Collecting a Composite Water Sample at the Project Boundary

2.0 Effluent and Environmental Monitoring

2.1 Radiological Monitoring

2.1.1 Air Monitoring

Air is monitored at several locations in order to ascertain the effect of Project activities. Samplers are located at points remote from the West Valley Demonstration Project site, at the perimeter of the site, and on the site itself. (See Appendix A, page A-3, for an explanation of the monitoring location codes.)

SAMPLE COLLECTION AND ANALYSIS

Air samples are collected by drawing air through a very fine filter with a vacuum pump. The total volume of air drawn through the sampler is measured and recorded by a meter. The filters trap particles of dust that are then tested in the laboratory for radioactivity. At two locations (AFRSPRD and AFGRVAL) samples are also collected for iodine-129 analysis using activated carbon cartridges. Three of the four perimeter samplers, mounted on towers 4 meters high, maintain an average flow of about 40 L/min (1.5 ft^3/min) through a 47-mm glass fiber filter. The remaining perimeter sampler and the four remote samplers operate with the same air flow rate as the three samplers mounted on towers, but the sampler head is 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 radioactivity. Gross alpha and gross beta measurements of each filter are made using a low-background gas proportional counter.

In addition, quarterly composites consisting of thirteen weekly filters from each sample station are analyzed. A complete tabulation of these stations is given in Tables C-2.12 through C-2.20 in Appendix C-2.

The exhaust from each permitted fixed ventilation system serving the site's facilities 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, small, glass fiber filters to trap any particles. Sensitive detectors continuously measure the radioactivity on these filters and provide remote readouts of alpha and beta radioactivity levels to control display panels.

A separate sampling unit on the ventilation stack of each system contains another filter that is removed every week and subjected to additional laboratory testing. This sampling system also may contain an activated carbon cartridge used to collect a sample that is analyzed for iodine-129.

In addition to these samples, water vapor from the main plant ventilation stack (ANSTACK) is collected by trapping moisture on 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.

- Perimeter and Remote Air Sampling

In 1990 airborne particulate radioactive samples were collected continuously at five locations around the perimeter of the site and at four remote locations at Great Valley, West Valley, Springville, and at Dunkirk, New York (Fig. 2-1).

The choice of the perimeter locations – on Fox Valley Road, Rock Springs Road, Route 240, Thomas Corners Road, and Dutch Hill Road – was based either on historical continuity or the highest probable annual average airborne concentrations.

The remote locations provide data from nearby communities – West Valley and Springville – and from natural background areas. Concentrations measured at Great Valley (AFGRVAL, 29 km south of the site) and Dunkirk (AFDNKRK, 50 km west of the site) are considered representative of natural background radiation. Data from these samplers are provided in Appendix C-2, Tables C-2.12 through C-2.20.

- Global Fallout Sampling

Global fallout is also sampled at four of the perimeter air sampler locations and at the base of the meteorological tower on-site. Precipitation from open pots at all of the locations is collected and analyzed every month. Results from these measurements are reported in nCi/m^2 per month for gross alpha and gross beta and in $\mu Ci/mL$ for tritium. The 1990 data from these analyses are found in Appendix C-2, Table C-2.21. The pH measurements for precipitation are found in Table C-2.22.

These collections indicate short-term effects, and the reporting units for alpha/beta indicate a rate of deposition rather than the actual concentration of activity within the collected water. Long-term deposition is measured by surface soil samples collected annually near each sampling station. Soil sample data are found in Table C-1.11 of Appendix C-1.

RADIOACTIVITY CONCENTRATIONS AT PERIMETER AND REMOTE LOCATIONS

The average monthly concentrations at the perimeter and remote locations ranged from 8.84E-15 $\mu Ci/mL$ to 8.45E-14 $\mu Ci/mL$ (3.3E-4 Bq/m^3 to 3.1E-3 Bq/m^3) of beta activity and from 5.2E-16 $\mu Ci/mL$ to 3.80E-15 $\mu Ci/mL$ (1.9E-5 Bq/m^3 to 1.4E-4 Bq/m^3) of alpha activity. Iodine-129 was not detected at either the Rock Springs Road location (AFRSPRD) or the Great Valley location (AFGRVAL), as shown in Tables C-2.13 and C-2.18 in Appendix C-2.

In all cases, the measured monthly gross activities were well below 3E-12$\mu Ci/mL$ (1.1E-1 Bq/m^3) beta and 2E-14$\mu Ci/mL$ (7.4E-4 Bq/m^3) alpha, the most stringent acceptable limits (referred to as derived concentration guides, or DCGs) set by the Department of Energy for any of the isotopes present at the WVDP. (Department of Energy standards and DCGs for radionuclides of interest at the West Valley Demonstration Project can be found in Appendix B.)

Annual data for the three samplers that have been in operation since 1983 average about 1.84E-14 $\mu Ci/mL$ (6.8E-04 Bq/m^3) of gross beta activity in air. This average is comparable to 1990 data. The average gross beta concentration at the Great Valley background station was 2 .04E-14 $\mu Ci/mL$ (7. 5E-04 Bq/m^3) in 1989, and in 1990 averaged 1.65E-14 $\mu Ci/mL$ (6.1E-04 Bq/m^3).

ON-SITE VENTILATION SYSTEMS

- The Main Plant Ventilation Stack (ANSTACK)

The main ventilation stack (ANSTACK) sampling system remained the most significant airborne effluent point in 1990. A high sample collection flow rate through multiple intake nozzles ensures a representative sample for both the weekly filter sample and the on-line monitoring system. Variations in monthly concentrations of airborne radioactivity reflect the level of Project activities within the facility. (See Appendix C-2, Table C-2.1.) However, at the point of discharge, average radioactivity levels were already below concentration

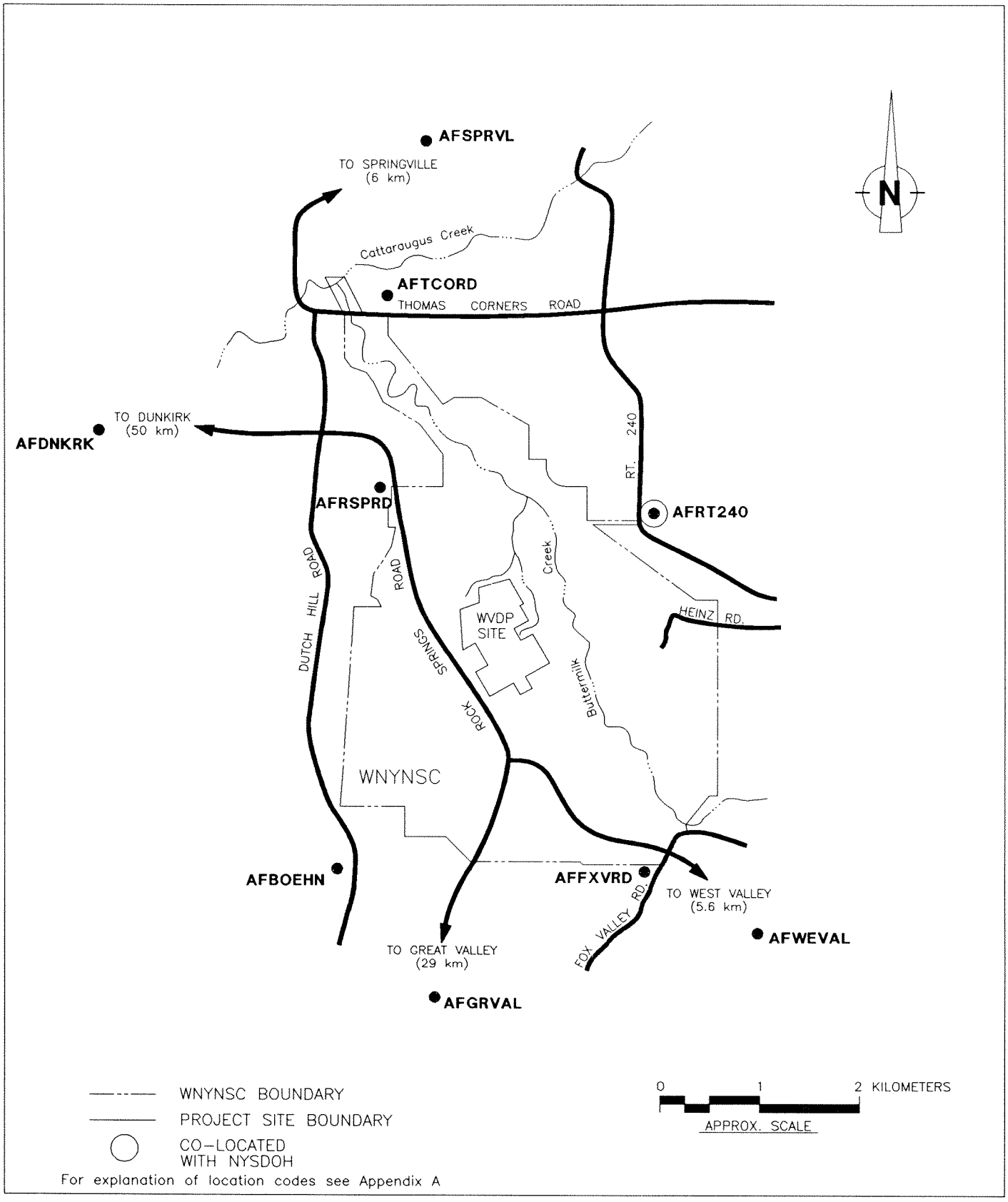


Figure 2-1. Off-Site Air Sampler Locations.

guidelines for airborne radioactivity in an unrestricted environment. (See Appendix C-2, Table C-2.3.) Further dilution from the stack to the site boundary reduces the concentration by an average factor of about 200,000.

