M-32

Department of Energy
Ohio Field Office
West Valley Demonstration Project
P.O. Box 191
West Valley, NY 14171

To The Reader:

This report, prepared by the U.S. Department of Energy West Valley Demonstration Project (OH/WVDP), summarizes the environmental protection program at the West Valley Demonstration Project (WVDP) for calendar year 1998. In the interest of conveying this information as soon as possible, this report has been made available to the public by the end of May 1999, well ahead of the official due date of October 1, 1999.

Monitoring and surveillance of the WVDP facilities used by the DOE are conducted in order to protect public health and safety and the environment. The quality assurance protocols applied to the environmental monitoring program by the DOE ensure the validity and accuracy of the monitoring data. Also included in this report are groundwater and ambient air data from the New York State Energy Research and Development Authority's (NYSERDA) New York State-licensed Disposal Area (SDA).

Air, surface water, groundwater, soil, and biological samples are collected and analyzed for radiological and nonradiological constituents in order to evaluate the potential effects of activities at the WVDP: Calculated doses to the hypothetical maximally exposed off-site individual from air- and waterborne radiological releases in 1998 were less than one percent of the DOE limit. Radionuclide concentrations in biological samples were at levels near to or statistically identical to background concentrations.

Results of nonradiological (chemical) tests of surface water and soil samples showed no effects on the off-site environment. Nonradiological liquid effluent releases are controlled and permitted through the New York State Pollutant Discharge Elimination System (SPDES). Releases in 1998 were below regulatory limits with no exceptions.

In June 1998 the Project completed the first phase of its mission as authorized by the U.S. Congress in 1980. Achieving this objective was a major Project milestone. Monitoring of the vitrification off-gas emissions and the facility ventilation system have verified that the dose received by off-site residents continues to be minimal.

If you have any questions or comments about the information in this report, please contact the West Valley Nuclear Services Company (WVNS) Manager of Public and Employee Communications, John D. Chamberlain, at (716) 942-4610 or fill out the enclosed questionnaire and receive a free pen made of recycled materials.

Sincerely,

B. A. Mazurowski, Director
West Valley Demonstration Project

NMSS01Public

Rec'd at DCD from NMSS on 11/1/00

SUMMARY OF CHANGES
TO THE 1998 WVDP SITE ENVIRONMENTAL REPORT
FROM
THE 1997 SITE ENVIRONMENTAL REPORT

This report, prepared by the U.S. Department of Energy (DOE) West Valley Demonstration Project Office, summarizes the environmental protection program at the West Valley Demonstration Project (WVDP) for calendar year 1998. Monitoring and surveillance of the facilities used by the DOE for the WVDP are conducted in order to protect public health and safety and the environment. The quality assurance protocols applied to the environmental monitoring program by the DOE ensure the validity and accuracy of the monitoring data. Also included in this report are groundwater and ambient air data from the New York State Energy Research and Development Authority's (NYSERDA) New York State-licensed Disposal Area (SDA).

To assist readers familiar with past WVDP annual Site Environmental Reports, changes in format and content for the 1998 report have been summarized below.

Format Changes

- Appendices have been reorganized and relabeled alphabetically.

- Sample location maps have been taken from the text and moved to Appendix A.

Content Revisions and Additions

- The Compliance Summary has been updated to reflect the 1998 regulatory compliance status.

- Implementation of a plan to integrate environmental, safety, and health management procedures at the WVDP, in association with the Integrated Safety Management System (ISMS), is discussed in the Environmental Compliance Summary.

- Data and text have been updated throughout the report to reflect the calendar year (CY) 1998 environmental monitoring program and compliance status. Tables, graphs, and maps have been updated, including sampling locations, analytes, and frequencies. Some photographs and references have been updated.

- Graphs of performance indicators presented in Chapter 1 were updated to include the 1998 performance results.

- Changes to the environmental monitoring program are summarized at the beginning of Appendix B. Note that Appendix B now describes the 1998 Environmental Monitoring Program.

- Chapter 1 describes continued successful operation of the WVDP vitrification facility in 1998. The completion of the Project's production phase (Phase I) in June 1998 was a major milestone. The new low-level waste treatment facility began operations in April 1998.

- Chapter 2 includes a discussion of 1998 radiological results from air emissions and from water effluents from the site as compared to DOE concentration guides. It also compares 1998 results from near-site locations to results from background locations in order to evaluate effects of site activities.

• Chapter 3 was updated to summarize and discuss results of the 1998 groundwater monitoring program, including continued monitoring for strontium-90 in the north plateau, special monitoring for gross beta and tritium at points near the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA), and issuance of the final report on a study of chromium and nickel in the sand and gravel unit.

• Chapter 4 provides an assessment of dose to the general public resulting from exposure to radiation and radionuclides released by the Project to the surrounding environment in 1998 and briefly discusses completion of the deer drive that moved the on-site herd off the WVDP premises.

• Chapter 5 was updated to include 1998 changes to the WVDP quality assurance program. In 1998 the NRC stopped placing thermoluminescent dosimeters (TLDs) co-located with WVDP TLDs as an independent verification of environmental radiation levels measured through the WVDP environmental monitoring program.

• Tables in the reorganized appendices were relabeled and text references changed. Data in the appendices were updated to reflect results of 1998 measurements.

Special Issues

• WVDP initiatives in response to the 1998 Clean Water Action Plan continued. For the first time since the DOE began operations at the WVDP in 1982 no State Pollutant Discharge Elimination System (SPDES) exceedances were noted.

• No unplanned radiological releases to the off-site environment occurred in 1998.

• Removal of the resident deer herd from inside the security-fenced area was successfully completed and monitored in the spring of 1998.

• A special assessment of environmental monitoring program hardware and software for year-2000 compliance was completed in July 1998.

• The Citizen Task Force issued its final report regarding preferred closure alternatives in July 1998.

• The site SPDES permit was administratively renewed without changes by the New York State Department of Environmental Conservation (NYSDEC) and was issued to the West Valley Nuclear Services Co. (WVNS) in September 1998. A draft SPDES permit including storm water monitoring, submitted for public comment in June 1997, is still pending.

• The NRC proposed decommissioning criteria for the WVDP in October 1998.

ERRATA and CORRIGENDA

West Valley Demonstration Project
Site Environmental Report
Calendar Year 1997

Strontium-90 calculations: During 1998 a flaw in decay-correction calculations during analysis of strontium-90 by a vendor laboratory was identified. The calculations were subsequently corrected and the affected strontium-90 values were updated. These new values were reviewed to assess any effects on radiological dose assessment values reported in the 1995 and 1996 Site Environmental Reports. The average increase in strontium-90 values was 6% for both 1995 and 1996. The radiological dose assessments for 1995 and 1996 were unaffected, with the exception of an approximate 1% increase in the 1995 estimated dose equivalent to the maximally exposed individual. This 1% increase was attributable to changes in air effluent data; values for strontium-90 in liquid effluents were not affected. All strontium-90 values generated after 1996 were corrected before the 1997 report was issued.

Uranium calculations: A problem with uranium isotope calculations by the same vendor laboratory also was detected in December 1998. The values reported were higher than the true values and affected samples from 1995 through 1998. Most concentrations did not differ by more than 0.5%, causing no change in the dose assessment. Corrections to the calculations for calendar year 1998 have been made and updated values have been entered in the database.

The vendor laboratory's software was surveilled and corrective actions to be taken by April 30, 1999 were identified. These actions have been substantially completed as of the date of publication of this report.

Other:

	Location	*Analyte*	*1997 Report Read*	*Should Read*
Page C2-15:	2nd Quarter	Total U	0.00±0.00E+00	0.00±8.49E-06
Page C5-8:	Outfall 001	Hexavalent Chromium	Chromium IV	Chromium VI

Any questions or comments about the corrigenda noted here may be directed to the Manager of Public and Employee Communications, John D. Chamberlain, West Valley Nuclear Services Company, at (716) 942-4610.

READER OPINION SURVEY

The purpose of the annual Site Environmental Report is to accurately present in one comprehensive report the environmental monitoring data collected during the year. It is intended for use by all interested citizens, agencies, and organizations.

Organizing the large amount of data in a way that is easy to use and understand is a challenge. We would like your comments on the format of this year's report and any ideas or suggestions you have on how we might make it better.

Please answer the following questions, then fold along the dotted lines, tape or staple shut, and drop it in the mail. The form is preaddressed for your convenience. Respondents will receive a free pen made of recycled materials. If you wish, you may also make suggestions and comments (subject: SER comments) via the web to the Public and Employee Communications e-mail address at http://www.wv.doe.gov/contact.html.

Thank you for completing this survey. Your comments will help us to serve you better.

WHAT INFORMATION IS EASIEST TO FIND/UNDERSTAND?

____

WHAT INFORMATION IS MOST DIFFICULT TO FIND/UNDERSTAND?

____

IS THERE ANY INFORMATION THAT SHOULD BE ADDED OR DELETED?

____

HOW MIGHT WE CHANGE THE REPORT TO MAKE IT EASIER TO FIND AND/OR INTERPRET INFORMATION? PLEASE BE SPECIFIC.

____

OPTIONAL

DO YOU WISH TO RECEIVE A FREE PEN MADE OF RECYCLED MATERIALS? ______ NUMBER IN HOUSEHOLD: ______

NAME: ______________________________

MAILING ADDRESS: ______________________________

____

AFFILIATION (IF APPLICABLE): ______________________________

YOUR INTEREST IN THE SITE ENVIRONMENTAL REPORT IS: ☐PROFESSIONAL ☐PERSONAL ☐ACADEMIC

Thank you!

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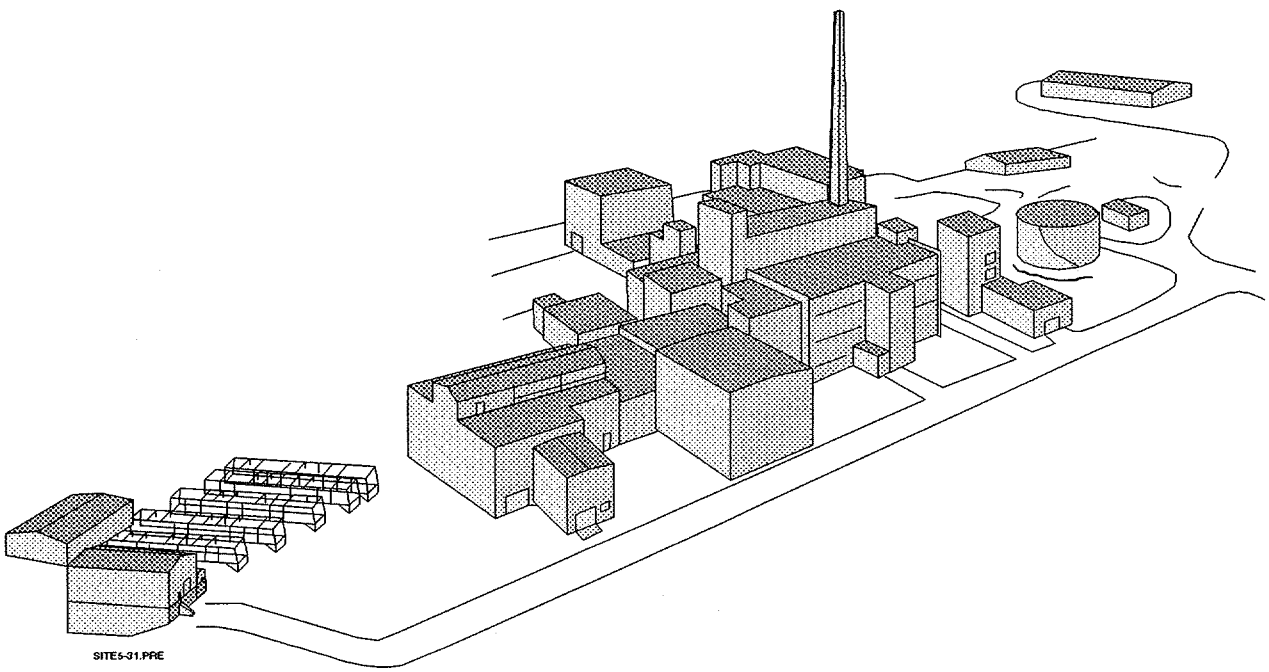
WEST VALLEY DEMONSTRATION PROJECT
SITE ENVIRONMENTAL REPORT
CALENDAR YEAR 1998



West Valley Nuclear Services Company
and
Dames & Moore

Prepared for:
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Ohio Field Office
West Valley Demonstration Project
Under Contract DE-AC24-81NE44139

June 1999
10282 Rock Springs Road
West Valley, New York 14171-9799

West Valley Demonstration Project

Site Environmental Report

for

Calendar Year 1998

Prepared for the U.S. Department of Energy

Ohio Field Office

West Valley Demonstration Project Office

under contract DE-AC24-81NE44139

June 1999

West Valley Nuclear Services Co.

10282 Rock Springs Road

West Valley, New York 14171-9799

Preface

Environmental monitoring at the West Valley Demonstration Project (WVDP) is conducted by the West Valley Nuclear Services Company (WVNS) under contract to the U.S. Department of Energy (DOE). The data collected provide an historical record of radionuclide and radiation levels from natural and manmade sources in the survey area. The data also document the quality of the groundwater on and around the WVDP and the quality of the air and water discharged by the WVDP.

This report represents a single, comprehensive source of off-site and on-site environmental monitoring data collected during 1998 by environmental monitoring personnel. The environmental monitoring program and results are discussed in the body of this report. The monitoring data are presented in the appendices. Appendix A contains maps of on-site and off-site sampling locations. Appendix B is a summary of the site environmental monitoring schedule. Appendices C through J contain summaries of data obtained during 1998 and are intended for those readers interested in more detail than is provided in the main body of the report. Appendix K lists the environmental permits and regulations pertaining to the WVDP. Appendix L lists data from the New York State-licensed Disposal Area.

Requests for additional copies of the 1998 Site Environmental Report and questions regarding the report should be referred to the Public and Employee Communications Department, 10282 Rock Springs Road, West Valley, New York 14171 (telephone: 716-942-4610). The report also is available electronically at http://www.wvdp.com under the Westinghouse/WVNS Site Contractor WVDP History page.

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CHAPTER 4. RADIOLOGICAL DOSE ASSESSMENT

Because of the difficulty of directly measuring any dose contributed by the WVDP to the off-site environment and the public, computer models are used to calculate dose estimates. Estimates are based on concentrations of radionuclides measured in air and water collected from on-site effluent points.

CHAPTER 5. QUALITY ASSURANCE

The West Valley Demonstration Project's quality assurance program certifies that sample collection and analyses are consistent, precise, and accurate.

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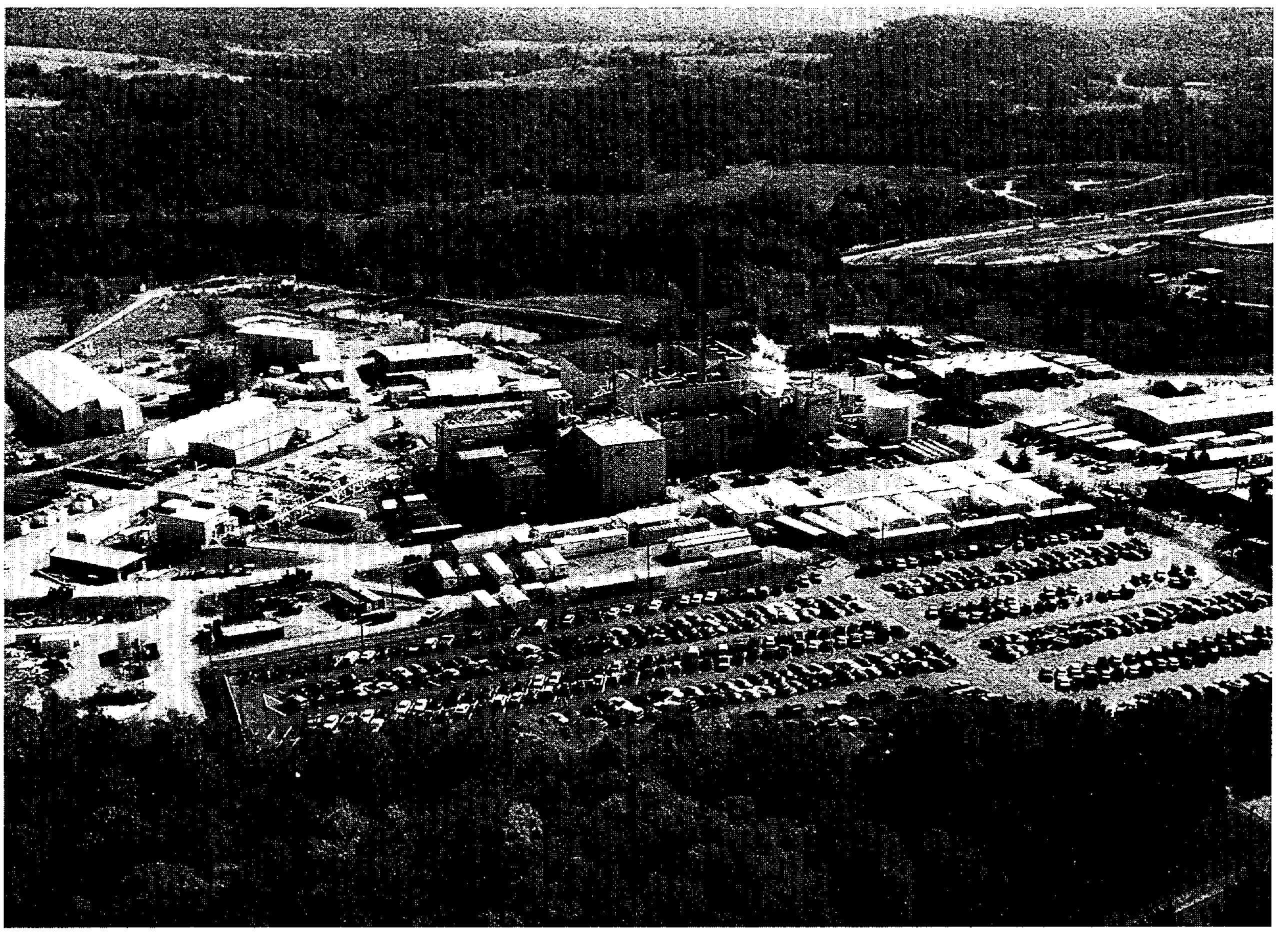

The West Valley Demonstration Project

EXECUTIVE SUMMARY

Project Description

The West Valley Demonstration Project (WVDP), the site of a U.S. Department of Energy (DOE) environmental cleanup activity operated by West Valley Nuclear Services Co. (WVNS), is in the process of stabilizing liquid high-level radioactive waste that remained at the site after commercial nuclear fuel reprocessing had been discontinued. The Project is located in Western New York State, about 30 miles south of Buffalo, within the New York State-owned Western New York Nuclear Service Center (WNYNSC). The WVDP's current focus is on stabilizing the remaining high-level waste, which is stored in underground tanks, in containers suitable for temporary storage on-site and for eventual transport to a federal repository. In 1998 the Project successfully completed the Phase I milestone for vitrification of high-level liquid radioactive waste into a durable, solid glass form.

