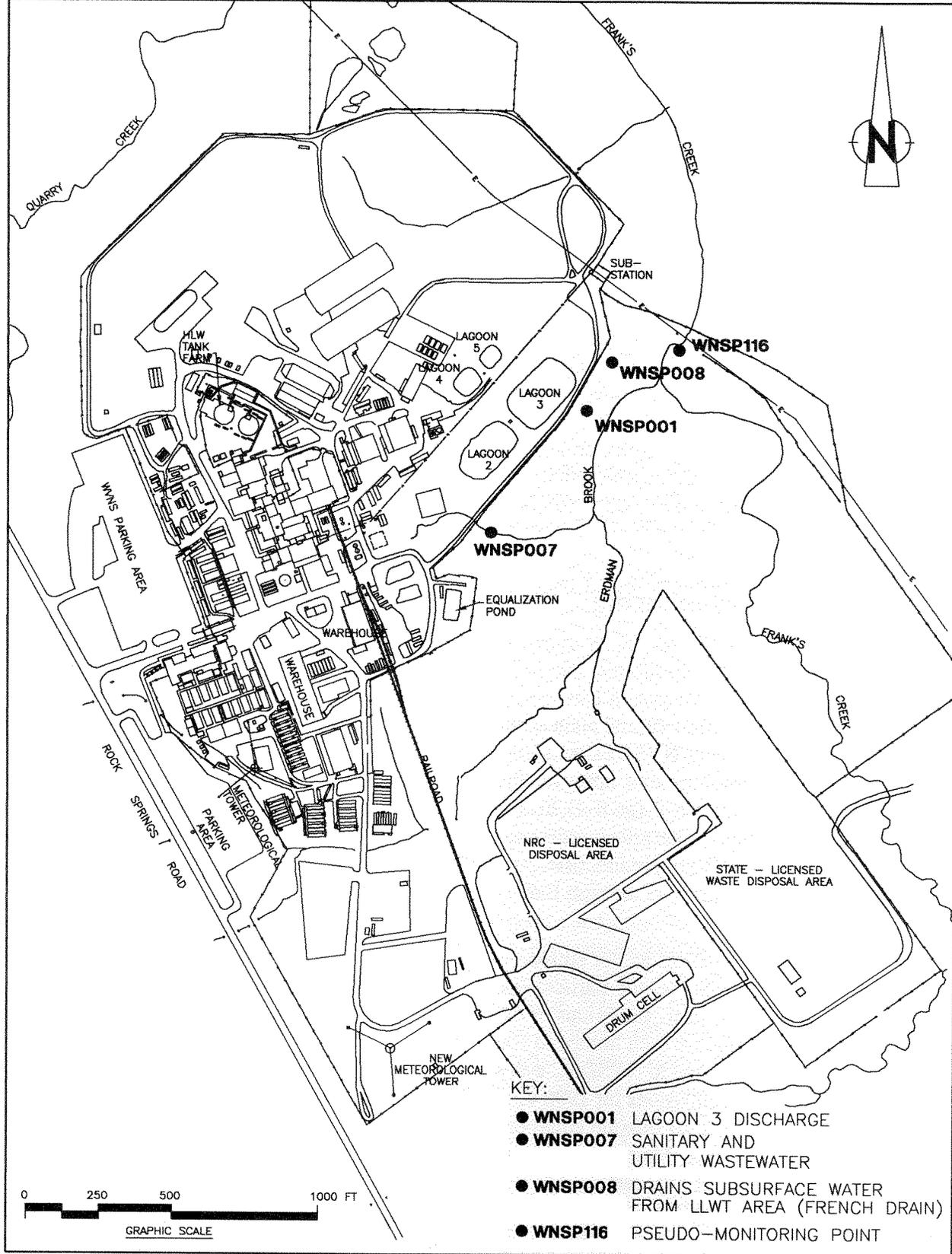


Figure 2-17. SPDES Monitoring Points.

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 amounts of iron that are naturally present in the site's incoming water. The flow-weighted limits apply to the sum of the Project effluents but allow the more dilute effluents to be factored into the formula for determining compliance with permit conditions.

The SPDES monitoring data for 1996 are displayed in Figures C-5.2 through C-5.54 in *Appendix C-5* (pp. C5-6 through C5-23). The WVDP reported two permit exceedances in 1996 (Table C-5.2 [p. C5-4]). See the *Environmental Compliance Summary: Calendar Year 1996* (p. liv).

Semiannual grab samples at locations 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 1996. 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-1.27 (p. C1-21) in *Appendix C-1*.

Results of sampling for nonpurgeable organic carbon (NPOC) and total organic halogens (TOX) at two locations that help monitor the NDA, WNNADR and WNNATR are found in Tables C-1.19 and C-1.20 (pp. C1-15 and C1-16). (See Fig. 2-3 [p. 2-6].) When NPOC and TOX values at both locations are compared, the data suggest that even with some fluctuation there is little, if any, significant difference.

Drinking Water Monitoring

The site's drinking water is monitored to verify compliance with EPA and NYSDOH regulations. (See **Safe Drinking Water Act** in the *Environmental Compliance Summary: Calendar Year 1996* [p. lv].)

Samples are collected annually for nitrate, fluoride, and metals concentrations analyses. Sampling and analysis for copper and lead are conducted according to Cattaraugus County Health Department guidance. Except for two maximum contaminant level exceedances for turbidity that occurred early in 1996, monitoring results indicated that the Project's drinking water met NYSDOH, EPA, and Cattaraugus County Health Department drinking water quality standards.