The total quantity of gross alpha, gross beta, and tritium released each month from the main stack, based on weekly filter measurements, is shown in Appendix C-2, Table C-2.1. The results of analyses for specific radionuclides in the four quarterly composites of stack effluent samples are listed in Table C-2.2.

- Other On-site Sampling Systems

Sampling systems similar to the main stack system monitor airborne effluents from the cement solidification system ventilation stack (ANCSSTK), the contact size reduction facility ventilation stack (ANCSRFK), and the supernatant treatment system ventilation stack (ANSTSTK). The 1990 samples showed detectable gross radioactivity, including specific beta- and alpha-emitting isotopes, but did not approach any Department of Energy effluent limitations. (See Tables C-2.4 through C-2.9 in Appendix C-2.)

Three other operations are routinely monitored for airborne radioactivity releases: the low-level waste treatment facility ventilation system (ANLLWTF), the contaminated clothing laundry ventilation system (ANLAUNV), and the supercompaction volume reduction ventilation system (ANSUPCV). Results of monitoring of the supercompaction volume reduction system are found in Tables C-2.10 and C-2.11 in Appendix C-2.

The total amount of radioactivity discharged from facilities other than the main ventilation stack is less than 1% of the airborne radioactivity released from the site and is not a significant factor in the airborne pathway in 1990.

During the early summer of 1990, ANSTACK, ANSUPCV, ANCSSTK, ANSTSTK, and ANCSRFK were flow-tested by an outside contractor. The testing was designed to assess the efficiency of flow and transport through the sampling lines by injecting a known quantity of various extremely small particulates at the intake nozzle and measuring the amount and size of the particles that were carried through to the air monitoring instuments. The data are now being evaluated to determine if sampling flow rate or minor design changes should be made.

2.1.2 Surface Water and Sediment Monitoring

SAMPLE COLLECTION

Four automatic samplers collect surface water at points along drainage channels within the WNYNSC. Water collection points were chosen at locations most likely to show any radioactivity released from the site and at a background station upstream of the site.

The 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 debris. The pump then reverses to collect a sample, reverses again to clear the line, then resets itself. The pump and sample container are housed in a small insulated and heated shed to allow sampling throughout the year.

- Off-site Surface Water Sampling

An off-site sampler (WFFELBR) is located on Cattaraugus Creek at Felton Bridge just downstream of the confluence with Buttermilk Creek, the major surface drainage from the Western New York Nuclear Service Center (Fig. 2-2). The sampler periodically collects an aliquot (a small volume of water, approximately 100 mL/hour) from the creek. 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 based on relative stream discharge. Gross alpha, beta, and tritium analyses are performed each week, and the composite is analyzed for strontium-90 and gamma-emitting isotopes.

In addition to the Cattaraugus Creek sampler, two surface water monitoring stations are located on Buttermilk Creek. Samplers collect water from a background location upstream of the Project (WFBCBKG) and from a location at Thomas Corners Road downstream of the

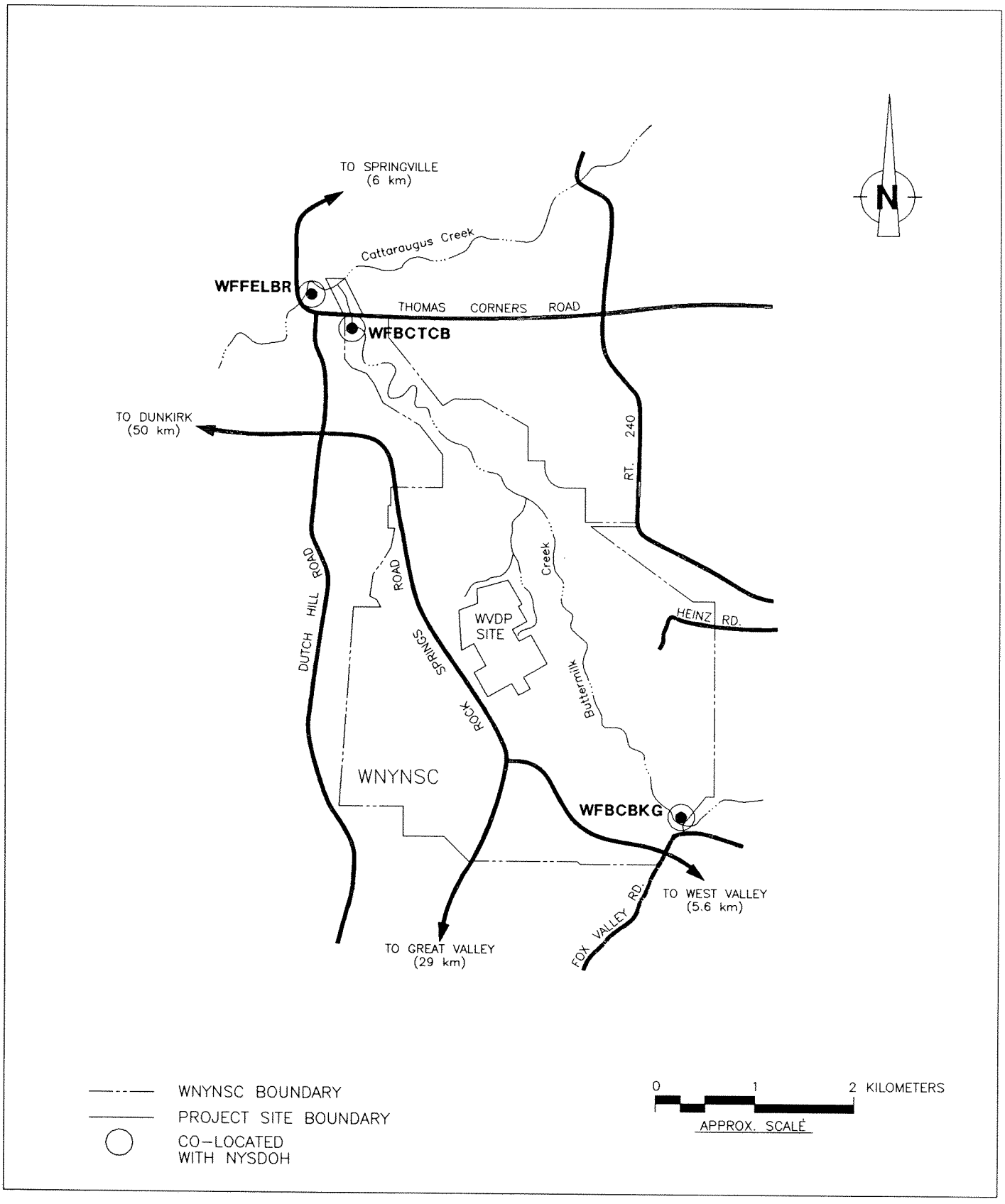


Figure 2-2. Off-Site Surface Water Sampling Locations.

plant and upstream of the confluence with Cattaraugus Creek (WFBCTCB). The samplers collect a 25-mL aliquot every half-hour. Samples are retrieved biweekly, composited monthly, and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite of the biweekly samples is analyzed for gamma-emitting isotopes and strontium-90.

The fourth station (WNSP006) is located on Frank's Creek where Project site drainage leaves the security area (Fig. 2-3). This sampler collects a 50-mL aliquot every half-hour. Samples are retrieved weekly and composited both monthly and quarterly. Weekly samples are analyzed for tritium and gross alpha and beta radioactivity. The monthly composite is analyzed for strontium-90 and gamma-emitting isotopes. A quarterly composite is analyzed for carbon-14, iodine-129, and alpha-emitting isotopes.

Tabulated data from surface water samplers are provided in Appendix C-1, Tables C-1.3 through C-1.7.

- On-site Surface Water Sampling

The largest single source of radioactivity released to surface waters from the Project is the discharge from the low-level waste treatment facility (LLWTF) through the Lagoon 3 weir (WNSP001, Fig. 2-3) into Erdman Brook, a tributary of Frank's Creek. There were four batch releases totaling about 42 million liters in 1990. The effluent was grab-sampled daily during the forty-four days of release and analyzed. The total amounts of radioactivity in the effluent are listed in Table C-1.1. Of the activity released, 0.8% of the tritium and 2.1% of the other gross radioactivity originated in the New York State-licensed disposal area (SDA), based on measurements of water transferred in 1990 from the SDA to the low-level waste treatment facility, and not from previous or current Project operations (see Table C-1.10 in Appendix C-1). The annual average concentrations from the Lagoon 3 effluent discharge weir, including all measured isotope fractions, were less than 30% of the DCGs (Table C-1.2 in Appendix C-1). Provisional results of isotopic uranium investigations of U-232 are reported in Table C-1.1 for Lagoon 3 releases. If these tentative values were normalized for 1990 liquid effluents, the releases would be 86% of the DCGs but would not affect the doses to the public.

RADIOACTIVITY CONCENTRATIONS AT OFF-SITE WATER SAMPLE LOCATIONS

Radiological concentration data from these sample points show that average gross radioactivity concentrations generally tend to be higher in Buttermilk Creek below the WVDP site, presumably because small amounts of radioactivity from the site enter Buttermilk Creek via Frank's Creek. The range of gross beta activity, for example, was from < 1.7E-9 to 5.9E-9 μCi/mL (< 6.3E-2 to 2.2E-1 Bq/L) upstream in Buttermilk Creek at Fox Valley (WFBCBKG), and from 2.9E-9 to 1.2E-8 μCi/mL (1.1E-1 to 4.4E-1 Bq/L) in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB). (See Tables C-1.3 and C-1.4.) Concentrations downstream of the site are only marginally higher than background concentrations upstream of the site. Yearly averages for Cattaraugus Creek at Felton Bridge are not significantly higher statistically than background levels.