Compliance

Management at the WVDP continued to provide strong support for environmental compliance issues in 1998. DOE Orders and applicable state and federal statutes and regulations are integrated into the Project's compliance program. Highlights of the 1998 compliance program were as follows:

- No State Pollutant Elimination Discharge (SPDES) permit limits were exceeded in 1998.

- No notices of violation from any environmental regulatory agencies were received by the WVDP in 1998.

- Inspections of hazardous waste activities by the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (EPA) verified Project compliance with the applicable state and federal regulations.

- The Project continued to monitor specific waste management areas at the site in order to comply with the Resource Conservation and Recovery Act (RCRA) 3008(h) Administrative Order on Consent.

- The Project also met the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA) by identifying information

A reader opinion survey has been inserted in this report. If it is missing, please contact Public and Employees Communications at (716) 942-4610. Additional Project information is available on the Internet at http://www.wvdp.com.

about hazardous materials used at the Project and making this information available to the local community. All EPCRA reporting deadlines were met ahead of schedule in 1998.

- The SPDES permit currently identifies four permitted liquid outfalls at the Project. A draft SPDES permit to monitor eleven identified storm water outfalls was issued for public comment in June 1997, and a final permit is expected to be issued to the WVDP in 1999.

- Among other pollution-prevention accomplishments, waste minimization goals for 1998 were exceeded in all but two of the waste categories set in the one-year goals statement. The WVDP continues to exceed expectations for the five-year waste-minimization goals.

- In accordance with the Site Treatment Plan developed under the Federal Facility Compliance Act, all calendar year 1998 milestones for the characterization, treatment, and disposition of radioactive mixed waste at the WVDP were completed.

- An integrated environmental, safety, and health (ES&H) management system was developed, implemented, and validated in 1998.

- There were no accidental off-site releases of radiological material in 1998.

Environmental Monitoring Program

Throughout the first two years of vitrification, specific, sustained attention was given to environmental monitoring and assessment of effluents from changing site operations. In 1998 Project environmental scientists continued to sample and measure effluent air and water, groundwater, surface streams, soil, sediment, vegetation, meat, milk, and game animals, and to record environmental radiation measurements. More than 11,000 samples were collected in order to assess the effect of site activities on public health, safety, and the environment.

The Project's environmental monitoring network is continually being evaluated and updated to ensure that all the locations and sample types that would be sensitive to process-related changes are monitored. Samples are tested for radioactivity or nonradioactive substances using approved laboratory procedures. Both the laboratory test results and direct measurement data are reviewed at several stages for quality and for comparison with similar data.

As environmental data are entered in the controlled database they are automatically compared to upper and lower acceptance values. Data points falling outside these values are brought to the attention of WVDP scientists for further investigation. WVDP scientists assess all data points and evaluate trends at key locations.

Air Monitoring. WVDP airborne radiological emissions in 1998 included six routinely operated permitted exhaust points and four exhausts excluded from permitting because of their low emission potential. As anticipated, radioactive releases from the Project in 1998 were far below the most restrictive limits that ensure public health and safety. Operating the vitrification process resulted in radiological air releases similar to those noted in the last few months of 1997. The dose from 1998 air emissions was about 0.4% of the most restrictive limit. In 1997 the dose from these emissions was about 0.5%.

Although several fission products contribute to the radioactivity, the most significant continued to be airborne iodine-129, a long-lived radionuclide that exists in gaseous form at the high temperatures of the vitrification process and that is not fully removed during treatment of the air effluent. The 1998 levels of gaseous iodine-129 emissions were slightly lower than 1997 levels. Total radionuclide emissions remained less than

1% of the EPA radionuclide emissions standard of 10 millirem (mrem) per year effective dose equivalent to the maximally exposed off-site individual. Approximately 99% of the 1998 calculated dose to the public is attributable to iodine-129 emissions from the vitrification process.

Six air samplers on the perimeter of the WNYNSC and four in more distant locations continuously collect samples of air at the average human breathing height. The samples are tested for radioactivity carried by airborne particles. At two of the ten locations test samples are collected for analysis of tritium and iodine-129.

Gross radioactivity (airborne particulate) in 1998 air samples from around the perimeter was within the historical range of radioactivity measured at remote background locations or nearby communities. Gross radioactivity at the nearest perimeter sampler remained the same in 1998 as in 1997. Concentrations in samples from three on-site ambient air samplers located near waste storage facilities operated during 1998 also were far below any applicable limits.

Nitrogen oxides, nonradiological byproducts of the vitrification process, are monitored as part of the emission-control process. A single occurrence of nitrogen oxide emissions briefly exceeded the New York State opacity standard, but no permit limit was violated. Although there are a number of permitted air-emissions sources at the Project, none release a sufficient quantity of nonradiological material to warrant continuous monitoring as a condition of a regulatory permit.

Surface Water Monitoring. 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 release outfall. The treated effluent water flows into Erdman Brook, which joins Frank's Creek just before exiting the Project's fenced area. Six treated batches totaling 11.5 million gallons were released over a combined thirty-nine day period in 1998. In 1997, 11.6 million gallons were released.

The combined average concentration of all radionuclides in liquid releases from lagoon 3 in 1998 was approximately 23% of the DOE derived concentration guide (DCG), which is used to evaluate liquid process discharges. (See Chapter 1, p.1-5, for an explanation of derived concentration guides.) The average radioactivity concentrations from 1994 to 1997 were 44%, 43%, 35%, and 22% of the DCG, respectively. The reduction over this period is mostly attributable to steadily decreasing strontium-90 concentrations. The other major contributor to the total combined liquid effluent DCG is uranium-232, which averaged 10% of its DCG in 1998, about 15% lower than in 1997.

Surface water is continually sampled on the Project premises by four automatic samplers: Time-composite samples are collected at Frank's Creek where it exits the Project, at two other on-site points where drainage flows off-site, and at a drainage point near the former radioactive waste disposal areas. Samples also are collected periodically at nine other points of drainage from facility areas. The data from these samples are used to determine the type, amount, and probable origin of both radiological and nonradiological contaminants.

As in 1997, the most notable source of gross beta and strontium-90 radioactivity in surface water in 1998 was from groundwater migrating beneath the north plateau and emerging as seepage to join the surface water drainage from the north plateau into Frank's Creek and thence off-site. (See Fig.A-2 in Appendix A [p.A-4].) This drainage point has been carefully monitored since the contaminated seep was identified in 1993. A groundwater recovery and treatment system currently is being used to reduce the seepage of strontium-90 to surface water on the north plateau. The strontium-90, which originates from pre-Project operations, was about 1.4 times the DCG for liquid discharges in 1998. The 1997 strontium-90 concentration at this point was 1.1 times the DCG. The increase in the 1998 strontium-90 concentration at the northeast swamp drainage may be linked to groundwater beyond the influence of the recovery system.

Soil and Stream Sediments. Surface soil is collected annually near the ten air sampler locations in order to track long-term deposition. Sediments from off-site creeks are collected annually from three downstream and two upstream locations. Three on-site drainage areas are also sampled annually in order to track waterborne movement of contaminants.

Surface soil samples in 1998 showed little change from previous years. For the most part, except for one area that historically has shown average cesium-137 concentrations above background values and one area northeast of the WVDP, the concentrations of radionuclides normally present in soil from both worldwide fallout and from Project air emissions are no different at near-site locations than at background locations. Because of pre-Project releases from nuclear fuel reprocessing activities, the concentrations of cesium-137 in downstream creek sediments have been historically above concentrations in the upstream sediments. However, sediment samples at one downstream location did show a marked decrease in 1998 from historical values as a result of an unusually high June flood. The thirteen-year graph (see Fig.2-4, p.2-12) indicates no upward trends at either upstream or downstream points. No changes were noted in on-site soil/sediment samples between 1998 and previous years.

Groundwater Monitoring. Groundwater samples were collected as scheduled from seventy-two on-site locations in 1998. Computerized screening of 1998 data speeded identification and evaluation of changes. Monitoring activities in 1998 included gathering more detailed information about the north plateau strontium-90 contamination. The 1998 groundwater program confirmed that strontium-90 is still the major contributor to elevated gross beta contamination in the plume on the north plateau. The concentrations of other isotopes were below the DCG levels generally applied to surface water.

In addition to collecting samples from wells, groundwater was routinely collected from seeps on the bank above Frank's Creek along the northeastern edge of the north plateau. Results of radiological anlayses indicate that gross beta activity from the north plateau plume has not migrated to the seepage area.

As in previous years, near-site residential water-supply wells sampled during 1998 were within the historical range of values measured at the background well.

Vegetation, Meat, and Milk. Test results from near-site samples of beans, apples, corn, hay, beef, and milk were consistent with results noted in previous years. No site-related effects were detected.

Game Animals. Fifty fish specimens from Cattaraugus Creek were collected in 1998 for testing. Ten of these were from below the Springville dam, including species that migrate up from Lake Erie. Two semiannual sample sets of ten fish each were collected downstream of Buttermilk Creek, which receives Project liquid effluents, and two sets were collected upstream. These samples represent sportfishing species and bottom-feeding indicator species. Testing for gamma-emitting isotopes and strontium-90 showed levels similar to those in 1997 samples.

Three samples of whitetail deer venison from a near-site (WNYNSC) herd were tested for gamma-emitting isotopes and strontium-90. Control deer samples more than thirty miles away from the site also were collected in 1998. A comparison of near-site and control samples reflects some variation in low levels of radioactivity from cesium-137, strontium-90, and naturally occurring potassium-40. (A person eating 100 pounds of meat from near-site deer would receive 0.20 mrem, which is 500 times less than the DOE 100 mrem dose standard.) Although results vary from year to year, data from the last eight years show no statistical differences between radionuclide concentrations in near-site and control vension samples.

Special samples also had been collected in 1997 from an on-site herd of approximately fifty deer that was moved from inside the facility fence. Calculation of cesium-137 concentrations indicated that there would be no detectable differences between background cesium-137 concentrations and cesium-137 concentrations in venison from this herd in the fall of 1998, during deer hunting season. In 1998, the fifth year of public access to portions of the WNYNSC for deer hunting, fifty-two deer were taken by hunters during the hunting season.

Program Quality

The WVDP environmental program is designed to produce high quality, reliable results. To maintain this standard, each scientist must give continuous attention to the details of sample handling, following approved collection and analysis procedures and data review. In addition to a formal self-assessment review just before vitrification start-up, the WVDP environmental laboratory also continued the practice of analyzing radiological crosscheck samples sent from a national laboratory. Of 158 radiological analyses performed at both the on-site Project laboratory and off-site commercial service laboratories, 96% were within the control limits. Forty of forty-one samples tested on-site at the Project environmental laboratory (98%) were within acceptable limits. Seventeen of the twenty-three nonradiological check samples tested at an off-site laboratory were within acceptable limits.

Although no formal external audits of the environmental program were conducted in 1998, test results from the crosscheck program, self-assessments, and comparisons of co-located sample measurements taken by independent agencies such as the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC) indicate that high quality standards are being met. The WVNS Environmental Affairs and the Quality Assurance departments periodically conducted and documented reviews of program activities in 1998.

Notable 1998 Events

The major event during 1998 was the continued successful operation of the WVDP vitrification facility and completion of Phase I, a major milestone. Operational tracking of various effluents occupied most of the year. Removal of the resident deer herd from inside the security-fenced area was successfully completed and monitored.

Dose Assessment

There were no events affecting public health and safety or the environment associated with Project operations in 1998. The small amounts of radioactive materials that were released were assessed and doses were calculated using approved computer modeling codes. These evaluations included calculations of doses received from the consumption of game animals and locally grown food. Airborne doses were calculated using CAP88-PC, an EPA-approved computer code. The result was a maximum dose to an off-site individual of 0.034 millirem (mrem). The limit is 10 mrem. Doses from the liquid pathway to the maximally exposed person were estimated to be 0.008 mrem from Project effluents (excluding north plateau drainage). The north plateau drainage contribution to the total liquid dose was estimated to be an additional 0.023 mrem. The predicted dose from all pathways was less than 0.07 mrem, or 0.07% of the 100-mrem DOE limit.

Conclusion

The West Valley Demonstration Project conducts extensive monitoring of on-site facilities and the surrounding environment. This program fulfills federal and state requirements to assess the effect of Project activities on public health and safety and the environment. In addition to demonstrating compliance with environmental regulations and directives, evaluation of data collected in 1998 indicated that Project activities pose no threat to public health, safety, or the environment.

INTRODUCTION

History of the West Valley Demonstration Project

In the early 1950s interest in promoting peaceful uses of atomic energy led to the passage of an amendment to the Atomic Energy Act that allowed the Atomic Energy Commission to encourage commercialization of nuclear fuel reprocessing as a way of developing a civilian nuclear industry. The Atomic Energy Commission made its technology available to private industry and invited proposals for the design, construction, and operation of reprocessing plants.

In 1961 the New York State Office of Atomic Development acquired 1,332 hectares (3,340 acres) near West Valley, New York and established the Western New York Nuclear Service Center (WNYNSC). Davison Chemical Co., together with the New York State Atomic Research and Development Authority, which later became the New York State Energy Research and Development Authority (NYSERDA), constructed and began operating a nuclear fuel reprocessing plant under a co-license issued by the Atomic Energy Commission. Nuclear Fuel Services, Inc. (NFS) was formed by Davison Chemical Co. to operate the plant as a commercial facility. NFS leased the property at the WNYNSC and in 1966 began operations to recycle fuel from both commercial and federally owned reactors.

In 1972, while the plant was closed for modifications and expansion, new and more rigorous federal and state safety regulations were imposed. Most of the changes concerned the disposal of high-level radioactive liquid waste and the prevention of earthquake damage to the facilities. NFS decided that compliance with the new regulations was not economically feasible and in 1976 notified NYSERDA that it would not continue in the fuel reprocessing business.

Following this decision, the reprocessing plant was shut down. Under the original agreement between NFS and New York State, the state was ultimately responsible for both the radioactive wastes and the facility. Numerous studies followed the closing, leading eventually in 1980 to the passage of Public Law 96-368, the West Valley Demonstration Project Act, which authorized the U.S.Department of Energy (DOE) to demonstrate a method for solidifying the 2.3 million liters (600,000 gal) of liquid high-level waste that remained at the West Valley site. Congress anticipated that the technologies developed at West Valley would be used at other facilities in the United States.

West Valley Nuclear Services Co. (WVNS), a subsidiary of Westinghouse Electric Corporation, was chosen by the DOE to be the management and operating contractor for the West Valley Demonstration Project (WVDP). The WVDP Act specifically states that the facilities and the high-level radioactive waste on-site shall be made available (by the state of New York) to the DOE without the transfer of title for as long as required for the completion of the Project.

The purpose of the WVDP is to solidify the high-level radioactive waste left at the site from the original nuclear fuel reprocessing activities, develop suitable containers for holding and transporting the solidified waste, arrange transportation of the solidified waste to a federal repository, dispose of any Project low-level and transuranic waste resulting from the solidification of high-level waste, and decontaminate and decommission the Project facilities.

The high-level waste was contained in underground storage tanks and had separated into two layers, a liquid supernatant and a settled sludge layer. Various subsystems were constructed that permitted the successful startup in May 1988 of the integrated radwaste treatment system (IRTS). The system removed most of the radioactivity from the liquid supernatant, allowing the major portion of the liquid to be treated as low-level waste. Treatment of the supernatant liquid from the high-level waste tanks through the IRTS was completed in 1990.

The next step in the process, washing the sludge with water to remove soluble constituents, began in late 1991 and was completed in 1994. (See Chapter 1, Environmental Monitoring Program Information [p.1-6], for a more detailed description.) In 1995, the contents of the high-level waste tanks were combined and the subsequent mixture washed a final time. Vitrification of the high-level waste residues began in July 1996. In June 1998 the WVDP successfully completed the first phase of the vitrification campaign. Currently the WVDP is conducting the second phase of vitrification, which involves removing and solidifying the high-level wastes remaining in the tanks.

Purpose of this Report

This annual environmental monitoring report is published to inform WVDP stakeholders about environmental conditions at the WVDP. The report presents a summary of the environmental monitoring data gathered during the year in order to characterize the performance of the WVDP's environmental management, confirm compliance with standards and regulations, and highlight significant programs.