In comparison, if the maximum beta concentration in Buttermilk Creek at Thomas Corners Bridge, to which dairy cattle have access, is assumed to be entirely iodine-129, which is the most restrictive beta-emitting isotope, then the activity represents 2.3% of the Department of Energy's derived concentration guide (DCG) for unrestricted use. (See Appendix B for a list of acceptable concentration limits.) The maximum observed 1990 beta concentration is less than that of 1989 at this location.

At the Project security fence (WNSP008) more than 4 kilometers from the nearest public access point, the most significant beta-emitting radionuclides were measured at 4.1E-8 μCi/mL (1.5E+00Bq/L) for cesium-137 and 4.6E-8 μCi/mL(1.7E+00 Bq/L) for strontium-90 during the period of highest concentration. This corresponds to 1.4% and 4.6% of the DCGs for cesium-137 and strontium-90,

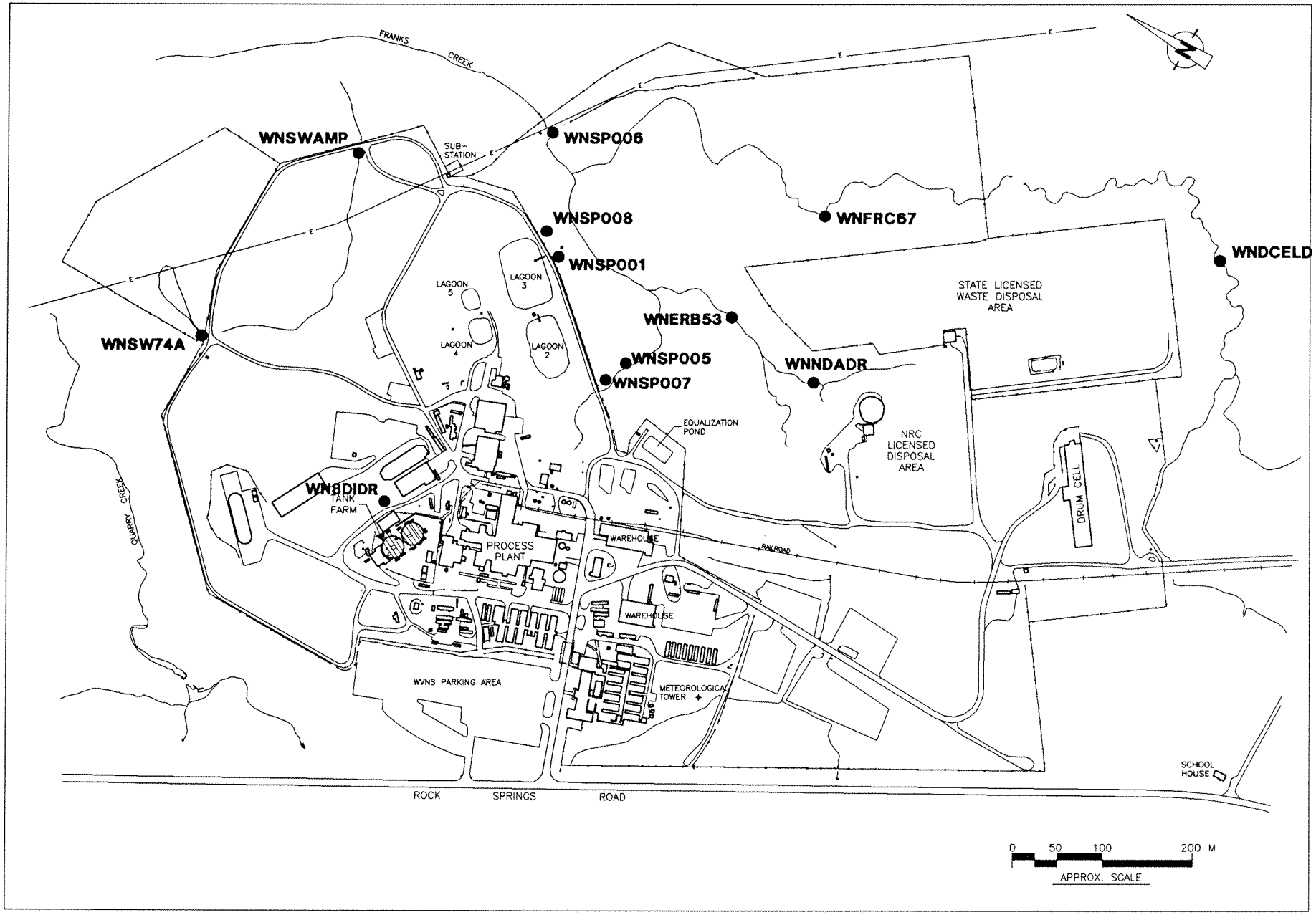


Figure 2-3. On-Site Surface Water Sampling Locations.

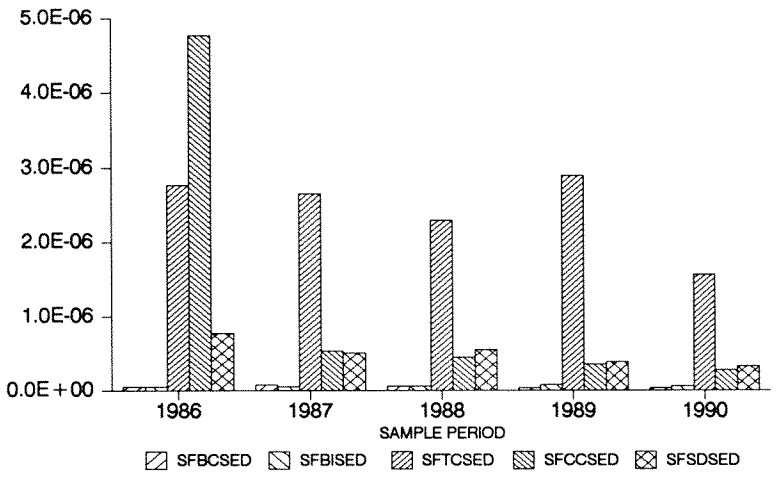


Figure 2 - 4

Annual averages of cesium-137 (μCi/g dry) in stream sediment for two locations upstream and three locations downstream of the WVDP.

respectively. The annual average was 0.7% for cesium and 2.7% for strontium. Tritium, at an annual average of 4.7E-6 μCi/mL (1.7E+2 Bq/L), was 0.2% of the DCG value. Except for four months of the year, the gross alpha was below the average detection limit of 1.9E-9 μ Ci/mL (6.9E-2 Bq/L), or less than 6.3% of the DCG for americium-241.

The highest concentrations in monthly composite water samples from Cattaraugus Creek during 1990 show strontium-90 to be less than 0.4% of the DCGs for drinking water. No gamma-emitting fuel cycle isotopes were detected in Cattaraugus Creek during 1990 (Table C-1.7).

- Sediment Sampling

Results of sediment sampling from streams upstream and downstream of the Project are tabulated in Appendix C-1, Table C-1.9. A comparison of annual averaged 1986-1990 cesium-137 concentrations for the two upstream locations and the three downstream locations is found in Fig. 2-4. As indicated, cesium-137 concentrations are decreasing or staying constant with time for the locations downstream of the Project (SFTCSED, SFCCSED, and SFSDSED). Concentrations of cesium-137 in upstream locations have remained consistent throughout the time period. A comparison of cesium-137 to naturally occurring potassium-40 (Fig. 2-5) for

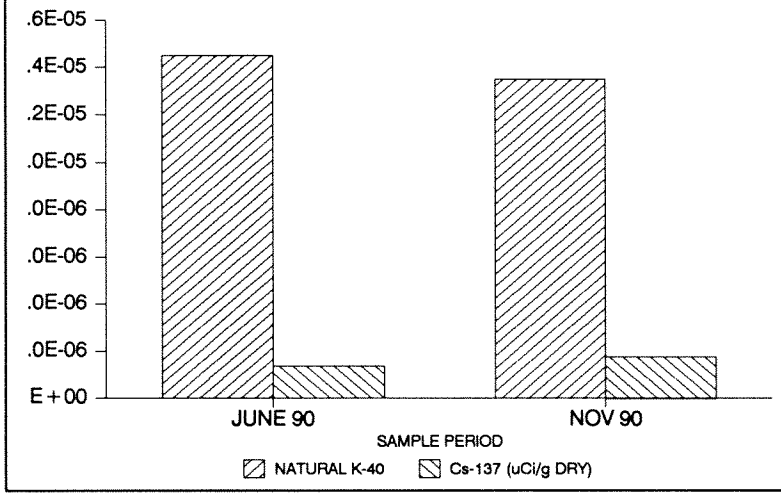


Figure 2 - 5

Comparison of cesium-137 and naturally occurring potassium-40 concentrations at downstream sampling location SFTCSED.

the downstream location nearest the Project (SFTCSED) indicates that cesium-137 is present at levels lower than naturally occurring gamma emitters.

2.1.3 Radioactivity in the Food Chain

Samples of fish and deer were collected near the site and from remote locations during periods when they would normally be taken by sportsmen for consumption. Milk and beef from cows grazing near the site and at remote locations, as well as hay, corn, apples, and beans were collected and analyzed during 1990. Locations of remote background samples are shown on Figure 2-6. The results of these sample analyses are found in Tables C-3.1 through C-3.4.

Fish

Fish samples are analyzed for strontium-90, cesium-134, and cesium-137. (See Table C-3.4 in Appendix C-3). Fish samples were collected semiannually during 1990 above the Springville dam from the portion of Cattaraugus Creek downstream of WNYNSC drainage (BFFCATC). Ten fish were collected from this section of the stream during each semiannual period and the strontium-90 content and gamma-emitting isotopes in flesh were determined. Fish samples (BFFCATD) were also taken from Cattaraugus Creek below the dam, including species that migrate nearly forty miles upstream from Lake Erie. These specimens were representative of sport fishing catches in the drainage downstream of the dam at Springville.

Control samples containing only natural background radiation provided comparisons with the concentrations found in fish taken from site-influenced waters. A similar number of fish were taken from waters that are not influenced by site runoff (BFFCTRL) and their edible portions were analyzed for the same isotopes. These control samples were representative of the species collected in Cattaraugus Creek downstream from the WVDP.

The only statistically significant results were obtained in the first half of 1990, with strontium-90 at concentrations of 1.1E-08 μ Ci/g (4.1 Bq/kg) wet weight in fish collected below the Springville dam. The background samples averaged 2.8 E-09 μ Ci/g (1.1Bq/kg).

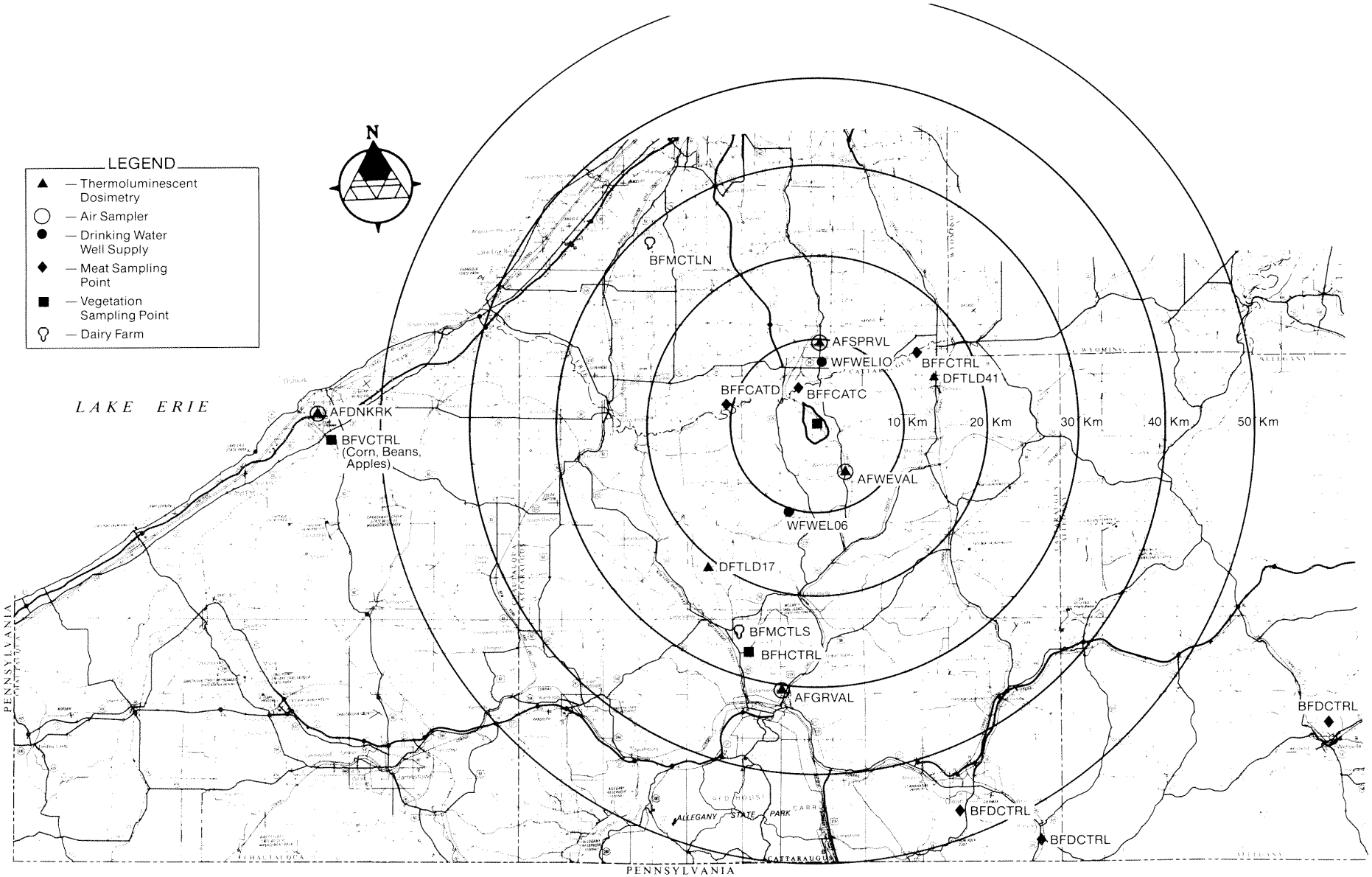
Venison

Specimens from an on-site deer herd were analyzed for radioactive components. (See Table C-3.2 in Appendix C-3). Historically, concentrations of radioactivity in deer flesh have been very low and site activities have not been shown to affect the local herd.

Meat and Milk

The concentration of strontium-90 in beef from the near-site farm appeared to be similar to the control samples. Cesium analysis of both samples yielded detection limit values. Historically, very little difference in isotope concentration has been observed between near-site and control herds.

Milk samples were taken in 1990 from dairy farms near the site (Fig. 2-7) and from control farms at some distance. Besides the quarterly composite sample from the maximally exposed herd to the north (BFMREED), an additional quarterly composite of milk was taken from a nearby herd to the northwest (BFMCOBO). Single samples were taken from herds to the south (BFMWIDR) and the southwest (BFMHAUR). Two samples from control herds (BFMCTLN and BFMCTLS) were also collected as quarterly composites. Each sample or composite was analyzed for strontium-90, tritium, iodine-129, and gamma-emitting isotopes (Table C-3.1). Strontium-90 in samples from near the site ranged from 3.3E-10 to 6.0E-09 μCi/mL (1.2E-02 to 2.2E-1 Bq/L). Iodine was not detected in any samples to the lower limit of detection (LLD) of 9.9E-10 μCi/mL(3.7E-2 Bq/L). Although tritium values above detection limites were observed in milk samples taken from near-site farms in 1990, higher values were observed in samples taken from distant control locations.



REF: NYSDOT, New York State Map — West Sheet, 1:250,000, Revised 1982

Figure 2-6. Sample Points in the WVDP Environs

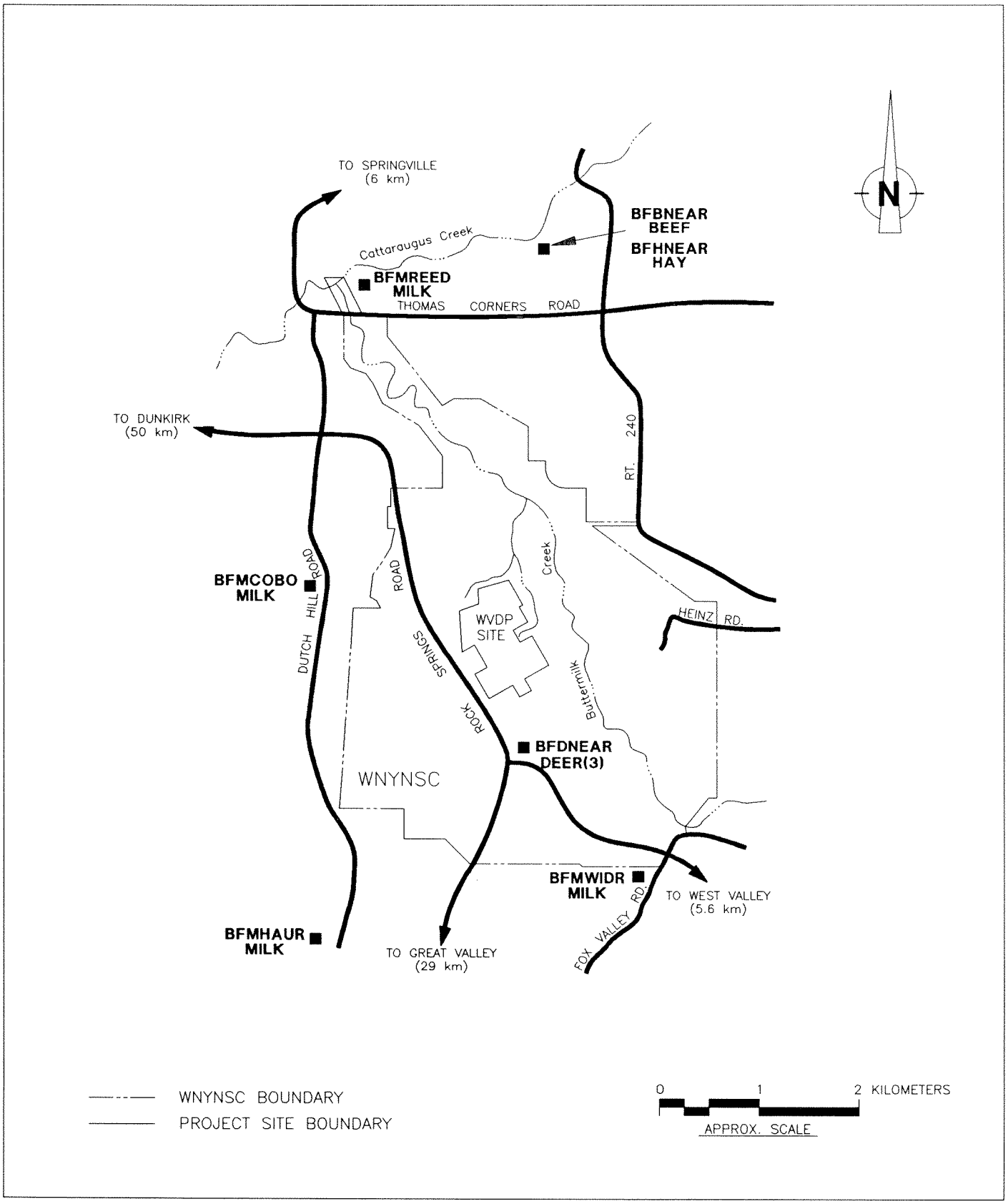


Figure 2-7. Biological Samples Taken Near the WVDP.