The geography, socioeconomics, climate, ecology, and geology of the region are principal factors in assessing possible effects of site activities on the surrounding population and environment and are an integral consideration in the design and structure of the environmental monitoring program.

Description of the West Valley Demonstration Project

The WVDP is located about 50 kilometers (30 mi) south of Buffalo, New York (Fig. 1 [*facing page*]). The WVDP facilities occupy a security-fenced area of about 80 hectares (200 acres) within the WNYNSC. This fenced area is referred to as either the Project premises or the restricted area.

The WVDP is situated on New York State's Allegheny plateau at an average elevation of 400 meters (1,300 ft). The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within 8 kilometers (5 mi) of the plant. Several roads and a railway pass through the WNYNSC, but the public does not have access to the WNYNSC. Generally, hunting, fishing, and human habitation on the WNYNSC are prohibited. A NYSERDA-sponsored pilot program to control the deer population, initiated in 1994, continued in 1998.

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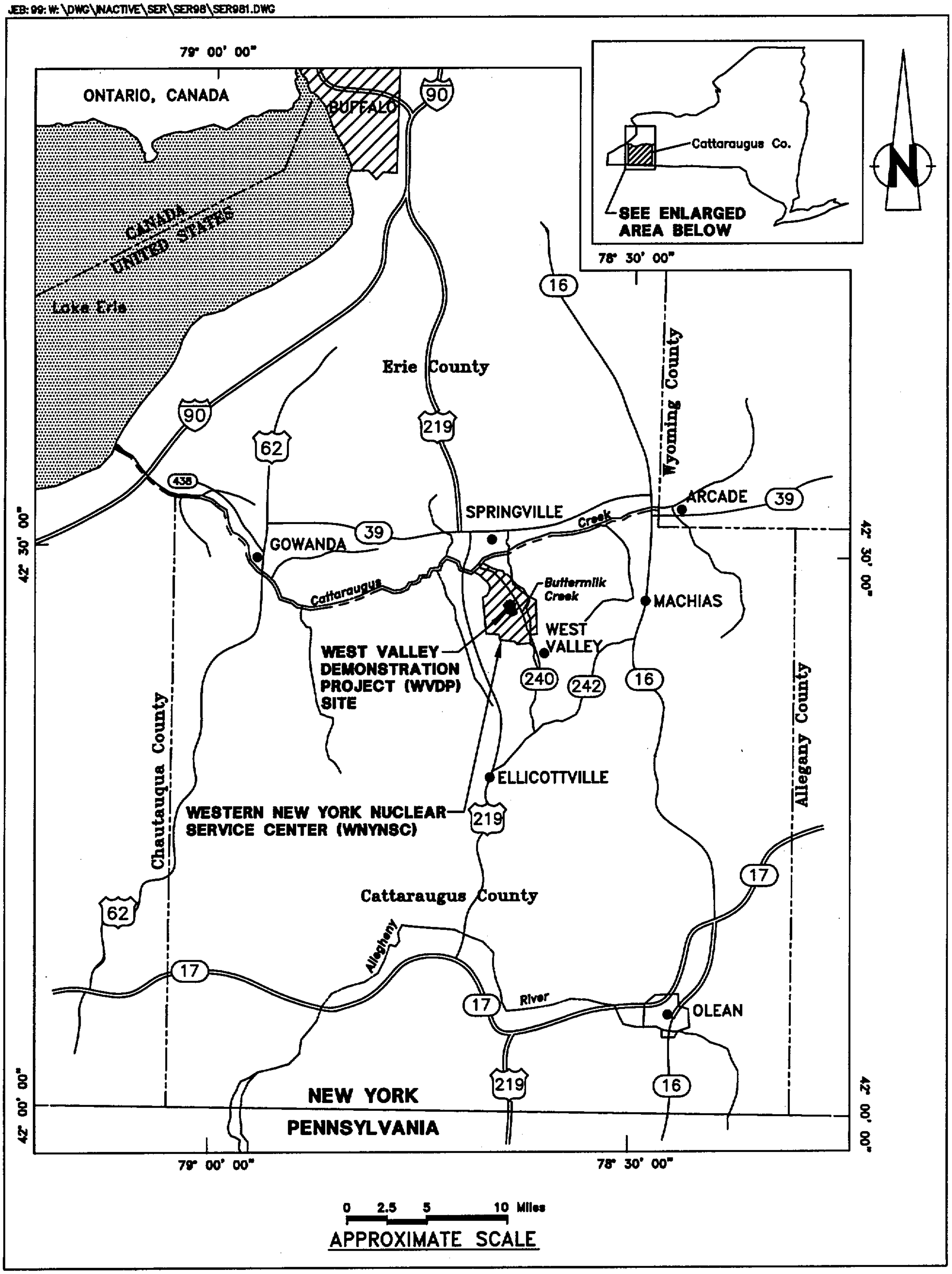


Figure 1. Location of the Western New York Nuclear Service Center.

Limited hunting permits were issued to local residents, and community response continued to be favorable.

Socioeconomics. The WNYNSC lies within the town of Ashford in Cattaraugus County. The nearby population, approximately 9,200 residents within 10 kilometers (6.2 mi) of the Project, relies primarily on an agricultural economy. No major industries are located within this area.

The land immediately adjacent to the WNYNSC is used principally for agriculture and arboriculture. Cattaraugus Creek is used locally for swimming, canoeing, and fishing. Although some water to irrigate nearby golf course greens and tree farms is taken from Cattaraugus Creek, no public water supply is drawn from the creek downstream of the WNYNSC before the creek flows into Lake Erie near Buffalo, New York. Water from Lake Erie is used as a public water supply.

Climate. Although there are recorded extremes of 37°C (98.6°F) and -42°C (-43.6°F) in Western New York, the climate is moderate, with an average annual temperature of 7.2°C (45.0°F). Rainfall is relatively high, averaging about 104 centimeters (41 in) per year. Precipitation in 1998 totaled 109 centimeters (43 in). Precipitation is evenly distributed throughout the year and is markedly influenced by Lake Erie to the west and, to a lesser extent, by Lake Ontario to the north. Regional winds are generally from the west and south at about 4 m/sec (9 mph).

Biology. The WNYNSC lies within the northern deciduous forest biome, and the diversity of its vegetation is typical of the region. Equally divided between forest and open land, the site provides a habitat especially attractive to white-tailed deer and various indigenous birds, reptiles, and small mammals. No species on the federal endangered-species list are known to be present on the WNYNSC.

Indigenous Small Mammal (Marmota monax)

Geology and Groundwater Hydrology. The WVDP site is located on the west shoulder of a steep-sided glacially scoured bedrock valley that is filled with a sequence of glacial sediments. (See Figs.3-1 and 3-2 [p.3-3] in Chapter 3, Groundwater Monitoring.) The WVDP site is bordered by two stream valleys (Frank's Creek and Quarry Creek) and divided by a third stream valley (Erdman Brook) into two portions, the north and south plateaus. (See Figs.A-6 through A-8 [pp.A-8 through A-10] in Appendix A.)

The uppermost layer of glacial sediments on the south plateau consists of a silty clay till, the Lavery till. The Lavery till does not transmit significant quantities of water except where it is exposed at ground surface, where weathering has fractured the near-surface soils. Groundwater flow in the weathered till has both a vertically downward component and a horizontal component to the northeast. Groundwater flow in the unweathered portion of the till, beneath the exposed weathered till, is predominantly downward.

On the north plateau a permeable alluvial sand and gravel layer overlies the less permeable glacial sequence of sediments (i.e., the Lavery till, the Kent recessional sequence, and the Kent till). Groundwater flow in the sand and gravel unit of the north plateau is predominantly horizontal, towards the northeast, discharging to seeps and streams along the plateau's edge and via evapotranspiration.

Within the Lavery till on the north plateau is a silty, sandy unit of limited extent, the Lavery till-sand. Gradients indicate that groundwater flows east-southeast. Surface discharge points have not been observed.

The Kent recessional sequence that underlies the Lavery till beneath both north and south plateaus is composed of silt and silty sand with localized pockets of gravel. Groundwater flow in the Kent recessional sequence is also towards the northeast and discharges ultimately to Buttermilk Creek.

Information in this Report

Individual chapters in this report provide information on compliance with regulations, general information about the monitoring program and significant activities in 1998, summaries of the results of radiological and non-radiological monitoring, calculations of radiation doses to the population within 80 kilometers (50 mi) of the site, and information about practices that ensure the quality of environmental monitoring data. Graphs and tables are included to illustrate important trends and concepts. The bulk of the supporting data is found in the appendices following the text. Page numbers are provided in the text wherever such information is noted.

Appendix A contains maps showing on-site and off-site sampling locations.

Appendix B summarizes the 1998 environmental monitoring program at the on-site (i.e., on the WNYNSC) and off-site locations. Samples are designated by a coded abbreviation indicating sample type and location. (A complete listing of the codes is found in the index to Appendix B [pp.B-v through B-vii].) Appendix B lists the kinds of samples taken, the frequency of collection, the parameters analyzed, the location of the sampling points, and a brief rationale for the monitoring activities conducted at each location.

Appendices C through I summarize radiochemical and chemical analytical data from air, surface water, groundwater, fallout in precipitation, sediment, soils, and biological samples (meat, milk, food crops, and fish), and from direct radiation measurements and meteorological monitoring.

Appendix J provides data from the comparison of results of analyses of identically prepared samples (crosscheck samples) by both the WVDP and independent laboratories. Radiological concentrations in crosscheck samples of air, water, soil, and vegetation are reported here, as are chemical water quality parameters.

Appendix K provides a list of radiation protection standards set by the DOE that are most relevant to the operation of the WVDP. It also lists federal and state laws and regulations that affect the WVDP and the environmental permits held by the site in 1998.

Appendix L contains groundwater monitoring data for the New York State-licensed disposal area (SDA), provided by NYSERDA.

The Glossary and the References sections are intended to help the reader with the scientific and technical terminology used in this report.

Acronyms. Acronyms often are used in technical reports to speed up the reading process. Although using acronyms can be a practical way of referring to agencies or systems with long, unwieldy names, having to look up rarely used acronyms can defeat the purpose of using them. Accordingly, full names of agencies and systems have been used in this report where it will help the reader. However, common acronyms that the reader is apt to recognize (e.g., DOE, EPA, NRC, NYSDEC, NYSERDA) or that are used often in this report (e.g., WVDP, WNYNSC) are spelled out only at the beginning of sections. A list of acronyms is provided at the end of this report.

Environmental Monitoring Program

The WVDP's environmental monitoring program began in February 1982. The primary program goal is to detect changes in the environment resulting from Project activities and to assess the effect of any such changes on the human population and the environment surrounding the site.

The monitoring network and sample collection schedule have been structured to accommodate specific biological and physical characteristics of the area. Among the several factors considered in designing the environmental monitoring program were the kinds of wastes and other byproducts resulting from the processing of high-level waste; possible routes that radiological and nonradiological contaminants could follow into the environment; geologic, hydrologic, and meteorologic site conditions; quality assurance standards for monitoring and sampling procedures and analyses; and the limits and standards set by federal and state governments and agencies. As new processes and systems become part of the Project, appropriate additional monitoring is provided. As processes are completed, unnecessary monitoring may be eliminated from the program.

Monitoring and Sampling. The environmental monitoring program consists of on-site effluent monitoring and on- and off-site environmental surveillance in which samples are measured for both radiological and nonradiological constituents. (See the Glossary [p.3] for more detailed definitions of *effluent monitoring* and *environmental surveillance*.) Monitoring and surveillance include both the continuous recording of data and the collecting of soil, sediment, water, air, and other samples at specific times.

Monitoring and sampling of environmental media provide two ways of assessing the effects of on-site radioactive waste processing. Monitoring generally is a continuous process of measurement that allows rapid detection of any changes in the levels of constituents that could affect the environment. Sampling is the collection of media at scheduled times; sampling is slower than direct monitoring in indicating changes in constituent levels because the samples must be analyzed in a laboratory to obtain data. However, sample analysis allows much smaller quantities of radioactivity to be detected.

Permits and Regulations. Data gathering, analysis, and reporting to meet stringent federal and state requirements and standards are an integral part of the monitoring program. The current program meets the requirements of DOE Orders 5400.1 (General Environmental Protection Program), 5400.5 (Radiation Protection of the Public and Environment), and 231.1 (Environment, Safety, and Health Reporting), and DOE Regulatory Guide DOE/EH-0173T (Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance).

The WVDP holds a State Pollutant Discharge Elimination System (SPDES) permit as required by the New York State Department of Environmental Conservation (NYSDEC), which regulates liquid effluent discharges containing nonradiological pollutants. The SPDES permit identifies the outfalls where liquid effluents are released to surface water drainage systems and specifies the sampling and analytical requirements for each outfall. It also specifies that concentrations of radionuclides at these outfalls must meet the requirements of DOE Orders 5400.1 and 5400.5.

Radiological air emissions must comply with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations. Depending upon the potential to emit radionuclides, some radiological emission points must be permitted by the Environmental Protection Agency (EPA). In addition, the site operates under state-issued air discharge permits for nonradiological plant emissions.

For more information about air and SPDES permits see the Environmental Compliance Summary: Calendar Year 1998 (pp.ECS-8 and ECS-10). Environmental permits are listed in Appendix K (pp.K-5 and K-6).

Exposure Pathways Monitored at the West Valley Demonstration Project. The major near-term pathways for potential movement of contaminants away from the site are by surface water drainage and airborne transport. For this reason the environmental monitoring program emphasizes the collection of air and surface water samples. Samples are collected on-site from locations such as plant ventilation stacks, various water effluent points, and surface water drainage locations. Analyses of samples of air, water, soils, and biota from the environment surrounding the site would detect any radioactivity that might reach the public from site releases. Extensive groundwater monitoring addresses the subsurface pathway.

Water and Sediment Pathways. Process waters are treated in a series of on-site lagoons before being discharged through a single outfall. (The locations of the lagoons are noted on Fig.A-2 [p.A-4] in Appendix A.) Samples of this process water and the effluent at two other discharge points are collected in accordance with permit requirements. The samples are analyzed for radiological parameters, including gross alpha and gross beta, tritium, strontium-90, and gamma-emitting radionuclides, and for nonradiological parameters, including pH. Additional analyses of composite samples determine metals content, solids, biochemical oxygen demand, nitrates, nitrites, ammonia, sulfate, organic chemicals, and specific radionuclides.

In general, on-site groundwater and surface water samples are collected regularly and analyzed, at a minimum, for gross alpha and gross beta radioactivity, tritium, and pH. Selected samples are analyzed for conductivity, chlorides, metals, volatile organic compounds, and other parameters. Potable water on the site is analyzed monthly for radioactivity and annually for chemical constituents. Residential drinking water wells located near the site are sampled annually and analyzed for gross alpha and gross beta radioactivity, tritium, gamma-emitting radionuclides, pH, and conductivity.

Off-site surface waters, primarily from Cattaraugus Creek and Buttermilk Creek, are sampled upstream of the Project for background radioactivity and downstream to measure possible Project contributions. Sediments deposited downstream of the facility and at upstream background locations are collected annually and analyzed for gross alpha, gross beta, and specific radionuclides. (See Appendix C [pp.C-3 through C-24] for water and sediment data summaries.)

Groundwater Pathways. Groundwater discharge at the WVDP site occurs as springs, seeps along stream channels, direct discharge to streams, evapotranspiration, vertical groundwater outflow, and discharge to artificial draining systems and lagoons. All of these discharges vary with the seasons. Discharge from springs and seeps is highest during the spring. Evapotranspiration is at a maximum during the summer. Groundwater discharge is, in general, lowest during the winter because the ground surface is frozen, which minimizes recharge.

Routine monitoring of groundwater includes sampling for contamination and radiological indicator parameters and specific analytes of interest such as volatiles, semivolatiles, metals, and radionuclides at particular monitoring locations. (See Table E-1 [p.E-3] in Appendix E.)

Air Pathways. Permitted effluent air emissions are continuously monitored for alpha and beta activity. Alarms indicate any unusual rise in radioactivity. Air particulate sampling filters, which are retrieved and analyzed weekly for gross radioactivity, are also composited quarterly and analyzed for strontium-90 and specific gamma- and alpha-emitting radionuclides.

Iodine-129 and tritium also are measured in effluent ventilation air at some locations. At two locations silica gel-filled columns are used to collect water vapor that is then distilled from the desiccant and analyzed for tritium. The distillates are analyzed weekly. Six permanent samplers contain activated charcoal adsorbent that is analyzed for iodine-129; the charcoal is collected weekly and composited for quarterly analysis.

Off-site sampling locations include those considered most representative of background conditions and those most likely to be downwind of airborne releases. Among the criteria used to position off-site air samplers are prevailing wind direction, land usage, and the location of population centers.

Off-site air is continuously sampled at ten locations. Background samplers are located far from the site in Great Valley and Nashville, New York. Nearby-community samplers are in Springville and West Valley, New York. (See Fig. A-12 [p. A-14] in Appendix A for these four off-site air sampling locations.) Six samplers are located on the perimeter of the WNYNSC. (See Fig.A-5 [p. A-7] in Appendix A.) These samples are analyzed for parameters similar to the effluent air samples. (See Appendix D [pp.D-3 through D-26] for air monitoring data summaries.)

Atmospheric Fallout. An important contributor to environmental radioactivity is atmospheric fallout. Sources of fallout include earlier atmospheric testing of atomic explosives and residual radioactivity from accidents such as that which occurred at Chernobyl in the Ukraine.