Fruit and Vegetables

Based on the samples analyzed in 1990 (Table C-3.3), there were no consistent differences in the concentration of tritium, strontium-90, or gamma-emitting isotopes in corn, beans, or apples grown either near the site or at remote locations.

2.1.4 Direct Environmental Radiation Monitoring

The current monitoring year, 1990, was the seventh full year in which direct penetrating radiation was monitored at the West Valley Demonstration Project using TL-700 lithium fluoride (LiF) thermoluminescent dosimeters (TLDs) located as shown on Figures 2-8, 2-9, and Fig. A-9 in Appendix A. The uncertainty of individual results and averages were acceptable and measured exposure rates were comparable to those of 1989. There were no significant differences in the data collected from the background TLDs (locations 17, 23, 37, and 41) and from those on the WNYNSC perimeter for the 1990 reporting period.

Dosimeters used to measure ambient penetrating radiation during 1990 were processed on-site. The system used Harshaw TL-700 LiF chips, which are used solely for environmental monitoring, apart from the occupational dosimetry TLDs. The environmental TLD package consists of five TLD chips laminated on a thick card bearing the location identification and other information. These cards are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure.

Monitoring points are located around the site's perimeter and access road, at the waste management units, at the inner facility fence, and at background locations remote from the WVDP site. Appendix C - 4 provides a summary of the results for each of the environmental monitoring locations by calendar quarter along with averages for comparison.

The quarterly averages and individual location results show very slight differences due to seasonal variation. The data obtained for all four calendar quarters compared favorably to the respective quarterly data in 1989 with no unusual situations observed. The sixteen perimeter TLD quarterly average was 19.7 milliroentgen (18.9 mrem) in 1990. A comparison of the perimeter TLD quarterly averages since 1983 is shown in Figure 2-10.

- On-site Radiation Monitoring

Presumably because of its proximity to the low-level waste disposal area, the dosimeter at location 19 showed a small elevation in radiation exposure compared to the WNYSC perimeter locations. Although above background, the readings are relatively stable from year to year. Location 25, on the public access road through the site north of the facility, also showed a small elevation above background because decontamination wastes are stored near location 24 within the inner facility fence. (See Appendix C-4, Table C-4.1.)

Location 24 on the north inner facility fence, like Location 19, is not included in the off-site environmental monitoring program; however, it is a co-location site for one NRC TLD (see Appendix D, Table D-7). This point received an average exposure of 0.63 milliroentgens (mR) per hour during 1990, down from 0.67 mR/hour observed in 1989 and 0.79 mR/hr in 1988. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby and the decrease in exposure rate reflects the radioactive decay of these materials. The storage area is well within the WNYNSC boundary (as is location 19) and is not readily accessible by the public.

TLDs 18 and 32 through 36, all located near the drum cell (storage) building, showed an increase in exposure rate. The average dose rate at these locations was 0.022 mR/hr in 1990, up from 0.015 mR/hr in 1989. This increase reflects 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 WNYSC boundary and are not readily accessible by the public.

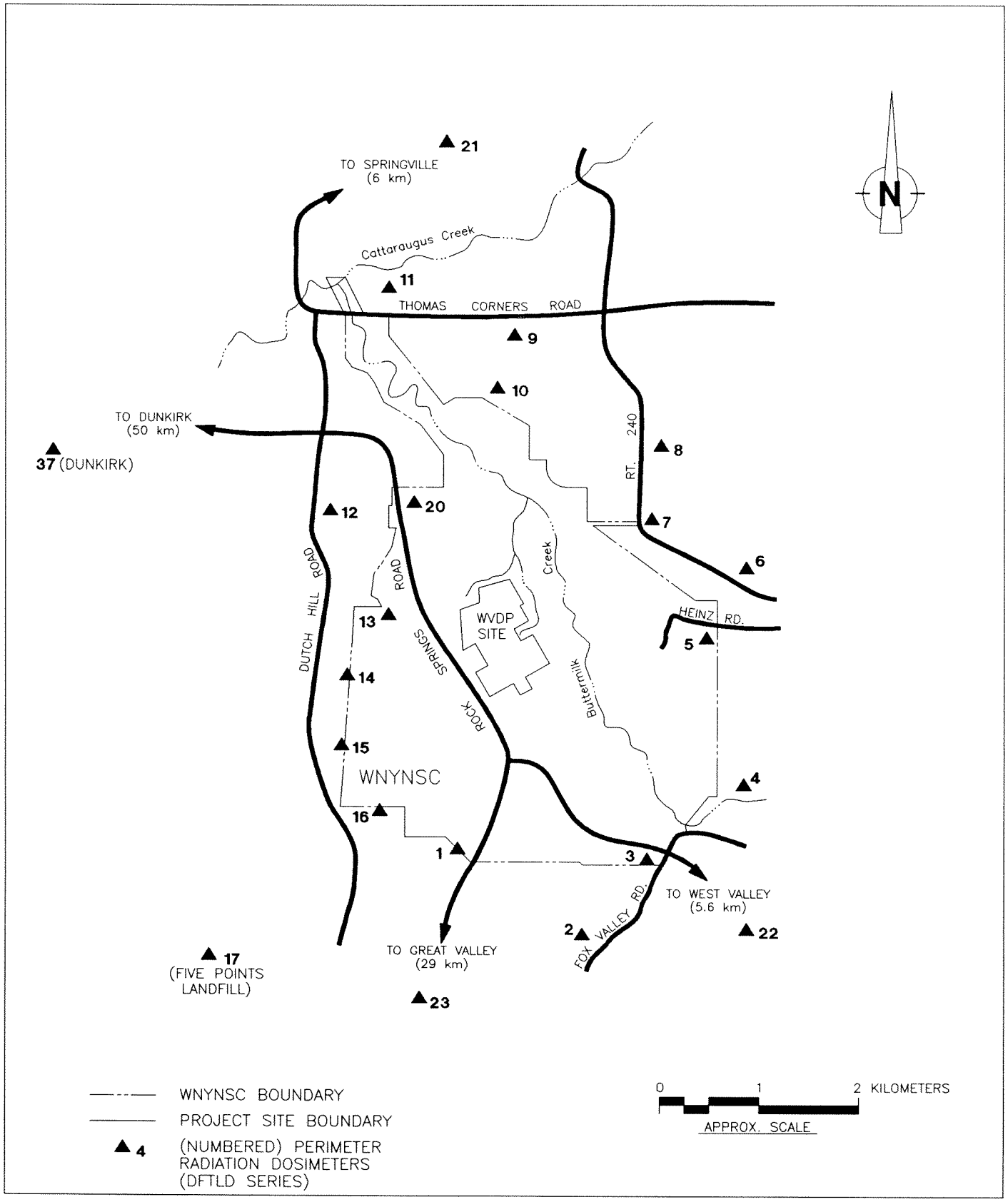


Figure 2-8. Perimeter Thermoluminescent Dosimetry (TLD) Locations.