Four site perimeter locations and one on-site location currently are sampled for fallout using pot-type samplers that are collected every month. Long-term fallout is assessed by analyzing soil collected annually at each of the six perimeter and four off-site air samplers. Three additional on-site soil samples are taken annually. (See Appendix D [pp.D-24 through D-26] for fallout data summaries and Appendix C [pp.C-22 and C-23] for soil data summaries.)

Food Pathways. A potentially significant pathway for radioactivity to reach humans is through consuming produce and meat and milk from domesticated farm animals raised near the WVDP and game animals and fish that include the WVDP in their range.

Animal and fish samples from potentially affected areas are gathered and analyzed for radionuclide content in order to reveal any long-term trends. Fish are collected at several locations along Cattaraugus Creek at various distances downstream from the WVDP. Venison is sampled from the deer herd ranging within the WNYNSC. Control samples of both fish and venison are collected from background areas outside WVDP influence. Beef, milk, hay, and produce samples also are collected at nearby farms and at selected locations well away from WVDP influence. (See Appendix F [pp.F-3 through F-8] for biological data summaries.)

Direct Radiation Measurement. Direct penetrating radiation is measured using thermoluminescent dosimeters (TLDs) located on- and off-site. Measurement points within the site are placed near selected waste management units and around the inner security fence. Other measurement locations are around the site perimeter and access road and at background locations remote from the WVDP. Forty-three measurement points were used in 1998.

The TLDs are retrieved quarterly and are processed by an off-site service to obtain the integrated gamma exposure. (Appendix H [p.H-3 is a summary of the direct radiation data.)

Meteorological Monitoring

Meteorological data are continuously gathered and recorded on-site and at a nearby regional location. Wind speed and direction, barometric pressure, temperature, dewpoint, and rainfall are all measured. Such data are valuable for evaluating long-term geohydrologic trends and for modeling airborne dispersion. In the event of an emergency, immediate access to the most recent meteorological data is indispensable for predicting the path and concentration of any materials that become airborne. (See Appendix I [pp.I-3 through I-9] for meteorological data summaries.)

Quality Assurance and Control

The work performed by and through the on-site Environmental Laboratory is regularly reviewed by several agencies for accuracy and compliance with applicable regulations. Assessments of the laboratory routinely focus on proper record keeping and reporting, timely calibration of equipment, training of personnel, adherence to accepted procedures, and general laboratory safety.

The Environmental Laboratory also participates in quality assurance crosscheck programs administered by federal agencies. (See Appendix J [pp. J-3 through J-9] for a summary of crosscheck performance.) The performance of outside laboratories contracted to analyze WVDP samples also is regularly assessed.

Environmental monitoring management continues to strengthen its formal self-assessment program, developing and implementing new strategies and procedures for ensuring high quality data. Experienced senior scientists and specialists in varying disciplines follow an annual schedule of self-assessments, produce formal reports with recommended corrective actions, and track the actions as they are completed.

During 1998 WVNS developed a safety management system for the WVDP, which was validated by the DOE Ohio Field Office. The safety management system integrates all safety programs, including environmental protection, to ensure that Project work can be safely and efficiently performed.

A special assessment was conducted in 1998 to determine if environmental monitoring program hardware and software were capable of handling data correctly when the year 2000 arrives. Several systems were examined, including the meteorological system, water samplers, air samplers, radiological counting instruments, and data management and reporting systems. A schedule for completing corrective actions such as purchasing updated equipment and software was developed, and corrective actions were started so that all systems will be year-2000 compliant in 1999.

ENVIRONMENTAL COMPLIANCE SUMMARY

CALENDAR YEAR 1998

Compliance Program

Currently the primary focus of the West Valley Demonstration Project (WVDP) is on completing the removal and vitrification of the liquid high-level radioactive mixed waste remaining in underground high-level waste tanks at the site. Vitrification incorporates high-level radioactive and hazardous materials into a glass-like substance that is safe for disposition at a long-term geologic repository. The treatment process is regulated by various federal and state laws that protect the public, workers, and the environment.

The U.S. Department of Energy (DOE), the federal agency that oversees the WVDP, established its policy concerning environmental protection in DOE Order 5400.1, General Environmental Protection Program. This Order lists the regulations, laws, and required reports that are applicable to DOE-operated facilities. DOE Orders 5400.1 and 231.1, Environment, Safety, and Health Reporting, require the preparation of this annual Site Environmental Report, which is intended to summarize environmental data gathered during the calendar year, describe significant programs, and document WVDP compliance with environmental regulations.

The major federal environmental laws and regulations that apply to the West Valley Demonstration Project are the Resource Conservation and Recovery Act, the Clean Air Act, the Emergency Planning and Community Right-to-Know Act, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and the National Environmental Policy Act. These laws are administered primarily by the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC) through state programs and regulatory requirements such as permitting, reporting, inspecting, and auditing.

In addition, because the emission of radiological and nonradiological materials from an active facility cannot be completely prevented, the EPA, NYSDEC, and the DOE have established standards for such emissions that are intended to protect human health and the environment. The WVDP applies to NYSDEC and the EPA for permits that allow the site to release limited amounts of radiological and nonradiological constituents through controlled and monitored discharges into water and air. These concentrations have been determined to be safe for humans and the environment.

In general, the permits describe the discharge points, specify management and reporting requirements, list the limits on those pollutants likely to be present, and define the sampling and analysis schedule.

Environmental inspections and audits are conducted routinely by the EPA, NYSDEC, the New York State Department of Health (NYSDOH), and the Cattaraugus County Health Department. On-site and off-site radiological monitoring in 1998 confirmed that site activities were conducted well within state and federal regulatory limits.

On-site nonradiological effluent monitoring confirmed that site effluents remained within permitted limits. In one instance, because of the emission of nitrous oxide, a regulatory standard for opacity at the main stack was exceeded. However, this release was below the federally enforced emissions limit for nitrous oxide approved for the WVDP. (This exceedance of a nonradiological standard is described in more detail under the Clean Air Act section [p.ECS-8].) Although the exceedance did not have any significant adverse environmental effects, the WVDP continues to make efforts to eliminate the potential for any reoccurrence.

Management at the WVDP continued to provide strong support for environmental compliance issues in 1998. Through the integrated safety management system (ISMS) process, DOE Orders and applicable state and federal statutes and regulations are integrated into the compliance program at the Project, demonstrating a commitment to protecting the public and the environment while working towards the WVDP goal of high-level radioactive mixed waste vitrification.

Compliance Status

The following environmental compliance summary describes the federal and state laws and regulations that are applicable to the WVDP and the relevant environmental compliance activities that occurred at the WVDP in 1998.

Resource Conservation and Recovery Act (RCRA). The Resource Conservation and Recovery Act was enacted to ensure that hazardous wastes are managed in a manner that protects human health and the environment. RCRA and its implementing regulations govern hazardous waste generation, treatment, storage, and disposal.

RCRA regulations mandate that generators take responsibility for ensuring the proper treatment, storage, and disposal of their wastes. The EPA is the federal agency responsible for issuing guidelines and regulations for the proper management of solid and hazardous waste.

In New York, the EPA has delegated the authority to enforce these regulations, including the radioactive and hazardous mixed waste program, to NYSDEC. In addition, the U.S. Department of Transportation (DOT) is responsible for issuing guidelines and regulations for the labeling, packaging, and spill-reporting provisions for hazardous and mixed wastes while in transit.

Each facility that treats, stores (large quantities for more than 90 days), or disposes of hazardous waste at that facility must apply for a permit from the EPA (or authorized state). The permit defines the treatment processes to be used, the design capacities, the location of hazardous waste storage units, the design and operating criteria for disposal units, and the hazardous wastes to be handled.

In 1984 the DOE notified the EPA of hazardous waste activities at the WVDP and identified the WVDP as a generator of hazardous waste. In June 1990 the WVDP filed a Part A Hazardous Waste Permit Application with NYSDEC for storage and treatment of hazardous wastes. Based on that application, the WVDP was granted interim status.

The WVDP continues to update the RCRA Part A Permit Application as changes to the site's interim-status waste-management operations occur. The last update occurred in October 1995. No updates to the Part A Permit Application were necessary in 1998.

Hazardous Waste Management Program. Hazardous wastes at the WVDP are managed in accordance with 6 NYCRR (New York Official Compilation of Codes, Rules, and Regulations) Parts 371-376. In order to dispose of hazardous wastes generated from on-site activities, the WVDP uses New York State-permitted transporters (pursuant to 6 NYCRR Part 364) to ship RCRA-regulated wastes to permitted or authorized treatment, storage, or disposal facilities (TSDFs), pursuant to 6 NYCRR Part 373-1. Using these services, the WVDP shipped approximately 22.4 metric tons (24.7 tons) of nonradioactive, hazardous waste off-site in 1998. Increases in the amount of hazardous waste shipped in 1998 as compared to 1997 are from the disposition of outdated, off-specification, and surplus materials. Of this amount, 1.2 metric tons (1.3 tons) were recycled by the treatment, storage, and disposal facilities.

Off-site hazardous waste shipments and their receipt at designated TSDFs are documented by signed manifests that accompany the shipment. If the signed manifest is not returned to the WVDP within the regulatory limit of forty-five days from shipment, an exception report must be filed and receipt of the waste confirmed with the TSDF. No exception reports for WVDP waste shipments were required to be filed in 1998.

Hazardous waste activities must be reported to NYSDEC every year through the submittal of an annual Hazardous Waste Report. This report summarizes the hazardous waste activities for the previous year, specifies the quantities of hazardous waste generated, treated, and/or disposed, and identifies the TSDFs used. The calendar year 1998 annual Hazardous Waste Report was submitted to NYSDEC on March 1, 1999.

In addition, a hazardous waste reduction plan must be filed every two years and updated annually. These plans document efforts to minimize the generation of hazardous waste and were first submitted to NYSDEC in 1990. The most recent Annual Status Report for the Hazardous Waste Reduction Program was submitted in June 1998. The next update is due July 1999.

An annual inspection to assess compliance with hazardous waste regulations was conducted by NYSDEC on March 20, 1998. The most recent EPA inspection occurred on September 16, 1998. No deficiencies were noted by either agency during the inspections.

Nonhazardous, Regulated Waste Management Program. The WVDP transported approximately 288 metric tons (318 tons) of nonradioactive, nonhazardous material off-site to solid waste management facilities in 1998. Of this amount, 6.3 metric tons (6.9 tons) were recycled or reclaimed. Some of the regulated materials managed as recyclable materials were lead acid batteries from which the lead was reclaimed and nonhazardous oils, which were recycled at off-site authorized reclamation and recycling facilities. The WVDP also shipped approximately 593 metric tons (654 tons) of digested sludge and untreated wastewater from the site sanitary and industrial wastewater treatment facility to the Buffalo Sewer Authority for treatment. The decreased quantity of wastewater shipped in 1998 (compared to 2,305 metric tons [2,541 tons] shipped in 1997) is in large part the result of improved temperature controls and treatment efficiency at the WVDP sanitary and industrial wastewater treatment facility.

Radioactive Mixed Waste Management Program. Radioactive mixed waste (RMW) contains both a radioactive component, regulated under the Atomic Energy Act, and a hazardous component, regulated under RCRA. Both the EPA and NYSDEC oversee RMW management at the WVDP. To address the management of the hazardous component of radioactive mixed waste, in March 1993 the DOE entered into a Federal and State Facility Compliance Agreement (FSFCA) with the EPA, NYSDEC, the New York State Energy Research and Development

Authority (NYSERDA), and West Valley Nuclear Services Company (WVNS), the primary contractor for the DOE at the WVDP. The FSFCA addressed requirements for managing the hazardous component of the radioactive mixed waste: regulatory compliance with the Land Disposal Restrictions (LDR) of RCRA for radioactive mixed waste specifies particular storage requirements for RMW and requires the characterization of historical wastes in storage at the WVDP.

In August 1997 a one-year extension of the FSFCA was requested to provide the additional time needed to characterize waste stored in the chemical process cell waste storage area. In November 1997 NYSDEC granted a one-year extension exclusively for section 7.2, Waste Analysis, to complete the final characterization of the containers. Characterization of historical wastes was completed and the FSFCA agreement terminated on March 22, 1999.

The Federal Facility Compliance Act (FFCAct) of 1992, an amendment to RCRA, was signed into law on October 6, 1992. The FFCAct requires DOE facilities to develop treatment plans for radioactive mixed waste inventories and to enter into agreements with the regulatory agencies that require the treatment of the inventories according to the approved plans.

DOE facilities were required to develop site treatment plans in three steps: conceptual, draft, and proposed. The WVDP's conceptual plan was submitted to NYSDEC in October 1993, the draft plan in August 1994, and the proposed site treatment plan in March 1995.

The proposed plan is comprised of two volumes: The Background Volume provides information on each radioactive mixed waste stream and information on the preferred treatment method for the waste; the Plan Volume contains proposed schedules for treating the radioactive mixed waste to meet the LDR requirements of RCRA. Each submittal to NYSDEC underwent a public comment period during which input was solicited from WVDP stakeholders.

The DOE and NYSDEC entered into a consent order on September 3, 1996, that requires the completion of the milestones identified in the Plan Volume. The WVDP began implementing the Site Treatment Plan immediately and updates it annually to bring waste stream and inventory and treatment information current to the end of the fiscal year. An update of fiscal year 1998 activities was completed in February 1999. All Plan Volume milestones for fiscal year 1998 were met.

Shipments of radioactive mixed waste to off-site facilities for treatment and their receipt at the designated TSDF are documented via manifests. In 1998 the WVDP shipped approximately 4.0 metric tons (4.4 tons) of radioactive mixed waste to an off-site facility.

RCRA Facility Investigation Program. The DOE and NYSERDA entered into a RCRA 3008(h) Administrative Order on Consent with NYSDEC and the EPA in March 1992. The Consent Order required NYSERDA and the DOE's West Valley Demonstration Project Office (OH/WVDP) to conduct RCRA-facility investigations (RFIs) at solid waste management units (SWMUs) in order to determine if there has been a release or if there is a potential for release of RCRA-regulated hazardous waste or hazardous constituents from SWMUs. Because of the proximity of some of the units to each other, twenty-five SWMUs were grouped into twelve super solid waste management units (SSWMUs) to facilitate investigative efforts under the RFI program.

In general, the purpose of a RCRA facility investigation is to collect and evaluate information to determine which of the following actions are appropriate for each SWMU or SSWMU in accordance with the Consent Order: no further action; a corrective measures study; or additional investigations to support either no further action or a corrective measures study.

To define and assess the environmental settings, unit and waste characteristics, and the potential sources and extent of nonradiological contamination, the WVDP reviewed existing information and collected and analyzed samples of surface soil, subsurface soil, sediment, and groundwater.

The last of the draft RFI reports were made final in 1997 after EPA and NYSDEC review. Of the twelve SSWMUs, five have been identified as requiring no further action: #2, miscellaneous small units; #6, the low-level waste storage area; #7, the chemical process cell waste storage area; #10, the radwaste treatment system drum cell; and #12, the hazardous waste storage lockers.

The seven remaining SSWMUs have been identified as requiring no immediate action other than continued groundwater monitoring: #1, the low-level waste treatment facility; #3, the liquid waste treatment system; #4, the high-level waste storage and processing area; #5, the maintenance shop leach field; #8, the construction and demolition debris landfill; #9, the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA); and #11, the New York State-licensed disposal area (SDA).

In addition to the twelve SSWMUs, sixteen rooms previously used during nuclear fuel reprocessing operations were evaluated in May 1994 under the RFI program, as required by the Consent Order. In December 1994 NYSDEC and the EPA reviewed the evaluation and issued a determination of no further action for eight of the rooms. At the same time, NYSDEC and the EPA requested additional information on the remaining eight rooms. In February 1995 the WVDP provided the requested information. On January 28, 1998 the EPA and NYSDEC completed their evaluation and concluded that the remaining rooms do not pose a significant threat of a release of hazardous waste or hazardous constituents.

With the submittal of the final RFI reports in 1997 and the determination for the sealed rooms, the site completed the investigation activities associated with the Consent Order. The WVDP continued in 1998 to monitor and evaluate SWMUs to ensure compliance with the requirements of the RCRA 3008(h) Administrative Order on Consent.

Waste Minimization and Pollution Prevention. The WVDP continued a long-term program to minimize the generation of low-level radioactive waste, radioactive mixed waste, hazardous waste, industrial waste, and sanitary waste and to promote affirmative procurement as directed by Executive Order 12856 (Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements), Executive Order 12873 (Federal Acquisition, Recycling, and Waste Prevention), and the new, 1998 Executive Order 13101 (Greening the Government through Waste Prevention, Recycling, and Federal Acquisition), which promotes the Affirmative Procurement Program (APP).

The APP specifies responsibilities and direction for federal agencies in acquiring recycled and environmentally preferable products and services designated by the EPA in 40 CFR Part 247. WVNS reports its challenges and successes associated with the purchase and use of these materials and services to the DOE each year.

Waste streams on-site are separated into either waste from sources directly associated with the vitrification process or into other nonvitrification sources. Using 1993 waste-generation rates as a baseline for comparison, the WVDP plans to reduce the generation of low-level radioactive waste, radioactive mixed waste, and nonvitrification hazardous waste by 50% by December 31, 1999. The WVDP plans to reduce the generation of sanitary waste and nonvitrification industrial waste by 30% by the same date.

Toward that end, the WVDP set the following cumulative waste-reduction goals for 1998: a 42% reduction in the generation of low-level radioactive waste, radioactive mixed waste, and hazardous waste; a 26% reduction in nonvitrification industrial waste; and a 22% reduction in sanitary waste.

The waste-reduction goals for wastes associated with vitrification operations were an 18% reduction in vitrification hazardous waste and a 12% reduction in vitrification industrial waste, compared to an annualized 1996 total of waste generated.

Progress toward meeting or exceeding most waste-reduction goals was excellent during calendar year 1998. Low-level radioactive waste generation was reduced by 86%, radioactive mixed waste generation by 81%, and vitrification hazardous waste generation by 59%. In a similar manner, nonvitrification industrial waste generation was reduced by 40% and sanitary waste generation by 67%.

The amount of nonvitrification-related acidic/caustic hazardous waste generated in 1998 was reduced by 34% through the use of elementary neutralization. Because of the large amount of acidic descaling solution generated, the reduction of this waste was less than desired. Similarly, the amount of vitrification-related industrial waste was reduced by only 7%. The effective use of elementary neutralization in treating acid and caustic hazardous waste resulted in a greater quantity of industrial waste.

Specific accomplishments in waste minimization and pollution prevention during 1998 included the following:

- 101.8 metric tons (112.2 tons) of paper were recycled
- 88.0 metric tons (97.0 tons) of galvanized steel, carbon steel, and stainless steel were recycled
- 8.7 metric tons (9.6 tons) of metal 55-gallon drums were emptied, cleaned, and either reused on-site or sent off-site for recycling
- 36.3 metric tons (40.0 tons) of concrete support piers were sent off-site to a local municipality for use in erosion control
- 90.7 metric tons (100.0 tons) of nonradioactive vitrification test glass were sent off-site to an asphalt vendor for use as aggregate
- 166.6 metric tons (183.7 tons) of scrap lumber were collected and donated to local not-for-profit and educational institutions for reuse
- excess stocks of mercury thermometers were donated to a local university's chemistry department for reuse
- 16.5 metric tons (18.2 tons) of wooden pallets were taken by a vendor for recycling
- used lead-acid batteries were recycled
- extra materials in controlled storage were made available in October 1998 to WVDP employees for reuse on-site, and materials with a total value of more than $31,000 were subsequently used.

Underground Storage Tanks Program. RCRA regulations also cover the use and management of underground storage tanks and establish minimum design requirements in order to protect groundwater resources from releases. The regulations, specified in 40 CFR Part 280, require underground storage tanks to be equipped with overfill protection, spill prevention, corrosion protection, and leak detection systems. New tanks must comply with regulations at the time of installation.

New York State also regulates underground storage tanks through two programs, petroleum bulk storage (Title 6 NYCRR, Parts 612 - 614) and chemical bulk storage (6 NYCRR, Parts 595 - 599). The state registration and minimum design requirements are similar to those of the federal program except that petroleum tank fill ports must be color-coded using American Petroleum Institute standards to indicate the product being stored. The WVDP does not use underground chemical bulk storage tanks.

A 550-gallon underground storage tank is used to store diesel fuel for the standby power supply for the supernatant treatment ventilation blower system. This tank, a double-walled steel tank with an interstitial leak detection system, is filled by a metered delivery system and is monitored through daily gauging and monthly reconciliations. It does not require tightness or integrity testing because of its integral leak detection system. The tank is equipped with aboveground piping and has an overflow catch basin at the fill port. System improvements implemented in 1998 included a new leak detection system and a high-level warning device. The 1998 improvements and upgrades have brought the 550-gallon tank into compliance with the most recent EPA requirements (40 CFR Part 280.21), which went into effect on December 22, 1998.

A former underground petroleum-storage tank, closed in place before the New York State underground storage tank program closure requirements were implemented in 1985, was removed in 1997. Testing of soils from the tank excavation had shown evidence of earlier petroleum leakage: investigations continued in 1998. (See Petroleum-Spill Reporting/Underground Storage Tanks, p.ECS-19.)

New York State-regulated Aboveground Storage Tanks. The state of New York regulates aboveground petroleum bulk storage under 6 NYCRR Parts 612, 613, and 614. Aboveground hazardous bulk chemical storage is regulated by New York State under 6 NYCRR Part 595 et seq. These regulations require secondary containment, external gauges to measure the current reserves, monthly visual inspections of petroleum tanks, and documented daily, annual, and five-year inspections of chemical tanks. Petroleum tank fill ports also must be color-coded and chemical tanks labeled to indicate the product stored.

WVDP registration at the end of 1998 included nine aboveground petroleum tanks and fourteen aboveground chemical storage tanks. Three of the petroleum tanks contain No. 2 fuel oil, one contains unleaded gasoline, and the remainder contain diesel fuel. Eleven of the chemical storage tanks contain nitric acid or nitric acid mixtures. Sulfuric acid, sodium hydroxide, and anhydrous ammonia are stored in the remaining three tanks. All of the tanks are equipped with gauges and secondary containment systems except the anhydrous ammonia tank, for which secondary containment is not required. (Any release of the contents of the anhydrous ammonia tank would be in gaseous form, thus making secondary containment unnecessary.)

The Quality Assurance department inspects the aboveground petroleum tanks every month. In December 1998 all aboveground chemical storage tanks were inspected to fulfill the requirements for annual inspection (6 NYCRR Part 598.7(c)). The ammonia tank was inspected in December 1998 to meet the five-year inspection requirements of 6 NYCRR Part 598.7(d). No violations were noted during the inspection. Documentation relating to these periodic inspections is maintained by the WVDP and is available for regulatory agencies to review.

Medical Waste Tracking. Medical waste poses a potential for exposure to infectious diseases and pathogens from contact with human bodily fluids. Medical evaluations, inoculations, and laboratory work at the on-site nurse's office regularly generate potentially infectious medical wastes that must be tracked in accordance with NYSDEC requirements (6 NYCRR Part 364.9). The WVDP has retained the services of a permitted waste hauler and disposal firm to manage these medical wastes.

Medical wastes are sterilized with an autoclave by the disposal firm to remove the associated hazard and then disposed. Twelve kilograms (26 lbs) of medical waste consisting of dressings and protective clothing such as rubber gloves, and needles, syringes, and other sharps were generated and disposed in 1998.

Clean Air Act (CAA). The Clean Air Act as amended in 1990, including Titles I through VI, establishes a framework for the EPA to regulate air emissions from both stationary and mobile sources. These amendments mandate that each state establish a program to permit the operation of sources of air pollution. In 1996 NYSDEC amended 6 NYCRR Parts 200, 201, 231, and 621 to implement the requirements of the new EPA Clean Air Act Title V permitting processes.

In New York State, either the EPA or NYSDEC issues permits for stationary sources emitting regulated pollutants, including hazardous air pollutants. Sources requiring permits are those that emit regulated pollutants in quantities above a predetermined threshold that are from a particular source such as a stack, duct, vent, or other similar opening. WVDP radiological emissions are regulated by the EPA, and all other air pollutants are regulated by NYSDEC.

Air emissions of radionuclides from point sources at the WVDP are regulated by the EPA under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations, 40 CFR Part 61, Subpart H, National Emission Standards for Emission of Radionuclides Other Than Radon From Department of Energy Facilities. The WVDP currently has permits for six radionuclide sources, including the slurry-fed ceramic melter and the vitrification heating, ventilation, and air conditioning (HVAC) system. Other less significant sources of radionuclide emissions, such as those from the on-site laundry, do not require permits. Non-point radiological sources of emissions such as lagoons and soil piles also do not require permits. Emissions from all these sources are quantified for reporting to the EPA. The WVDP reports the radionuclide emissions from its non-permitted and permitted sources to the EPA annually in accordance with NESHAP regulations. Calculations to demonstrate compliance with NESHAP radioactive dose limits showed 1998 doses to be less than 0.4% of the 10 millirem standard.

Nonradiological point sources of air emissions are regulated by NYSDEC. Major-source facilities are required by 6 NYCRR Part 201 to file a Title V permit application, unless operating limits are established, to ensure that the facility does not emit pollutants above the threshold limits. WVDP emissions of nitrogen oxides (NO_x) and sulfur dioxide (SO_2) are each capped at 100 tons per year. Thus, the WVDP is not required to file a Title V permit.

In lieu of a Title V permit application, the WVDP opted to file a State Facility Permit Application for the site. A State Facility Permit Application containing data on two new boilers was filed in October 1997 and approved in January 1998. A State Facility Permit modification to include all remaining WVDP air emission sources was submitted in December 1997, and the WVDP is awaiting approval of this permit. Under the new State Facility Permit, compliance will be based on site-wide limits for all regulated constituents, and the totals for all will be recorded annually in an air emissions inventory.

Existing certificate-to-operate permits (COs) are in effect until the State Facility Permit modification is approved by NYSDEC. The WVDP has a total of seven COs for nonradiological point sources. (During 1998 seven COs were removed from service or were exempted from the permitting requirements of NYSDEC.)

The WVDP submits quarterly reports to NYSDEC that contain NO_x and SO_2 total emissions data. NO_x emissions (8.9 tons) and SO_2 emissions (0.3 tons) were well below the 100-ton cap for each category. The WVDP also conducts cylinder gas audits every quarter and annual relative accuracy test audits of the melter off-gas

EPCRA 302-303:			
Planning Notification	[√] Yes	[ ] No	[ ] Not Req.
EPCRA 304:			
EHS Release Notification	[ ] Yes	[ ] No	[√] Not Req.
EPCRA 311-312:			
*MSDS/Chemical Inventory	[√] Yes	[ ] No	[ ] Not Req.
EPCRA 313:			
TRI Reporting	[√] Yes	[ ] No	[ ] Not Req.

* *Material Safety Data Sheet*

NO_x analyzers to establish compliance with the Capping Plan approved by NYSDEC on July 28, 1995.

On April 15, 1998, the WVDP exceeded the opacity standard established by 6 NYCRR 212.6(a) for approximately twelve minutes. This exceedance was reported to NYSDEC. It was calculated that approximately sixteen pounds of nitrous oxide were emitted during this time. The release did not exceed the NO_x permit limits approved by NYSDEC for the WVDP and was not considered a threat to human health or the environment. No emergency response actions were required. There were no other exceedances in 1998.

The air permits that were in effect at the WVDP in 1998 are listed in Appendix K, Table K-3 (pp. K-5 and K-6).

Emergency Planning and Community Right-to-Know Act (EPCRA). The Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted as Title III of the Superfund Amendments and Reauthorization Act (SARA). EPCRA was designed to create a working partnership between industry, business, state and local governments, public health and emergency response representatives, and interested citizens. EPCRA is intended to address concerns about the effects of chemicals used, stored, and released in local communities.

Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, requires all federal agencies to comply with the following EPCRA provisions: planning notification (Sections 302 - 303), extremely hazardous substance (EHS) release notification (Section 304), material safety data sheet (MSDS)/chemical inventory (Sections 311 - 312), and toxic release inventory (TRI) reporting (Section 313). The WVDP continued to comply with these provisions in 1998 as indicated in the table above.

- WVDP representatives participated in semi-annual meetings of the Cattaraugus County Local Emergency Planning Committee (EPCRA Section 302 - 303). WVDP representatives also attended numerous meetings held by the Cattaraugus and Erie County Emergency Management Services concerning WVDP and other local emergency planning activities. Area hospitals, a helicopter ambulance service (Mercy Flight), and the West Valley Volunteer Hose Company continued to participate in on-site training drills and in information exchanges involving management of hazardous substances at the WVDP.

- Compliance with all EPCRA reporting requirements was maintained and all required reports were submitted within the required time frame. There were no releases of extremely hazardous substances at the WVDP that triggered the release notification requirements of Section 304 of EPCRA.

- Under EPCRA Section 311 requirements, the WVDP reviews information about reportable chemicals every quarter. If a hazardous chemical, which was not previously reported, is present on-site in an amount exceeding the threshold planning quantity, an MSDS and an updated hazardous chemical list is submitted to the state and local emergency response groups. This supplemental reporting continues to ensure that the public and the emergency responders have current information about hazardous chemicals at the WVDP. No new chemicals were added to the hazardous chemicals list in 1998, and no additional EPCRA Section 311 notifications were required.

• Under EPCRA Section 312 regulations, the WVDP submits annual reports to state and local emergency response organizations and fire departments that specify the quantity, location, and hazards associated with chemicals stored on-site. The number of reportable chemicals did not change between 1997 and 1998: sixteen reportable chemicals above threshold planning quantities were stored at the WVDP in 1998.

• Under EPCRA Section 313 requirements, the WVDP submitted a toxic release inventory report to the EPA in 1998 for three chemicals (nitric acid, ammonia, and nitrate compounds).

• All notifications required under SARA regulations were submitted ahead of schedule.

Clean Water Act (CWA). Section 402 of the Clean Water Act of 1972, as amended, authorizes the EPA to regulate discharges of pollutants to surface water and groundwater through a National Pollutant Discharge Elimination System (NPDES) permit program. The EPA has delegated this authority to the state of New York, which issues State Pollutant Discharge Elimination System (SPDES) permits for discharges to surface water and groundwater.

Section 404 of the CWA regulates the development of areas in and adjacent to the waters of the United States. Supreme Court interpretations of Section 404 have resulted in the inclusion of wetlands in the regulatory definition of waters of the United States.

While Section 402 generally regulates disposal of liquids, Section 404 regulates the disposal of solids, in the form of dredged or fill material, into these areas by granting the U.S. Army Corps of Engineers the authority to designate disposal areas and issue permits for these activities. Executive Order 11990, Protection of Wetlands, directs federal agencies to "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practical alternate." (Article 24 of the New York State Environmental Conservation Law also contains requirements for the protection of freshwater wetlands.)

In addition, Section 401 of the CWA requires applicants for a federal license or permit pursuant to Section 404 to obtain certification from the state that the proposed discharge complies with effluent and water quality-related limitations, guidelines, and national standards of performance identified under sections 301, 302, 303, 306, 307, and 511(c) of the CWA. The EPA has delegated administration of this program to New York State.

SPDES-permitted Outfalls. Point-source liquid effluent discharges to surface waters of New York State are permitted through the New York SPDES program. The WVDP has four SPDES-permitted outfalls that discharge to Erdman Brook and Frank's Creek.

• Outfall 001 (WNSP001) discharges treated wastewater from the low-level waste treatment facility (LLWTF) and the north plateau groundwater recovery system. (See North Plateau Groundwater Recovery [p.ECS-12] and Chapter 3, Groundwater Monitoring, Special Groundwater Monitoring, p.3-15). The treated wastewater is held in lagoon 3, sampled and analyzed, and periodically released after notifying NYSDEC.

In 1998 the treated wastewater from the LLWTF was discharged at WNSP001 in six batches totaling 43.5 million liters (11.5 million gal) for the year. The annual average concentration of radioactivity at the point of release was approximately 23% of the DOE derived concentration guides (DCGs). None of the individual releases exceeded the DCGs. (See *derived concentration guide* in the Glossary.)

• Outfall 007 (WNSP007) discharges the effluent from the site sanitary and industrial wastewater treatment facility, which treats sewage and various nonradioactive wastewaters from physical plant systems (e.g., water plant production residuals and boiler blowdown). The average daily flow at WNSP007 in 1998 was 39,600 liters (10,500 gal).

• Outfall 008 (WNSP008) discharges groundwater and storm water flow directed from the northeast side of the site's LLWTF lagoon system through a french drain. The average daily flow at WNSP008 in 1998 was 7,300 liters (1,900 gal).

• Monitoring point 116, located in Frank's Creek, represents the confluence of discharge from outfalls 001, 007, and 008; base stream flow; wet weather flows (e.g., storm water runoff); groundwater surface seepage; and augmentation water (i.e., untreated water from the site reservoirs). This is not a physical outfall but a location chosen for monitoring in order to demonstrate compliance during discharge of lagoon 3. Before discharge of lagoon 3, sample data for total dissolved solids (TDS) and flow measurements from upstream sources are used to calculate the amount of augmentation water and flow needed to maintain compliance with SPDES-permitted TDS limits.

During calendar year 1998 there were no SPDES permit limit excursions. (See Clean Water Action Plan Initiatives at the WVDP, p.ECS-18.)

On March 19, 1998 NYSDEC conducted its annual facility inspection. At the request of the inspector, the SPDES outfalls, the sanitary and industrial wastewater treatment facility, and the LLWTF were observed. No violations were noted during the inspection.

The WVDP obtained storm water characterization data through sampling and analysis and in March 1996 submitted an application for a SPDES permit modification to increase the average flow of effluent from the north plateau groundwater recovery system from approximately 9.8 million liters (2.6 million gal) a year to approximately 39.7 million liters (10.5 million gal) a year. (See the discussion of North Plateau Groundwater Recovery [p.ECS-12].) NYSDEC issued the draft SPDES permit in June 1997 for public comment. The final permit is expected to be issued to the WVDP in 1999.

Wetlands. In the summer of 1998 a wetlands assessment was conducted to identify and delineate jurisdictional wetlands regulated under the Clean Water Act, Section 404, and/or those wetlands that may be regulated by the state of New York under Article 24 of the Environmental Conservation Law. The 375-acre assessment area covered a portion of the Western New York Nuclear Service Center (WNYNSC), including the entire 220-acre WVDP and adjacent parcels north, south, and east of the WVDP premises. The assessment also supported the requirements of Executive Order 11990, Protection of Wetlands. This assessment updated a 1993 investigation.

Clean Water Act Section 404 jurisdictional wetlands are defined as those satisfying specific technical criteria related to vegetation, soils, and hydrologic conditions. Using these criteria, fifty-nine jurisdictional wetlands ranging in size from 0.01 acres to 8.6 acres were identified, a total of approximately 39 acres of wetland.

The WVDP notifies the U.S. Army Corps of Engineers and NYSDEC of proposed actions that have the potential to affect any of the fifty-nine wetland units that are not specifically exempted from regulation or notification. In 1998 there were no actions requiring the Corps of Engineers or NYSDEC to be notified under the provisions of the wetlands regulatory programs.