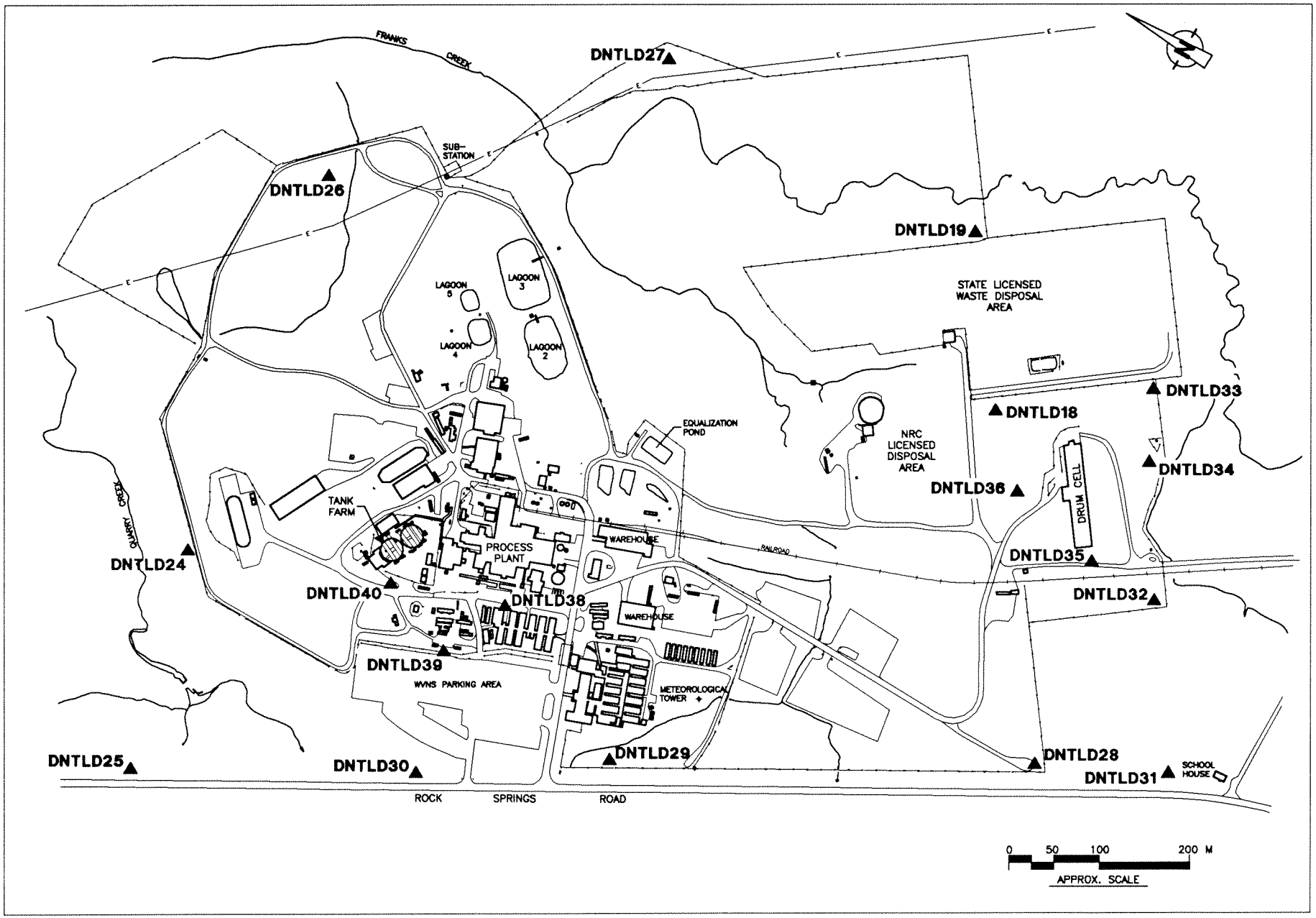


Figure 2-9. On-Site Thermoluminescent Dosimetry (TLD) Locations.

TLD locations 26 through 36 are located along the Project security fence, forming an inner ring of monitoring around the facility area. TLDs 38-40 monitor waste management units and on-site sources.

- Perimeter and Off-site Radiation Monitoring

The perimeter 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. 2-10) indicate no trends other than normal seasonal fluctuations. TLDs 17, 21-23, 37, and 41 monitor background locations. The results from these monitoring points are statistically the same as the perimeter TLDs. Figure C-4.1 in Appendix C-4 shows the TLD location average for off-site TLDs, and Figure C-4.2 shows the location average for on-site TLDs.

2.1.5 Meteorological Monitoring

Meteorological monitoring was conducted in 1990 at the WVDP to collect representative and verifiable data that characterize the local and regional climatology of the site. These data are used to assess potential effects of routine and nonroutine releases of airborne radioactive materials and to calculate dispersion models for any releases that may exceed DOE effluent limits.

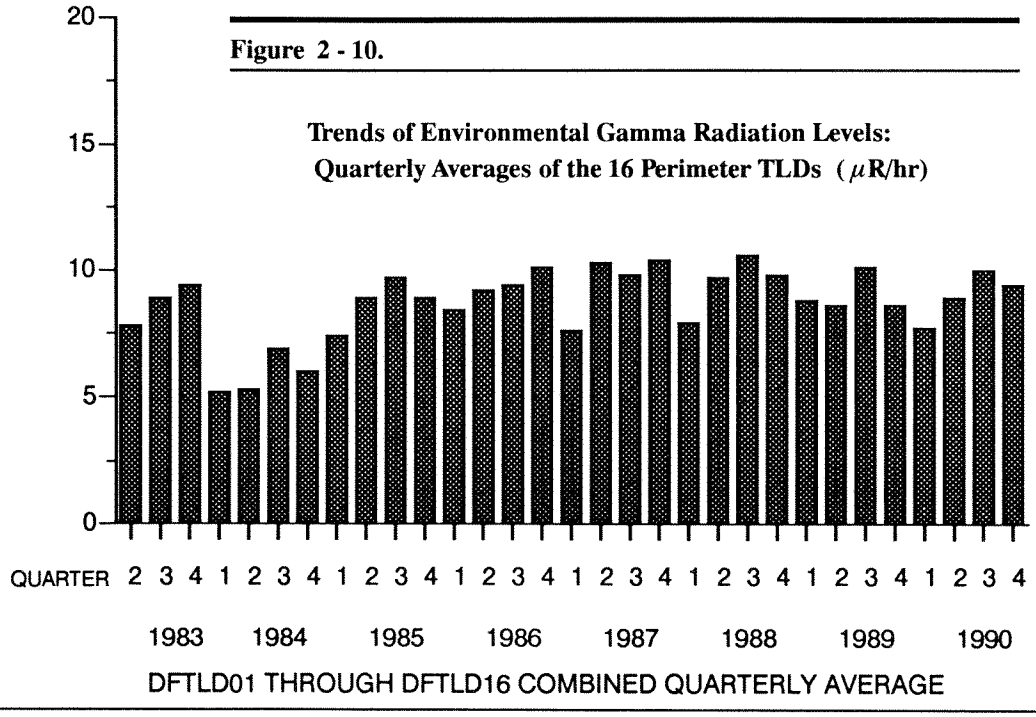
Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability, which is a function of the difference in temperature between the 10-meter and 60-meter elevations, these parameters are continuously monitored at the WVDP and are available to emergency assessment personnel at all times.

The on-site 60-meter meteorological tower continuously monitors wind speed, wind direction, and temperatures at 60-meter and 10-meter elevations. In addition, an independent, remote 10-meter meteorological tower is located approximately 5 miles south of the site on the top of Dutch Hill Road. This regional tower also continuously monitors wind speed and wind direction at the 10-meter elevation.

The two meteorological towers support the primary digital and analog data acquisition systems located within the Environmental Laboratory. All systems are run on line power

Figure 2 - 10.

Trends of Environmental Gamma Radiation Levels: Quarterly Averages of the 16 Perimeter TLDs (μR/hr)



with an uninterruptible power source battery backup in case of site power failure.

Mean wind speed and direction (wind frequency rose) figures for 1990 are found in Figures C-6.1 and C-6.2 in Appendix C-6.

A chart-recording microbarograph is located on-site in the Environmental Laboratory and a digital, tipping-bucket heated precipitation gauge is located near the site meteorological tower.

Cumulative total and weekly total precipitation data is found in Figures C - 6.3 and C - 6.4 in Appendix C - 6. The 1990 total of 53.5 inches of precipitation, which includes snow meltwater equivalent, was considerably higher than the 37.0 inches recorded in 1989. The 1990 totals for the WVDP are about 30% higher than the regional 41-inch precipitation average.

Meteorological information such as meteorological system calibration records, site log books and analog strip charts are archived off-site and are available for evaluation when needed. Meteorological towers and instruments are examined weekly for proper function and calibrated semiannually and/or whenever instrument maintenance might affect calibration.

2.1.6 Special Monitoring

IRTS Drum Cell Radiation Monitoring

During 1990 liquid high-level waste supernatant from tank 8D-2 was processed by the integrated radwaste treatment system (IRTS), which produced 3,850 71-gallon drums of cement-solidified waste. Approximately 6,200 drums were placed in the drum cell before 1990; approximately 10,000 drums are now stored in the drum cell.

Most of the gamma radiation emitted from these drums is shielded by the drum cell walls. Some radiation, however, is emitted through the unshielded roof of the drum cell, scatters in air, and adds to the naturally occurring gamma radiation background levels. Strength of the gamma-ray fields can vary considerably from day to day and season to season because of changes in meteorological conditions. Variability in background radiation levels depends on factors such as precipitation, solar activity, average temperature, humidity, and barometric pressure.

Radiation exposure levels were monitored both in the drum cell control room and at five points along a transect west of the drum cell. These five points ranged from a 2–foot distance from the drum cell wall to approximately 300 meters from the drum cell wall at Rock Springs Road, the closest accessible public location.

Baseline measurements were taken in 1987 and 1988 before the drums were stored in the cell. Two types of measurements were taken: instantaneous, using a high pressure ion chamber (HPIC), and cumulative, using thermoluminescent dosimeters (TLDs).

TLD measurements provide a much more accurate estimation of changes in the radiation field over extended periods of time than instantaneous measurements because they integrate the radiation exposure over an entire calendar quarter. Two sets of quarterly TLD measurements were taken at the Rock Springs Road locations nearest the drum cell. These locations are identified as TLD 28 and TLD 31 (see Fig. 2-9) and their measurements are found in Table C - 4.1 in Appendix C - 4.

To assess any increase in the gamma radiation field contributed at Rock Springs Road by the 10,000-plus drums in the drum cell, the two sets of four quarterly measurements were summed and averaged. An average annual exposure rate of 84 mR/yr was obtained. Compared to the pre-drum cell background rate of 86 mR/year recorded during 1987-1988, net contribution from the drum cell activities during 1990 cannot be distinguished from recorded annual variations in natural levels.

Investigation of Biological Radiological Transport

In April 1990 a combination of warm weather and optimum timing resulted in an unusually large insect hatch from one of the on-site liquid waste treatment ponds. A routine radiological

survey of sweepings containing flying adults attracted to facility lighting revealed detectable contamination. An investigation of the source of the insects confirmed that a large number (estimated to be several million) of midges of the *Chironomus* family had hatched from feed Lagoon 2 in the low-level waste treatment system.

Subsequent collection of midges and investigation of the holding pond conditions revealed that a plant ion exchange process adjustment initiated several years earlier had resulted in a pH change to the feed water. The feed water stabilized at a lower pH in which the *Chironomus* insects could thrive but that was still high enough to discourage predator insects. The midges had absorbed radioactivity by living in the contaminated feed water and had retained a detectable amount when they hatched to flying adults.

Contamination of individual insects could not be detected by direct counting. By analyzing a number of midges together, however, an estimate of the radioactivity contained in each insect was possible. About 2.6 picocuries of cesium-137 was calculated for each midge, with a maximum release of 30 μCi estimated for the overall hatch. Radiochemical analyses of the midges for strontium-90 and actinides showed the strontium-90 isotope to be fifty times less than the cesium-137 and the actinides to be three hundred times less than the cesium-137.

In comparison, one routine release from the treatment system at well below the Department of Energy DCG limits would contain four hundred times more radioactive material than the maximum estimated material transported out of the lagoon by this insect hatch. It was determined that the maximum potential radioactivity levels transported would not have exceeded reporting levels or action limits and that the release was of no consequence to the public health or environment.

The pH in Lagoon 2 was adjusted upward to discourage or prevent further insect hatches. As a long-term solution, several insecticide treatments and pond-covering methods were proposed. The effectiveness of the pH control, along with the practicality of other controls, will be evaluated during the 1991 calendar year.

Storage Facilities Air Sampling

Special air sampling at the West Valley Demonstration Project during the summer and fall of 1989 began a preliminary investigation to demonstrate compliance with DOE Draft Order 5400.6. Several enclosed radioactive waste storage areas on-site are not at present directly monitored with air sampling equipment by the Environmental Laboratory. They are, however, routinely monitored by the Radiation and Safety Department (R&S) for surface contamination and exposure rates. The study was designed to confirm that this monitoring by R&S is an appropriate practice and within established guidelines for the site.

The sampling method used in the study was similar to that used for routine sampler locations on- and off-site. The areas sampled were the lag storage building; the lag storage building, annex 1 (LSA-1); the lag storage building, annex 2 (LSA-2); the drum cell; the chemical process cell hardstand; the NRC-licensed disposal area (NDA) tent; and the NRC-licensed disposal area hazardous/mixed waste storage building (see Table 2-1).

All seven sites are diffuse sources and do not presently require NESHAPS applications. (A diffuse source is defined as an area source or a collection of point sources that discharge into the atmosphere.) In general, diffuse sources can be difficult to categorize. However, the locations in question here are all of similar geometry and structure.

The site also currently operates seven separate fixed point sources. (A point source is defined in DOE Draft Order 5400.6 as "a single defined point [origin] of an airborne release such as a vent or stack.") At present, all point sources on-site are continuously sampled by the Environmental Laboratory or R&S groups (see section 2.1.1 above).

Sampling and analysis methodologies followed current routine procedures. It was calculated that the sample volume needed to attain op-

timum detection levels would be approximately 500,000 liters. Two locations, however, were not supplied with electricity and so the volumes at those points were reduced to a four-day, thirty-two hour sample of 250,000 liters to accomodate the use of a portable electric generator.

The sampling train consisted of a 47-millimeter open-faced filter head, 3/8"copper tubing (where applicable after the filter head), a glass fiber filter (Gelman type A/E), a Rockwell calibrated dry gas meter and a 3/4 horsepower carbon vane vacuum pump. Filtered exhaust from the pump was passed through a desiccant column apparatus designed to absorb water vapor for tritium analysis. Flow through the desiccant column was 500 cc/min.

At each location the sampling equipment was placed in a spot judged to represent the area of highest possible contamination.

All seven glass fiber filter samples were counted for both gross alpha and beta and for gamma contamination. Water samples from the desiccant columns were analyzed for tritium. All samples were also given ample time to allow for the decay of naturally occurring radon daughters.

Background samples for alpha, beta, and gamma analysis were collected from the Dunkirk, New York sampling station, which collects background samples for the Environmental Laboratory's air monitoring program. The tritium background sampling station is in Great Valley, New York.

The background alpha/beta values for the week of May 29, 1990 are for a volume of 227,000 liters and the background tritium values are for 2,520 liters of air. The cesium-137 background value is also for the same location but for the fourth quarter composite from 1989 and has a volume of approximately 4 million liters of air. The effect of these high air volumes is that the minimum detection limit is lowered because the final analytical result must be divided by the total volume.

Several values reported for on-site diffuse sources are above the typical background values. However, almost all are still below the

Table 2-1
Storage Facilities Air Sampling Counting Results (μCi/mL air)

Location:	Alpha	Beta
LAG	3.38±0.88 E-15	7.51±1.29 E-15
LSA-1	5.92±1.78 E-15	9.73±2.49 E-15
LSA-2	1.17±0.31 E-14	2.18±0.44 E-14
Drum Cell	4.18±1.35 E-15	8.83±2.05 E-15
CPC Hardstand	2.09±0.45 E-14	3.03±0.54 E-14
NDA Tent	4.79±0.14 E-15	1.59±0.23 E-14
NDA Building	6.32±1.56 E-15	1.47±0.23 E-15
Background	2.53±2.53 E-16	7.72±2.50 E-15
	Cs-137	**H-3**
LAG	<1.4 E-14	5.66±0.57 E-12
LSA-1	<1.4 E-14	4.49±0.45 E-12
LSA-2	<1.4 E-14	5.97±0.60 E-12
Drum Cell	<1.4 E-14	6.83±0.68 E-14
CPC Hardstand	<1.4 E-14	2.19±0.22 E-12
NDA Tent	<1.4 E-14	6.03±0.60 E-12
NDA Building	<1.4 E-14	5.09±0.51 E-12
Background	<5.23E-16	1.62±0.16 E-12

most conservative derived concentration guides (DCGs) for radionuclides in air (see Appendix B). The DCG for gross alpha used at the WVDP site is 2E-14 mCi/mL (as for americium-241), the DCG for gross beta is 3E-12 mCi/mL (as for radium-228) and the DCG for tritium is 1E-7 mCi/mL. Because of the difficulty of sampling with a portable generator the CPC location had the lowest volume of air and the optimum detection levels were not achieved.

Solvent Contamination Monitoring

In November 1983, organic contamination was encountered in a USGS series-82 groundwater monitoring well near the NRC-licensed disposal area (NDA). Waste organic solvent composed of n-dodecene mixed with tributyl phosphate had been buried in tanks when the NFS, Inc. reprocessing facility had been operating. Wells were drilled from 1984 to 1986 to monitor and recover the solvent from the disposal area. The apparent movement of solvent away from the buried location in 1988 initiated more extensive monitoring and characterization of the area.

Changes in the organic solvent levels that were observed in some wells monitored in November 1989 by the WVNS waste management group renewed concerns of migration.

In December 1989 nonroutine sampling of wells 85-I-9, 89-5-N and 89-14-E was carried out to determine the chemical and radiological makeup of the solvent-contaminated groundwater. Well 85-I-9 is a 6-inch diameter PVC-cased well, while the remaining two are steel-cased 2-inch wells. These wells were selected because they had exhibited increases in organic levels.

Samples collected from the wells were submitted for a variety of analyses including volatile and semivolatile organics, pesticides, PCBs, and tributyl phosphate. A sufficient sample volume collected from well 85-I-9 allowed for additional testing. Metals, biological and chemical oxygen demand, water quality, and selected radiological and nonradiological parameters were included in the analyses.

Analytical results of an independent laboratory were presented in the 1989 site environmental report. Their findings yielded results below analytical detection limits with only a few exceptions (see the WVDP Site Environmental Report for Calendar Year 1989, Appendix E, Table E-15). Additional positive results for a variety of unknown compounds, mainly saturated hydrocarbons, were also reported. These findings support the belief that the detected compounds originated from the organic solvent used during reprocessing operations.

In response to the migrating organic solvent, an interceptor trench bordering the northeast and northwest boundaries of the NDA was installed in 1990. The trench, measuring approximately 250 meters (800 ft.) in length and having a maximum depth of 6.4 meters (21 feet), was constructed over an eighteen-month period. The purpose of the trench system is to intercept and collect any organic solvent leaching from the NDA. Once in the trench, the leachate will be routed to the liquid pretreatment system (LPS) where the solvent will be separated from the water and the water will be pretreated to remove iron and iodine-129. The remaining water will be directed to the LLWTF for further processing. This treatment system is scheduled to become operational in June 1991.

Liquid collected in the trench currently is being held in storage tanks and samples are removed for analyses before being pumped to Lagoon 2. At the present time no organics have been found in the trench collection system, indicating the solvent front has not yet reached the trench.

Monitoring of 85- and 89-series wells continued through 1990 by the WVNS waste management group. Wells are examined routinely for water and solvent level. Several new 90-series wells located along the northeast corner of the NDA were sampled in 1990 for selected parameters, including analysis for volatile organics. The results, as determined by a subcontracted laboratory, indicated no volatile organic contamination.

Monitoring of critical wells and liquid drainage to the trench will continue in an effort to track the migration patterns of the solvent leachate. The liquid pretreatment system (LPS) will be capable of handling an estimated flow rate of 11 liters (3 gal.) per minute through the trench. This would result in an annual treatment of approximately 6 million liters (1.6 million gal.) of contaminated water.

The interceptor trench and LPS will be operated within the limits of DOE orders and other applicable state and federal regulations. The system as a whole has been designed and is being operated in such a manner as to prevent the spread of organic solvent into the surface waters of New York State.

2.2 Nonradiological Monitoring

2.2.1 Air Monitoring

Nonradiological emission and plant effluents are controlled and permitted under New York State and U.S. Environmental Protection Agency regulations. The regulations that apply to the WVDP are listed in Table B-2 in Appendix B. The individual air permits held by the WVDP are identified and described in Table B - 3.

The nonradiological air permits are for minor sources of regulated pollutants that include particulates, nitric acid mist, oxides of nitrogen, and sulfur. However, because of their insignificant concentrations and small mass discharge, monitoring of these parameters currently is not required.