North Plateau Groundwater Recovery. In November 1995 the WVDP installed a groundwater recovery system to mitigate the movement of strontium-90 contamination in the groundwater northeast of the process building. Three recovery wells, installed near the leading edge of the groundwater plume, collect contaminated groundwater from the underlying sand and gravel unit. The recovery system uses ion-exchange to remove strontium-90 from the groundwater and the groundwater is then treated in the new LLW2. After the groundwater is processed, it is normally discharged to lagoon 4 or 5 near the LLW2. Approximately 54 million liters (14.3 million gal) of groundwater have been processed through the system since its inception, including about 17 million liters (4.4 million gal) in 1998.

The Project began evaluating a new in-place treatment technology, permeable treatment wall (PTW) technology, for treating contaminated groundwater. PTW technology is a passive treatment method, i.e., neither pumps nor a separate water treatment system are used. Rather, contaminants are removed from the groundwater as it flows through a trench filled with treatment media. Laboratory benchscale tests were initiated in December 1998 to further examine this technology for removal of strontium-90 in WVDP groundwater. A pilot-scale field deployment may be implemented in 1999.

Petroleum- and Chemical-Product Spill Reporting. The WVDP has a Spill Notification and Reporting Policy to ensure that all spills (see Glossary) are properly managed, documented, and remediated in accordance with applicable regulations. This policy identifies the departmental responsibilities for spill management and presents the proper spill-control procedures. The policy stresses the responsibility of each employee to notify the main plant operations shift supervisor upon discovery of a spill. This first-line reporting requirement helps to ensure that spills are properly evaluated and managed.

Under a June 1996 agreement with NYSDEC regarding the agency's petroleum spill-reporting protocol, the WVDP is not required to report spills of petroleum products of 5 gallons or less onto an impervious surface that are cleaned up within two hours of discovery. Spills onto the ground of petroleum products of 5 gallons or less are entered in a monthly petroleum spill log. Spills of any amount that travel to waters of the state must be reported immediately to the NYSDEC spill hotline and entered in the monthly log. Spills of petroleum products that enter any navigable waters of New York State are reported to the National Response Center within two hours of discovery. Each monthly petroleum spill log is submitted to NYSDEC on the fifteenth day of the following month. In addition to the NYSDEC spill- and release-reporting regulations, the WVDP also reports spills of hazardous substances in accordance with the reporting requirements of RCRA, the CAA, EPCRA, the CWA, and the Toxic Substances Control Act (TSCA).

Two minor spills of petroleum were reported in 1998, both occurring on the same day in January. The first spill discovered was less than a gallon of diesel fuel released through a leak in a portable truck-mounted tank. Minutes later, the second spill was discovered — approximately one-quarter cup of diesel fuel had been released from a vehicle onto a paved roadway in another area of the site. In each case, rain carried a portion of the spill into a nearby storm drain. Upon discovery of the spills, absorbent wipes were used to clean up the remaining fuel from the pavement and absorbent booms were placed around the storm drain near the larger spill. NYSDEC was notified of the spills within one hour of their discovery; NYSDEC's response was that no further actions were required. Both spills were entered into the monthly spill report sent to the

NYSDEC Region 9 office. No other immediate notifications relating to petroleum spills were required during 1998.

No chemical spills or releases exceeded the reportable quantities and, therefore, no spills required immediate reporting. All spills that occurred during 1998 were cleaned up in a timely fashion in accordance with the WVDP Spill Notification and Reporting Policy, thereby minimizing any effects on the environment. Debris generated during cleanup activities was characterized and dispositioned appropriately.

Safe Drinking Water Act (SDWA). The Safe Drinking Water Act (SDWA), as amended in 1996, requires that each federal agency having jurisdiction over a federally owned or maintained public water system must comply with all federal, state, and local requirements regarding safe drinking water. Compliance with regulations promulgated under the SDWA in the state of New York is overseen by the New York State Department of Health (NYSDOH) through county health departments.

The WVDP obtains its drinking water from surface water reservoirs on the WNYNSC and is considered a non-transient, noncommunity public water supplier. The WVDP's drinking water treatment facility purifies the water by clarification, filtration, and chlorination before it is distributed on-site.

As an operator of a drinking water supply system, the WVDP routinely collects drinking water samples to monitor water quality. The results of these analyses are reported to the Cattaraugus County Health Department. The Cattaraugus County Health Department also independently collects a sample of WVDP drinking water every month to determine bacterial and residual chlorine content. Analysis of the microbiological samples collected in 1998 produced satisfactory results and the free chlorine residual measurements taken throughout the distribution system were positive on all occasions, indicating proper disinfection.

The WVDP regularly samples and tests the site's drinking water for lead and copper in accordance with EPA and NYSDOH regulations. Sampling for lead and copper in 1998 indicated that all results were below the action levels for these metals. If the 1999 results are below the action levels for lead and copper, regulations will allow the WVDP to reduce sampling to every three years.

The Cattaraugus County Health Department conducted its annual inspection of the WVDP water supply system on October 30, 1998. No findings or notices of violation were issued.

Toxic Substances Control Act (TSCA). The Toxic Substances Control Act (TSCA) of 1976 regulates the manufacture, processing, distribution, and use of chemicals, including asbestos-containing materials (ACMs) and polychlorinated biphenyls (PCBs). Because PCBs are a hazardous waste in New York State, the WVDP continued in 1998 to manage radioactively contaminated PCB wastes as radioactive mixed wastes. Details concerning PCB-contaminated radioactive waste management, including a description of the waste and proposed treatment technologies and schedules, can be found in section 3.1.5 of the Site Treatment Plan, Fiscal Year 1998 Update (West Valley Nuclear Services Co., Inc. February 1999).

To comply with TSCA, all operations associated with PCBs comply with the PCB and PCB-Contaminated Material Management Plan (West Valley Nuclear Services Co., Inc. December 28, 1998). The WVDP also maintains an annual document log that details PCB use and appropriate PCB waste storage on-site and any changes in storage or disposal status. In August 1996 the DOE and the EPA entered into a Federal Facility Compliance Agreement on Storage of Polychlorinated Biphenyls, which allowed PCB wastes to be stored for more than the one-year statutory limit for storage under TSCA. This agreement terminated with the promulgation of EPA 40 CFR Parts 750 and 761, Disposal of Polychlorinated Biphenyls (PCBs), effective August 28, 1998, which allows PCB wastes to be stored for more than one year. The WVDP is complying with these new regulations.

During December 1997 and January 1998 the WVDP Waste Operations department completed an inspection of the asbestos-management program. Results of the inspection will be included in the 1999 update to the WVDP Asbestos Management Plan.

In 1998 the WVDP also continued to maintain compliance with all TSCA requirements for asbestos by managing asbestos-containing materials (ACMs) at the site in accordance with the Asbestos Management Plan (West Valley Nuclear Services Co., Inc. May 1, 1996). The plan includes requirements for limiting worker exposure to ACMs, requirements for asbestos-abatement projects, maintenance activities, and periodic surveillance inspections (at least once every three years). The plan also identifies the inventory and status of on-site ACMs.

Activities in 1998 included the repair or abatement of damaged/friable ACMs, removal of roofing materials containing asbestos, and the maintenance of signs and labels to warn workers of asbestos-containing materials. All activities associated with ACMs are completed by personnel who are certified by the New York State Department of Labor (NYSDOL). WVNS maintains an asbestos-handling license issued by NYSDOL.

National Environmental Policy Act (NEPA). The National Environmental Policy Act (NEPA) of 1969, as amended, establishes a national policy to ensure that protection of the environment is included in federal planning and decision making (Title I). Its goals are to prevent or eliminate potential damage to the environment that could arise from federal legislative actions or proposed federal projects. The President's Council on Environmental Quality (CEQ), established under Title II of NEPA, sets the policy for fulfilling these goals. The CEQ regulations for implementing NEPA are promulgated at 40 CFR Parts 1500 - 1508.

The DOE began revising its NEPA-compliance procedures and guidelines in 1990. On May 26, 1992 the President's Council on Environmental Quality approved the DOE's NEPA procedures, which are promulgated as regulations at 10 CFR Part 1021. In July 1996 the DOE amended the NEPA regulations.

NEPA requires that all federal agencies proposing actions that have the potential to significantly affect the quality of human health and the environment prepare detailed environmental statements. The DOE implements NEPA by requiring an environmental review of all proposed actions (10 CFR Part 1021). The DOE's NEPA procedures are a hierarchical system of assessment for reviewing and documenting proposed actions commensurate with the action's potential for affecting the environment. The levels of review and documentation are: no impact and a categorical exclusion (CX); potential impact and an environmental assessment (EA); and significant impact and an environmental impact statement (EIS). (See the Glossary at the back of this report for definitions of *categorical exclusion*, *environmental assessment*, and *environmental impact statement*.)

Several actions at the WVDP were reviewed and approved in 1998 under the DOE's NEPA-implementing regulations. The following proposed actions were categorically excluded:

- ventilation improvements to the main plant equipment decontamination room
- construction of a new counting room in an existing site structure
- relocation of the blueprint reproduction facility

- site routine maintenance activities
- transfer of the supercompactor to the Savannah River site
- upgrade of the utility room hypochlorite feed system
- upgrade of the maintenance building heating, ventilation, and air conditioning (HVAC) system
- installation of a decontamination equipment trailer for radiological response
- management of mixed low-level waste in accordance with the WVDP Site Treatment Plan
- upgrade of the equalization basin for site sanitary wastewater treatment system
- replacement of the lag storage area #4 enclosure.

Since the Record-of-Decision for the 1982 final environmental impact statement (EIS) for long-term management of high-level radioactive waste at West Valley (U.S. Department of Energy June 1982), modifications to operations and activities at the WVDP have been made in order to improve operations and to mitigate potentially adverse environmental effects. The DOE's NEPA-implementing regulations require the preparation of a Supplement Analysis if there are substantial changes to a proposed action or if significant new circumstances or information relevant to environmental concerns have emerged after an environmental impact statement (EIS) is made final. The regulations also require a review of an EIS once every five years to verify its continued adequacy.

In 1993 the DOE issued its first Supplement Analysis of the 1982 final EIS to re-examine ongoing high-level waste solidification activities as well as actions within ancillary facilities. The DOE thereafter confirmed the validity of the environmental analyses in the final EIS and determined that a Supplemental EIS was not required. In June 1998 the DOE prepared and published a second Supplement Analysis of the 1982 final EIS. The Supplement Analysis identified the following operations as refinements of the actions originally evaluated in the 1982 final EIS:

- removal, washing, and solidification of the high-level waste tank heel
- decontamination and disposition of vitrification equipment
- retrieval of waste from the head end cells
- construction and operation of a high-level waste canister ship-out facility
- construction and operation of a facility for managing remote-handled waste
- off-site disposal of hazardous waste, radioactive mixed waste, and low-level waste
- packaging of transuranic (TRU) waste for interim storage or disposal
- shipping spent fuel for interim storage at the Idaho National Engineering and Environmental Laboratory (INEEL)
- repair and maintenance of the WNYNSC rail spur.

(Definitions of *remote-handled waste*, *hazardous waste*, *mixed waste*, *low-level waste*, *transuranic waste*, and *spent fuel* are provided in the Glossary.)

The 1998 Supplement Analysis discussed these refinements of the actions originally evaluated in the 1982 final EIS and concluded that no environmentally relevant or substantial changes in Project scope had occurred and that no significant new circumstances or newly relevant information existed. It also confirmed that the environmental analyses performed for the 1982 final EIS are still valid. The Ohio Field Office approved the Supplement Analysis in June 1998. In their approval the Field Office agreed with the conclusions of the 1998 Supplement Analysis and issued their determination that a Supplemental EIS is not required.

Activities continued in 1998 in support of the Draft Environmental Impact Statement for Completion of the West Valley Demonstration Project and Closure or Long-Term Management of Facilities at the Western New York Nuclear Service Center.

The Citizen Task Force issued the West Valley Citizen Task Force Final Report on July 29, 1998. This report provides recommendations and advice on the development of a preferred alternative for the completion of the WVDP and WNYNSC closure or long-term management. The preferred alternative is being developed and is scheduled to be completed in 1999; the final EIS is scheduled to be issued in 2000.

The NRC, as a cooperating agency in this EIS and as part of its responsibilities under the WVDP Act, issued SECY-98-251, Decommissioning Criteria for West Valley, on October 30, 1998. This document proposed decommissioning criteria for the WVDP and the WNYNSC and identified potential alternatives that may be necessary to ensure acceptable long-term control and care of the site. The NRC staff presented SECY-98-251 to the NRC Commissioners for review and approval. The DOE, NYSERDA, NYSDEC, and the Citizen Task Force were invited to a briefing in January 1999 to discuss their issues and concerns.

In May 1997 DOE Headquarters issued the Final Waste Management Programmatic Environmental Impact Statement to evaluate nationwide management and siting alternatives for the treatment, storage, and disposal of five types of radioactive and hazardous waste. The alternatives are for waste generated from operations over the next twenty years at fifty-four sites in the DOE complex. The final EIS was issued with the particular intent of developing separate waste form-specific records of decision and issuing these in sequence.

In 1998 two Records of Decision were issued: On January 20 DOE Headquarters issued the Record of Decision for the DOE's Waste Management Program for Treatment and Storage of Transuranic Waste, and on August 5 the DOE issued the Record of Decision for the Treatment of Non-wastewater Hazardous Waste. The decisions specific to WVDP wastes included continuing to use off-site facilities for the treatment of non-wastewater hazardous waste and preparation and storage of transuranic waste on-site before disposal. (Currently there is no transuranic waste-disposal facility identified to accept WVDP-generated transuranic waste.) The preferred alternatives for other WVDP wastes include: off-site treatment of low-level mixed waste and disposal at one of two or three regional disposal sites; on-site treatment of low-level waste and shipment for disposal to one of two or three regional disposal sites; and on-site storage of WVDP vitrified high-level waste pending disposal in an off-site geologic repository.

Summary of Permits

The environmental permits that were in effect at the WVDP in 1998 are listed in Appendix K, Table K-3 (pp.K-5 and K-6).

Current Achievements and Program Highlights

Significant environmental initiatives, compliance successes, new site programs, and challenges and events that occurred in 1998 and continued in 1999 are summarized below.

Completion of Phase I of Vitrification. The first phase of high-level waste vitrification was completed in June 1998. Phase I of the vitrification campaign at the WVDP began on June 24, 1996, when the first transfer of high-level radioactive waste from the underground storage tanks was completed. During the following two years 210 canisters were filled with vitrified high-level waste and placed into storage. The next phase of vitrification is expected to continue into 2001. During this phase, high-level wastes remaining in the bottom 10 inches of the underground tanks will be transferred to the vitrification system. Waste in the grid-like structure on the bottom of the tanks may be dislodged by a combination of high-pressure water spray nozzles or other removal tools on mechanical arms or by chemical washing.

Implementation of an Integrated Safety Management System. A plan to integrate environmental, safety, and health (ES&H) management procedures at the WVDP was developed and implemented in 1998. Implementation included writing an ES&H management system description, developing two new site-specific procedures, and integrating more than thirty key procedures. One of the more important areas identified for improvement in order to successfully implement an integrated environmental, safety, and health management system was the enhanced work planning (EWP) program, which closely matches the core elements of an integrated safety management system (ISMS). (See Glossary.) In pursuit of improvement, a site-wide work review group (WRG) was established. This cross-functional group reviews work plans for safety, health, and environmental concerns and comments on proposed work documents. The initiation of the WRG, along with other improvements such as up-front worker involvement, satisfied EWP and ISMS requirements, and the Project's EWP and ISMS received verification from the DOE Ohio Field Office in December 1998.

Environmental Management System. Environmental management at the WVDP is integral to ISMS core components at the site. WVNS has in place an environmental management system (EMS) that integrates various components of programs designed to limit environmental harm from Project activities. The EMS is described in WVNS Environmental Management System (West Valley Nuclear Services Co., Inc. February 1998b). Existing procedures implemented within the environmental management system provide the basic policy and direction for proactive management, environmental stewardship, and the integration of appropriate technologies across all Project functions.

The WVNS EMS is based upon the Code of Environmental Management Principles for Federal Agencies (CEMP), developed by the EPA, and upon ISO (International Organization for Standardization) 14001, Environmental Management Systems - Specifications for Guidance and Use. Both the CEMP and ISO 14001 promote guiding principles and the development of performance drivers to continually improve environmental performance.

The WVNS EMS provides that effects of Project activities on the environment be considered; identifies practices that eliminate or minimize negative effects; includes monitoring and compliance with all applicable environmental laws, regulations, and requirements; and requires the management of programs, projects, and activities in a manner that protects the environment and public health. Any potential threats to the environment from planned work are evaluated through environmental assessments (EAs) or environmental impact statements (EISs), which are required by NEPA.

NRC Proposed Decommissioning Criteria for the WVDP. In October 1998 NRC staff issued the Decommissioning Criteria for West

Valley (SECY-98-251) for the NRC Commissioners to review. The NRC hosted a public meeting on January 12, 1999 for representatives from the NRC staff, the DOE, NYSERDA, and the West Valley Citizen Task Force to brief the Commissioners on various issues before they made a decision. As a result, the Commissioners requested that the NRC staff examine the statutory limitations (i.e., authority, obligations, and limitations under the WVDP Act) of NRC involvement at West Valley and to supplement the SECY paper with an expanded discussion of the options for the manner and timing of NRC final criteria for decontamination and decommissioning. On February 23, 1999, NRC staff published SECY-99-057, Supplement to SECY-98-251, Decommissioning Criteria for West Valley, which provides the additional information requested by the commissioners.

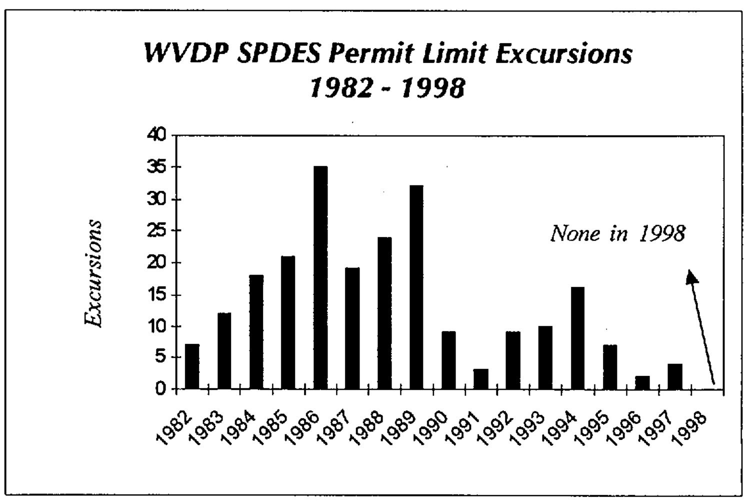
Clean Water Action Plan Initiatives at the WVDP. The 1998 Clean Water Action Plan (CWAP) charts a new course for protecting and restoring our nation's waterways, emphasizing collaborative strategies for communities and the watersheds that sustain them. For the past year, nine federal agencies have been working together to carry out the key actions in the Clean Water Action Plan and to assist state and local groups with their watershed work.

A Water Task Team, formed in February 1995, consists of WVDP personnel with expertise in wastewater engineering, treatment plant operation and process monitoring, and NPDES/ SPDES permitting and compliance. See SPDES Permit Limit Exceedances in Chapter 1 (p.1-14).

As shown in the accompanying chart (*this page*), the annual number of exceptions to the numerical discharge limits specified in the site's SPDES permit have been substantially reduced, especially when compared to the peak of thirty-five exceptions noted in 1986. Calendar year 1998 is the first year since 1982, when the DOE began operating the Project, that no exceptions were reported.

SPDES Permit Renewal. On July 17, 1998 the WVDP filed an application with NYSDEC for administrative renewal of the site SPDES permit, which expired on February 1, 1999. On September 11, 1998, NYSDEC issued the renewed SPDES permit, which became effective on February 1, 1999 and expires February 1, 2004.

Storm Water Discharge Permit Application. Precipitation can become contaminated with pollutants from industrial process facilities, material storage and handling areas, access roads, or vehicle parking areas. To protect the environment, aquatic resources, and public health, Section 402(p) of the CWA requires that a storm water discharge permit application containing facility-specific information be submitted to the permitting authority. NYSDEC, the permitting authority in New York State, uses this information to ascertain the potential for pollution from storm water collection and discharge systems and to determine appropriate permitting requirements. The WVDP is expecting SPDES permit modifications in 1999 that encompass storm water and the flow increase associated with the north plateau groundwater recovery system.



Petroleum-Spill Reporting/Underground Storage Tanks Program. In October 1997 petroleum-contaminated soils were encountered at the bottom of an underground storage tank excavation, and the appropriate regulatory agencies were notified. It was presumed that the leak had occurred before 1985 when the tank had been decommissioned by filling it with concrete. The final report on results of a field investigation to determine the lateral and vertical extent of the petroleum-contaminated soils, completed in February 1998, confirmed that petroleum contamination was limited to the area around the former tank.

A second field investigation in October 1998 collected information to be used to evaluate in situ alternatives for remediating the contaminated soil. On March 19, 1999 the DOE and NYSDEC executed a Stipulation Pursuant to Section 17-0303 of the Environmental Conservation Law and Section 176 of the Navigation Law for cleanup and removal of the petroleum contaminants. Remedial plans, including a soil-venting system, are currently being designed. Construction is expected to begin in mid-1999.

Flood Protection: Water Supply Dam Inspection. On September 22, 1998 NYSDEC performed its periodic four-year inspection of the site's two water supply reservoir dams and the emergency spillway located at the WNYNSC. The inspection, which included a walkdown of the downstream slopes of the dams, the emergency spillway, and outlets, focused on verifying proper maintenance and on detecting ground disruptions such as erosion or slumping that could affect the structural integrity of the impoundments.

Dam #2 and the emergency spillway were found to be satisfactorily maintained. However, an area of displaced soil a few feet thick extending approximately 100 feet down the slope of dam #1 was observed. The slumping was attributed to a failed section of an access road directly upgradient of the displaced soil. NYSDEC was informed of the WVDP's repair and restoration plan, which included relocation of that section of the roadway, removal of associated piers and rock baskets, diversion of the road underdrain, installation of silt fencing, and final reseeding of the disturbed area. NYSDEC concurred with the plans and confirmed that these activities constituted routine maintenance and did not require a permit under the Protection of Waters program for dams and impoundment structures (6 NYCRR Part 608.3).

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 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 1998 and found to be in generally good condition. The grass cover on the clay and soil cap is routinely maintained and cut, and drainage is maintained to ensure that no obvious ponding or soil erosion occurs.

Project Assessment Activities in 1998

As the primary contractor for the DOE at the WVDP, WVNS maintains a comprehensive review program for proposed and ongoing operations. Assessments are conducted through formal surveillances and an informal "walk and talk" program. Formal surveillances ensure compliance with regulations, directives, and DOE Orders. The "walk and talk" program is used to identify issues or potential problems that can be corrected on the spot.

The local DOE Project office also independently reviews various aspects of the environmental program, and in 1998 overall results of the reviews reflected continuing, well-managed environmental programs at the WVDP.

Significant external environmental overview activities in 1998 included an inspection by NYSDEC and the EPA for compliance with RCRA; an inspection by NYSDEC for compliance with SPDES requirements; an inspection of the water supply reservoir dams and the water supply emergency spillway; and an annual inspection of the WVDP potable water supply system by the Cattaraugus County Health Department. These inspections did not identify any environmental program findings and further demonstrated the WVDP's commitment to protection of the environment.

During 1998 the DOE reviewed the WVDP EMS and ISMS procedures. The Project subsequently received verification of its enhanced work planning (EWP) and ISMS programs from the DOE Ohio Field Office.

Hardware and software used in the environmental monitoring program were assessed for year-2000 compliance. Included in the assessment were the meteorological system, water samplers, air samplers, radiological counting instruments, emergency response equipment, laboratory and field equipment and instruments, and data management and reporting systems. A schedule for completing corrective actions was developed and implemented so that all systems will be year-2000 compliant in 1999.

CHAPTER 1
ENVIRONMENTAL MONITORING PROGRAM INFORMATION

Introduction

The high-level radioactive waste (HLW) presently stored at the West Valley Demonstration Project (WVDP) is the byproduct of the reprocessing of spent nuclear fuel conducted during the late 1960s and early 1970s by Nuclear Fuel Services, Inc.(NFS).

Since the Western New York Nuclear Service Center (WNYNSC) is no longer an active nuclear fuel reprocessing facility, the environmental monitoring program focuses on measuring radioactivity and chemicals associated with the residual effects of NFS operations and the Project's high-level waste treatment and low-level waste management operations. The following information about the operations at the WVDP and about radiation and radioactivity will be useful in understanding the activities of the Project and the terms used in reporting the results of environmental testing measurements.

Radiation and Radioactivity. Radioactivity is a process in which unstable atomic nuclei spontaneously disintegrate or "decay" into atomic nuclei of another isotope or element. (See *isotope*, p.5, in the Glossary.) The nuclei decay until only a stable, nonradioactive isotope remains. Depending on the isotope, this process can take anywhere from less than a second to hundreds of thousands of years.

As atomic nuclei decay, radiation is released in three main forms: alpha particles, beta particles, and gamma rays. By emitting energy or particles, the nucleus moves toward a less energetic, more stable state.

Alpha Particles. An alpha particle, released by decay, is a fragment of a much larger nucleus. It consists of two protons and two neutrons (similar to a helium atom nucleus) and is positively charged. Compared to beta particles, alpha particles are relatively large and heavy and do not travel very far when ejected by a decaying nucleus. Alpha radiation, therefore, is easily stopped by a thin layer of material such as paper or skin. However, if radioactive material is ingested or inhaled, the alpha particles released inside the body can damage soft internal tissues because all of their energy is absorbed by tissue cells in the immediate vicinity of the decay. An example of an alpha-emitting radionuclide is the uranium isotope with an atomic weight of 232 (uranium-232). Uranium-232 is in the high-level waste mixture at the WVDP as a result of a thorium-based nuclear fuel reprocessing campaign conducted by NFS and has been previously detected on occasion in liquid waste streams.

Beta Particles. A beta particle is an electron that results from the breakdown of a neutron in a radioactive nucleus. Beta particles are small compared to alpha particles, travel at a higher speed (close to the speed of light), and can be stopped by a material such as wood or aluminum less than an inch thick. If beta particles are released inside the body they do much less damage than an equal number of alpha particles. Because they are smaller and faster and have less of a charge, beta particles deposit energy in fewer tissue cells and over a larger volume than alpha particles. Strontium-90, a fission product (see Glossary, p.4), is an example of a beta-emitting radionuclide. Strontium-90 is found in the stabilized supernatant.

Gamma Rays. Gamma rays are high-energy "packets" of electromagnetic radiation, called photons, that are emitted from the nucleus. They are similar to x-rays but generally have a shorter wavelength and therefore are more energetic than x-rays. If the alpha or beta particle released by the decaying nucleus does not carry off all the energy generated by the nuclear disintegration, the excess energy may be emitted as gamma rays. If the released energy is high, a very penetrating gamma ray is produced that can be effectively reduced only by shielding consisting of several inches of a heavy element, such as lead, or of water or concrete several feet thick. Although large amounts of gamma radiation are dangerous, gamma rays are also used in many lifesaving medical procedures. An example of a gamma-emitting radionuclide is barium-137m, a short-lived daughter product of cesium-137. Both barium-137m and cesium-137 are major constituents of the WVDP high-level radioactive waste.

Measurement of Radioactivity. The rate at which radiation is emitted from a disintegrating nucleus can be described by the number of decay events or nuclear transformations that occur in a radioactive material over a fixed period of time. This process of emitting energy, or radioactivity, is measured in curies (Ci) or becquerels (Bq).

The curie is based on the decay rate of the radionuclide radium-226 (Ra-226). One gram of radium-226 decays at the rate of 37 billion nuclear disintegrations per second (3.7×10^{10} d/s), so one curie equals 37 billion nuclear disintegrations per second. One becquerel equals one decay, or disintegration, per second.

Very small amounts of radioactivity are sometimes measured in picocuries. A picocurie is one-trillionth (10^{-12}) of a curie, equal to 3.7×10^{-2} disintegrations per second, or 2.22 disintegrations per minute.

Measurement of Dose. The amount of energy absorbed by the receiving material is measured in rads (radiation absorbed dose). A rad is 100 ergs of radiation energy absorbed per gram of material. (An erg is the approximate amount of energy necessary to lift a mosquito one-sixteenth of an inch.) "Dose" is a means of expressing the amount of energy absorbed, taking into account the effects of different kinds of radiation.

Alpha, beta, and gamma radiation affect the body to different degrees. Each type of radiation is given a quality factor that indicates the extent of human cell damage it can cause compared with equal amounts of other ionizing radiation energy. Alpha particles cause twenty times as much damage to internal tissues as x-rays, so alpha radiation has a quality factor of 20 compared to gamma rays, x-rays, or beta particles, which have a quality factor of 1.

The unit of dose measurement to humans is the rem (roentgen-equivalent-man). Rems are equal to the number of rads multiplied by the quality factor for each type of radiation. Dose can also be expressed in sieverts. One sievert equals 100 rem.

Environmental Monitoring Program Overview

Human beings may be exposed to radioactivity primarily through air, water, and food. At the WVDP all three pathways are monitored, but air and surface water path-

Ionizing Radiation

Radiation can be damaging if, in colliding with other matter, the alpha or beta particles or gamma rays knock electrons loose from the absorber atoms. This process is called ionization, and the radiation that produces it is referred to as ionizing radiation because it changes an electrically neutral atom, in which the positively charged protons and the negatively charged electrons balance each other, into a charged atom called an ion. An ion can be either positively or negatively charged. Various kinds of ionizing radiation produce different degrees of damage.

Potential Effects of Radiation

The biological effects of radiation can be either somatic or genetic. Somatic effects are restricted to the person who has been exposed to radiation. For example, sufficiently high exposure to radiation can cause clouding of the lens of the eye or loss of white blood cells.

Radiation also can cause chromosomes to break or rearrange themselves or to join incorrectly with other chromosomes. These changes may produce genetic effects and may show up in future generations. Radiation-produced genetic defects and mutations in the offspring of an exposed parent, while not positively identified in humans, have been observed in some animal studies.

The effect of radiation depends on the amount absorbed within a given exposure time. The only observable effect of an instantaneous whole-body dose of 50 rem (0.5 Sv) might be a temporary reduction in white blood cell count. An instantaneous dose of 100-200 rem (1-2 Sv) might cause additional temporary effects such as vomiting but usually would have no long-lasting side effects.

Assessing biological damage from low-level radiation is difficult because other factors can cause the same symptoms as radiation exposure. Moreover, the body apparently is able to repair damage caused by low-level radiation.

The effect most often associated with exposure to relatively high levels of radiation appears to be an increased risk of cancer. However, scientists have not been able to demonstrate with certainty that exposure to low-level radiation causes an increase in injurious biological effects, nor have they been able to determine if there is a level of radiation exposure below which there are no biological effects.

Background Radiation

Background radiation is always present, and everyone is constantly exposed to low levels of such radiation from both naturally occurring and manmade sources. In the United States the average total annual exposure to this low-level background radiation is estimated to be about 360 millirem (mrem) or 3.6 millisieverts (mSv). Most of this radiation, approximately 295 mrem (2.95 mSv), comes from natural sources. The rest comes from medical procedures, consumer products, and other manmade sources. (See p.4-3 in Chapter 4, Radiological Dose Assessment.)

Background radiation includes cosmic rays, the decay of natural elements such as potassium, uranium, thorium, and radon, and radiation from sources such as chemical fertilizers, smoke detectors, and televisions. Actual doses vary depending on such factors as geographic location, building ventilation, and personal health and habits.

ways are the two primary means by which radioactive material can move off-site.

The geology of the site (types of soil and bedrock), the hydrology (location and flow of surface water and groundwater), and meteorological characteristics of the site (wind speed, patterns, and direction) are all considered in evaluating potential exposure through the major pathways.

The on-site and off-site monitoring program at the WVDP includes measuring the concentration of alpha and beta radioactivity, conventionally referred to as "gross alpha" and "gross beta," in air and water effluents. Measuring the total alpha and beta radioactivity from key locations, which can be done within a matter of hours, produces a comprehensive picture of on-site and off-site levels of radioactivity from all sources. In a facility such as the WVDP, frequent updating and tracking of the overall levels of radioactivity in effluents is an important tool in maintaining acceptable operations.

More detailed measurements are also made for specific radionuclides. Strontium-90 and cesium-137 are measured because they have been previously detected in WVDP waste materials. Radiation from other important radionuclides such as tritium or iodine-129 are not sufficiently energetic to be detected by gross measurement techniques, so these must be analyzed separately using methods with greater sensitivity. Heavy elements such as uranium, plutonium, and americium require special analysis to be measured because they exist in such small concentrations in the WVDP environs.

The radionuclides monitored at the Project are those that might produce relatively higher doses or that are most abundant in air and water effluents. Because manmade sources of radiation at the Project have been decaying for more than twenty years, the monitoring program does not routinely include short-lived radionuclides, i.e., isotopes with a half-life of less than two years, which would have only 1/1,000 of the original radioactivity remaining. (See Appendix B [pp. B-1 through B-44] for the schedule of samples and radionuclides measured and Appendix K, Table K-1 [p.K-3] for related Department of Energy [DOE] protection standards, i.e., derived concentration guides [DCGs] and half-lives of radionuclides measured in WVDP samples.)

Data Reporting. Because the decay of radioactive atoms is a random process, there is an inherent uncertainty associated with all environmental radioactivity measurements. This can be demonstrated by repeatedly measuring the number of atoms that decay in a radioactive sample over some fixed period of time. The result of such an experiment would be a range of values for which the average value would provide the best indication of how many radioactive atoms were present in the sample.

However, in actual practice a sample of the environment usually is measured for radioactivity just once, not many times. The inherent uncertainty of the measurement, then, stems from the fact that it cannot be known whether the result that was obtained from one measurement is higher or lower than the "true" value, i.e., the average value that would be obtained if many measurements had been taken.

The term confidence interval is used to describe the range of measurement values above and below the test result within which the "true" value is expected to lie. This interval is derived mathematically. The width of the interval is based primarily on a predetermined confidence level, i.e., the probability that the confidence interval actually encompasses the "true" value. The WVDP environmental monitoring program uses a 95% confidence level for all radioactivity measurements and calculates confidence intervals accordingly.

The confidence interval around a measured value is indicated by the plus-or-minus (±) value following the result, e.g., 5.30 ± 3.6E-09 μCi/mL, with the exponent of 10^{-9} expressed as "E-09." Expressed in decimal form, the number would be 0.0000000053 ± 0.0000000036 µCi/mL. A sample measurement expressed this way is correctly interpreted to mean "there is a 95% probability that the concentration of radioactivity in this sample is between 1.7E-09 µCi/mL and 8.9E-09 µCi/mL."

If the confidence interval for the measured value includes zero (e.g., 5.30 ± 6.5E-09 µCi/mL), the value is considered to be below the detection limit. The values listed in tables of radioactivity measurements in the appendices include the confidence interval regardless of the detection limit value.