2.2.2 Surface Water Monitoring

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The regulations that apply to the WVDP are listed in Appendix B. The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook and that specifies the sampling and analytical requirements for each outfall (Fig. 2-11). This permit was modified in 1990 to include additional monitoring requirements at outfall WNSP001 (see Table B-3, Appendix B).

Three outfalls are identified in the permit: outfall 001, discharge from the low-level waste treatment facility (LLWTF); outfall 007, discharge from the sanitary and utility effluent mixing basin; and outfall 008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons. The conditions and requirements of the current SPDES permit are summarized in Table C-5.1 in Appendix C-5.

The most significant features of the SPDES permit are the requirements to report data as flow-weighted concentrations and to apply a net discharge limit for iron. The net limit allows for subtraction of incoming naturally present amounts of iron from the Project's effluent. The flow-weighted limits apply to the total discharge of Project effluents but allow maximum credit for dilute waste streams in determining compliance with effluent concentration limits specified in the permit.

The SPDES monitoring data for 1990 are graphically displayed in Figures C-5.2 through C-5.36 in Appendix C-5. The WVDP reported a total of nine noncompliance episodes in 1990 (Table C-5.2). These are described above in the Environmental Compliance Summary: Calendar Year 1990.

2.2.3 Special Monitoring

1,1,1 Trichloroethane Detection Investigation

Routine groundwater samples are collected from a seepage point (WNGSEEP) located on the west bank of Frank's Creek immediately east of the northeast corner of the site perimeter. It has been monitored for volatile organic compounds since October 1989. (See Figures 3-4 and 3-5 in Chapter 3.0, Groundwater Monitoring, for locations of on-site groundwater monitoring points.) During routine groundwater monitoring activities in 1990, measurable levels of 1,1,1-trichloroethane (1,1,1-TCA) were detected in samples collected from WNGSEEP (Fig. 2-12).

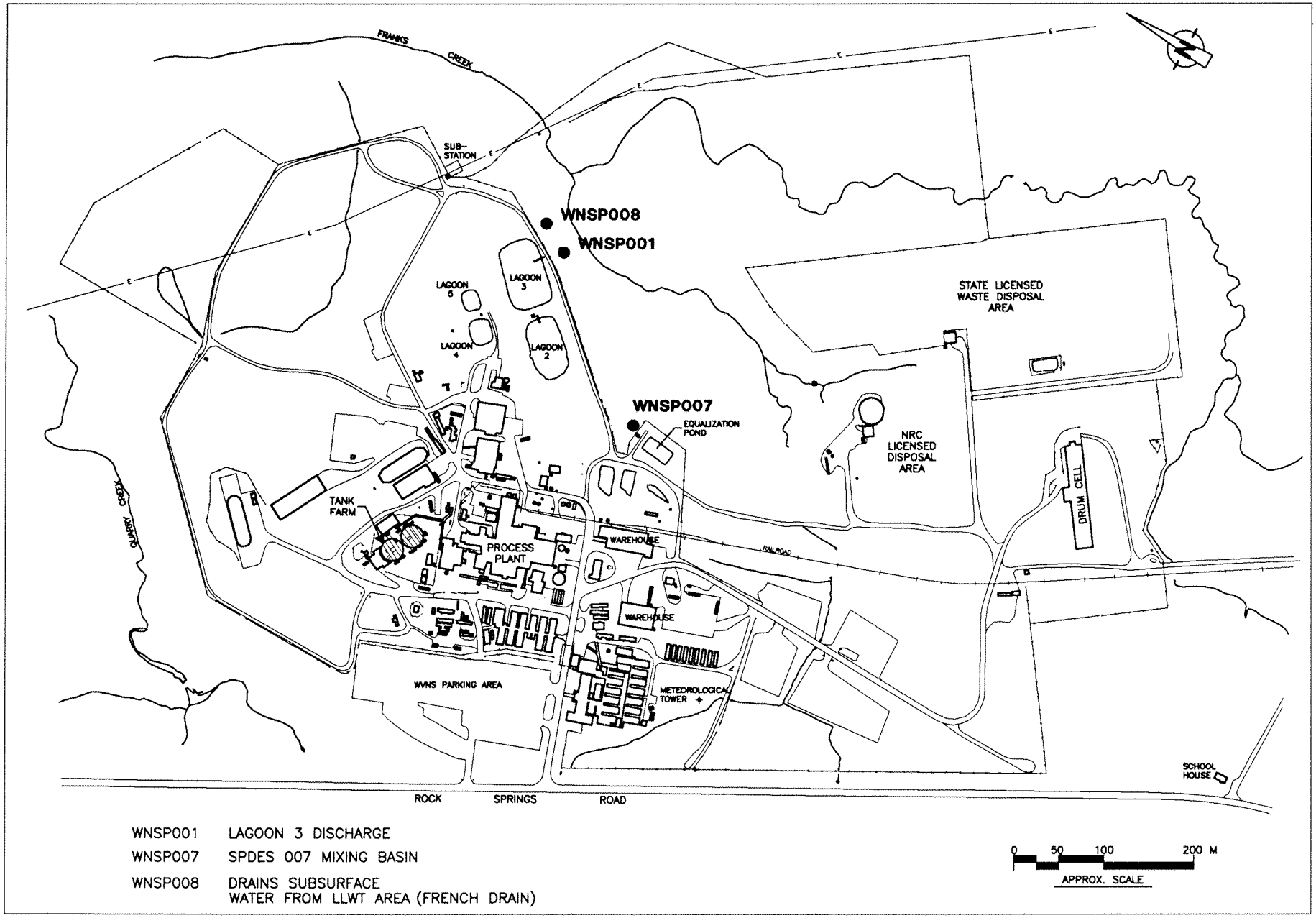


Figure 2-11. SPDES Monitoring Points.

A measurable level of 1,1,1-TCA was detected for the first time when WNGSEEP was sampled on April 24, 1990. Before this, 1,1,1-TCA was not detected above the method detection limit in any of the groundwater monitoring wells. This first detection of 1,1,1-TCA was confirmed when volatile organic analysis results from June 6, 1990 and June 14, 1990 sampling showed measurable concentrations of this compound.

In response to the consistent detection of 1,1,1-TCA in WNGSEEP, a series of samples was taken on June 28, 1990 at three locations: Frank's Creek upstream of WNGSEEP influence; Frank's Creek downstream of WNGSEEP influence; and downslope of WNGSEEP, approximately three feet above Frank's Creek. The results suggest that 1,1,1-TCA is not detectable in WNGSEEP water as it runs down the bank towards Frank's Creek or in Frank's Creek itself either upstream or downstream of WNGSEEP.

During another sampling on July 9, 1990, samples were collected in the immediate vicinity of WNGSEEP (SEP101) to characterize the potential effect of the PVC pipe, the mechanism from which WNGSEEP water flows, and to provide further insight into the loss of 1,1,1-TCA after the water emerges from the ground and begins to run downhill towards Frank's Creek (SEP102). The results suggest that the PVC pipe does not have an effect on 1,1,1-TCA concentrations and that 1,1,1-TCA is not detectable in water collected very near to the outlet of WNGSEEP. (See Fig.2-12 for a graphical representation of 1,1,1-TCA in WNGSEEP during 1990).

An HNU organic vapor analyzer was also used to investigate the power substation area, which is believed to be upgradient of WNGSEEP. The HNU did not detect any organic vapors originating from the substation area.

Five soil gas measurements were also made by collecting soil gas samples with a gas-tight syringe and analyzing the collected gas with GC/MS. Three samples were collected in the vicinity of the construction and demolition debris landfill, and two samples were collected near the location of WNGSEEP. The sample in the immediate vicinity of WNGSEEP was the only one to show detectable levels of 1,1,1-TCA.

Estimated calculations have shown that any quantities of 1,1,1-TCA released from the site are well below the reportable quantities listed in federal regulations (40 CFR, part 302, July 1, 1989 edition). No source of the 1,1,1-TCA has yet been identified.

1,1-Dichloroethane

During October 1989 samples from groundwater monitoring wells were collected and analyzed for volatile organic compounds. The analysis indicated positive detections of 1,1-dichloroethane in three groundwater monitoring wells at levels greater than the

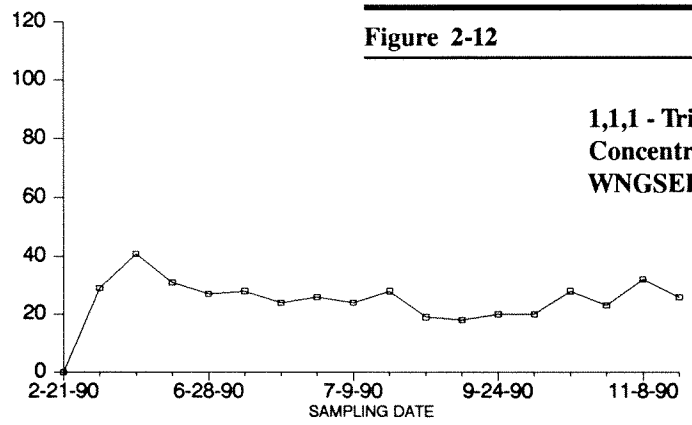


Figure 2-12

1,1,1 - Trichloroethane Concentrations in WNGSEEP - 1990 (μg/L)

analytical detection limit of 5 μg/L. These wells, WNW86-09, WNW86-12, and WNWN-1 exhibited concentrations ranging from 6.5 μg/L to 18.5 μg/L. This trend continued through 1990 in WNW86-09 and WNW86-12, with concentrations ranging between 6.5 μg/L and 14 μg/L. The remaining groundwater wells that were monitored in 1990 lacked positive detections of 1,1-dichloroethane above method detection limits, suggesting there is no widespread contamination of this compound throughout the site. The source of the 1,1-dichloroethane has not been identified.