In general, the detection limit is the minimum amount of constituent or material of interest detected by an instrument or method that can be distinguished from background and instrument noise. Thus, the detection limit is the lowest value at which a sample result shows a statistically positive difference from a sample in which no constituent is present.

Nonradiological data conventionally are presented without an associated uncertainty and are expressed by the detection limit prefaced by a "less-than" symbol (<) if that analyte was not measurable. (See also Data Assessment and Reporting [p.5-7] in Chapter 5, Quality Assurance.)

Changes in the 1998 Environmental Monitoring Program. Changes in the 1998 environmental monitoring program enhanced the environmental sampling and surveillance network in order to support current activities and to prepare for future activities.

• The quarterly environmental monitoring data report (QEMDR) was discontinued in mid-1998. The annual (radioactive) effluent information system/on-site discharge information system (EIS/ODIS) also was discontinued. Data formerly contained in these two reports are now evaluated monthly in the monthly trend analysis report

Derived Concentration Guides

A derived concentration guide (DCG) is defined by the DOE as the concentration of a radionuclide in air or water that, under conditions of continuous exposure by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation) for one year, would result in an effective dose equivalent of 100 mrem (1 mSv) to a "reference man." These concentrations — DCGs — are considered screening levels that enable site personnel to review effluent and environmental data and to decide if further investigation is needed. (See Table K-1, Appendix K, p.K-3 for a list of DCGs.)

DOE Orders require that the hypothetical dose to the public from facility effluents be estimated using specific computer codes. (See Dose Assessment Methodology [p.4-6] in Chapter 4, Radiological Dose Assessment.) Doses estimated for WVDP activities are calculated using actual site data and are not related directly to DCG values.

Dose estimates are based on a sum of isotope quantities released and the dose equivalent effects for that isotope. For liquid effluent screening purposes, percentages of the DCGs for all radionuclides present are added: if the total percentage of the DCGs is less than 100, then the effluent released complies with the DOE guideline.

Although the DOE provides DCGs for airborne radionuclides, the more stringent U.S. Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) apply to Project airborne effluents. As a convenient reference point, comparisons with DCGs are made throughout this report for both air and water samples.

(MTAR) and are summarized in full in the annual site environmental report (SER).

• Air monitoring point ANSUPCV was discontinued in 1998 because the supercompactor was decommissioned and shipped off-site in May 1998.

• Effluent point ANLLWTVC was discontinued in 1998 because the processes housed in the O2 building were transferred to the new low-level waste treatment (LLW2) facility.

• Monitoring point ANLLW2V, associated with the new LLW2 facility, was added to the program in 1998.

• Co-located NRC monitoring points used to independently verify environmental radiation levels were discontinued in 1998.

Appendix B summarizes the program changes (p.B-iv) and lists the sample points and parameters measured in 1998 (pp.B-1 through B-44).

Vitrification Overview. High-level radioactive waste from NFS operations was originally stored in two of four underground tanks (tanks 8D-2 and 8D-4). The waste in 8D-2, the larger of the active tanks, had settled into two layers: a liquid — the supernatant — and a precipitate layer on the tank bottom — the sludge. To solidify the high-level waste, WVDP engineers designed and developed a process of pretreatment and vitrification.

Pretreatment Accomplishments. The supernatant (in tank 8D-2) was composed mostly of sodium and potassium salts dissolved in water. Radioactive cesium in solution accounted for more than 99% of the total radioactivity in the supernatant. During pretreatment, sodium salts and sulfates were separated from the radioactive constituents in both the liquid portion of the high-level waste and the sludge layer in the bottom of the tank.

Pretreatment of the supernatant began in 1988. The integrated radwaste treatment system (IRTS) reduced the volume of the high-level waste needing vitrification by producing low-level waste stabilized in cement: The supernatant was passed through zeolite-filled ion exchange columns in the supernatant treatment system (STS) to remove more than 99.9% of the radioactive cesium. The resulting liquid was then concentrated by evaporation in the liquid waste treatment system (LWTS). This low-level radioactive concentrate was blended with cement in the cement solidification system (CSS) and placed in 269-liter (71-gal) steel drums. The cement-stabilized waste form has been accepted by the U.S. Nuclear Regulatory Commission (NRC). Finally, the steel drums were stored in an on-site aboveground vault, the drum cell. Processing of the supernatant was completed in 1990, with more than 10,000 drums of cemented waste produced.

The sludge that remained was composed mostly of iron hydroxide. Strontium-90 accounted for most of the radioactivity in the sludge. Pretreatment of the sludge layer in high-level waste tank 8D-2 began in 1991. Five specially designed 50-foot-long pumps were installed in the tank to mix the sludge layer with water in order to produce a uniform sludge blend and to dissolve the sodium salts and sulfates that would interfere with vitrification. After mixing and allowing the sludge to settle, processing of the wash water through the integrated radwaste treatment system began. Processing removed radioactive constituents for later solidification into glass, and the wash water containing salt was then stabilized in cement.

Sludge washing was completed in 1994 after approximately 765,000 gallons of wash water had been processed. About 8,000 drums of cement-stabilized wash water were produced.

In January 1995, high-level waste liquid stored in tank 8D-4 was transferred to tank 8D-2. (Tank 8D-4 contained THOREX high-level radioactive waste, which had been produced by a single reprocessing campaign of a special fuel containing thorium that had been conducted from November 1968 to January 1969 by the previous facility operators.) The resulting mixture was washed and the wash water was processed. The IRTS processing of the combined wash waters was completed in May 1995.

In all, through the supernatant treatment process and the sludge wash process, more than 1.7 million gallons of liquid had been processed by the end of 1995, producing a total of 19,877 drums of cemented low-level waste.

As one of the final steps, the ion-exchange material (zeolite) used in the integrated radwaste treatment system to remove radioactivity was blended with the washed sludge before being transferred to the vitrification facility for blending with the glass-formers. In 1995 and early 1996 final waste transfers to high-level waste tank 8D-2 were completed in preparation for vitrification.

Preparation for Vitrification. Nonradioactive testing of a full-scale vitrification system was conducted from 1984 to 1989. In 1990 all vitrification equipment was removed to allow installation of shield walls for fully remote radioactive operations. The walls and shielded tunnel connecting the vitrification facility to the former reprocessing plant were completed in 1991.

The slurry-fed ceramic melter was fully assembled, bricked, and installed in 1993, and the cold chemical building was completed, as was the sludge mobilization system that transfers high-level waste to the melter. This system was fully tested in 1994. Several additional major systems components also were installed in 1994: the canister turntable, which positions the stainless steel canisters as they are filled with molten glass; the submerged bed scrubber, which cleans gases produced by the vitrification process; and the transfer cart, which moves filled canisters to the storage area.

Nonradiological testing ("cold" operations) of the vitrification facility began in 1995, and the first canister of nonradiological glass was produced. The WVDP declared its readiness to proceed with the necessary equipment tie-ins of the ventilation and utility systems to the vitrification facility building and tie-ins of the transfer lines to and from the high-level waste tank farm and the vitrification facility. In this closed-loop system, the transfer lines connect to multiple common lines so that material can be moved among all the points in the system. High-level waste vitrification began in 1996 and continued throughout 1998.

1998 Activities at the WVDP

The WVDP's environmental management system is an important factor in the environmental monitoring program and the accomplishment of its mission. Significant components, initiatives, and pertinent information about the work accomplished at the WVDP in 1998 are summarized below.

Vitrification. Solidification of the high-level waste in glass continued in 1998. The high-level waste mixture of washed sludge and spent zeolite from the ion-exchange process is combined in batches with glass-forming chemicals and then fed to a ceramic melter. The waste mixture is heated to approximately 2,000°F and poured into stainless steel canisters. Approximately 270 stainless steel canisters eventually will be needed to hold all of the vitrified waste. Each canister, 10 feet long by 2 feet in diameter, is filled with a uniform, high-level waste glass that will be suitable for eventual shipment to a federal repository. During Phase I (June 1996 to June 1998) 210 canisters were filled.

In 1998 more than 2.1 million curies of radioactivity were transferred to the vitrification facility and fifty-two high-level waste canisters were produced. Since the beginning of vitrification in 1996 through calendar year 1998, 230 high-level waste canisters have been filled. Based on analysis of the first sixty-eight batches, more than 10.3 million cesium/strontium curies have been transferred to the vitrification facility and vitrified.

Environmental Management of Aqueous Radioactive Waste. Water containing radioactive material from site process operations is collected and treated in the low-level waste treatment facility (LLWTF). (Water from the sanitary system, which does not contain added radioactive material, is managed in a separate system.) The treated process water is held, sampled, and analyzed before it is released through a State Pollutant Discharge Elimination System (SPDES)-permitted outfall. In 1998, 43.5 million liters (11.5 million gal) of water were treated in the LLWTF and discharged through outfall 001, the lagoon 3 weir.

The discharge waters contained an estimated 12 millicuries of gross alpha plus gross beta radioactivity. Comparable releases during the previous thirteen years averaged about 41 millicuries per year. The 1998 release was about 29% of this average. (See Radiological Monitoring: Surface Water, Low-level Waste Treatment Facility Sampling Location [p.2-2] in Chapter 2.)

Approximately 0.20 curies of tritium were released in WVDP liquid effluents in 1998. This is 13% of the thirteen-year average of 1.57 curies.

Environmental Management of Airborne Radioactive Emissions. Ventilated air from the various points in the IRTS process (high-level waste sludge treatment, main plant and liquid waste treatment system, and the cement solidification system) and from other waste management activities is sampled continuously during operation for both particulate matter and for gaseous radioactivity. In addition to monitors that alarm if particulate matter radioactivity increases above preset levels, the sample media are analyzed in the laboratory for the specific radionuclides that are present in the radioactive materials being handled.

Air used to ventilate the facilities where radioactive material cleanup processes are operated is passed through filtration devices before being emitted to the atmosphere. These filtration devices are generally more effective for particulate matter than for gaseous radioactivity. For this reason, facility air emissions tend to contain a greater amount of gaseous radioactivity (e.g., tritium and iodine-129) than radioactivity associated with particulate matter (e.g., strontium-90 and cesium-137). However, gaseous radionuclide emissions still remain so far below the most restrictive regulatory limit for public safety that additional treatment technologies beyond that already provided by, for example, the vitrification off-gas treatment system, are not necessary.

Gaseous radioactivity emissions from the main plant in 1998 included approximately 34.5 millicuries of tritium (as hydrogen tritium oxide [HTO]) and 4.97 millicuries of iodine-129. (See Chapter 2, p.2-24, for further discussion of iodine-129 emissions from the main plant stack.) In 1997, a year in which the vitrification system was in operation for the entire year, tritium and iodine-129 emissions were 140 millicuries and 7.43 millicuries respectively.

Particulate matter radioactivity emissions from the main plant in 1998 included approximately 0.2 millicuries of beta-emitting radioactivity and 0.001 millicuries of alpha-emitting radioactivity. In 1997, beta-emitting and alpha-emitting radioactivity emissions were 0.4 millicuries and 0.001 millicuries respectively.

Unplanned Radiological Releases. There were no unplanned air or liquid radiological releases on-site or to the off-site environment from the Project in 1998.

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 DOE 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 1998. Approximately 205,000 gallons of water were collected from the interceptor trench and transferred to lagoon 2 during the year.

Results of surface and groundwater monitoring in the vicinity of the trench are discussed in Chapter 2 under SDA and NDA Sampling Locations, p.2-6, and in Chapter 3 under Results of Monitoring at the NDA, p.3-13.

Waste Minimization Program. The WVDP formalized a waste minimization program in 1991 to reduce the generation of low-level waste, mixed waste, and hazardous waste. This is an organized, comprehensive, and continual effort to prevent or minimize pollution, and the overall goal of this program is to reduce health and safety risks, protect the environment, and comply with all federal and state regulations. (For more details see the Environmental Compliance Summary: Calendar Year 1998, Waste Minimization and Pollution Prevention [p.ECS-5].)

Pollution Prevention Awareness Program. The WVDP's pollution prevention (P2) awareness program is a significant part of the Project's waste minimization program. The goal of the program is to make all employees aware of the importance of pollution prevention both at work and at home.

A crucial component of the P2 awareness program at the WVDP is the Pollution Prevention Coordinators group. This group of volunteers communicates, shares, and publicizes prevention, reduction, reuse, and recycling information to all departments at the WVDP.

The P2 coordinators identify and facilitate the implementation of effective source reduction, reuse, recycling, and procurement of recycled products. Six self-directed teams evaluate specific concerns and issues and make recommendations for resolution.

Accomplishments of the P2 Awareness Program. As part of the goal of achieving a larger community awareness of pollution prevention, the Pollution Prevention Coordinators organized annual Earth Day activities for WVDP employees and a community outreach that involved a local business, the local school, the WVDP, and the surrounding community. The P2 coordinators also promoted the first WVDP event for National Pollution Prevention Week as well as the first Energy Awareness Month, sponsored by the Department of Energy. In addition, the P2 coordinators created a P2 web page on the site's Intranet that highlights activities, resources, and successes of the Waste Minimization/Pollution Prevention Program.

Waste Management. Significant achievements in 1998 included overall strategy and long-range waste management program planning; waste storage, processing, and off-site disposal; compliance with regulatory requirements; waste volume reduction; and waste minimization and pollution prevention.

• The WVDP Site Technology Coordination group continued to help identify and implement new waste management technologies for WVDP wastes. This group is charged with identifying technology required to meet existing and future waste management goals, evaluating emerging technologies, and promoting technology transfer between DOE facilities, federal agencies, and private industry.

• Improved wastewater technology was incorporated, resulting in a reduction of approximately 1,000 ft^3 per year in the volume of ion-exchange resin used for treating north plateau groundwater and for operation of the LLWTF.

• Low-level radioactive waste shipments off-site to licensed treatment, storage, and disposal facilities (TSDFs) totaled 10,422 ft^3 in 1998, compared to 4,835 ft^3 in 1997.

• Approximately 200,000 lbs of nonradioactive testing glass was sent to a recycling facility in lieu of disposal.

• Excess stocks of mercury thermometers were shipped to area universities for reuse, avoiding disposal as a hazardous waste.

• Decommissioned equipment was radiologically surveyed and released for reuse on-site, resulting in a reduction of approximately 167 ft^3 of low-level waste.

Three additional waste management milestones were completed during 1998: Matching Technologies Being Pursued to Site Needs, Classification of Backlog Wastes in Inventory, and Completion of a Soil Management Program.

The Waste Management department also was reengineered to improve methods of addressing waste management at the WVDP. Reengineering included establishing a baseline database and providing characterization and disposition information during work planning. Other procedural improvements included container management, staging, and transportation.

National Environmental Policy Act Activities. Under the National Environmental Policy Act (NEPA), the Department of Energy is required to consider the overall environmental effects of its proposed actions or federal projects. The President's Council on Environmental Quality established a screening system of analyses and documentation that requires each proposed action to be categorized according to the extent of its potential environmental effect. The levels of documentation include categorical exclusions (CXs), environmental assessments (EAs), and environmental impact statements (EISs).

Categorical exclusions evaluate and document actions that will not have a significant effect on the environment. Environmental assessments evaluate the extent to which the proposed action will affect the environment. If a proposed action has the potential for significant effects, an environmental impact statement is prepared that describes proposed alternatives to an action and explains the effects.

NEPA activities at the WVDP involve facility maintenance and minor projects that support high-level waste vitrification. These projects are documented and submitted for approval as categorical exclusions, although environmental assessments are occasionally necessary.

In December 1988 the DOE published a Notice of Intent to prepare an environmental impact statement for the completion of the WVDP and closure of the facilities at the WNYNSC. The environmental impact statement describes the potential environmental effects associated with Project completion and various site closure alternatives.

The draft environmental impact statement was completed in 1996 and released for a six-month public review and comment period. Comments currently are being evaluated. Having met throughout 1997 and 1998 to review alternatives presented in the environmental impact statement, the Citizen Task Force issued the West Valley Citizen Task Force Final Report (July 29, 1998). This report provided recommendations and advice on the development of a preferred alternative. The Citizen Task Force continues to meet and discuss the issues related to this environmental impact statement.

The Nuclear Regulatory Commission (NRC), as a cooperating agency in this environmental impact statement and as part of its responsibilities under the WVDP Act, issued SECY-98-251, Decommissioning Criteria for West Valley (October 30, 1998). This document proposed decommissioning criteria for the WVDP and the West Valley site and identified potential alternatives that may be necessary to ensure acceptable long-term control and care of the site. The NRC staff presented this to the NRC Commissioners for their approval. The DOE, NYSERDA, NYSDEC, and the Citizen Task Force were invited to the briefing. (See the Environmental Compliance Summary: Calendar Year 1998 [p.ECS-14] for a more detailed discussion of specific NEPA activities in 1998.)

A supplement to the draft environmental impact statement is scheduled for release in 1999, with a final version of the EIS expected in 2000.

Self-assessments continued to be conducted in 1998 to review the management and effectiveness of the WVDP environmental protection and monitoring programs. Results of these self-assessments are evaluated and corrective actions are tracked through completion. Overall results of these self-assessments found that the WVDP continued to implement and in some cases improve the quality of the environmental protection and monitoring program. (See the Environmental Compliance Summary: Calendar Year 1998 [p.ECS-19] and Chapter 5, Quality Assurance [p.5-6].)

In addition to the public comment process required by the National Environmental Policy Act, NYSERDA, with participation from the DOE, formed a Citizen Task Force in January 1997. The mission of the Task Force is to assist in the development of a preferred alternative for the completion of the West Valley Demonstration Project and the cleanup, closure, or long-term management of the facilities at the Western New York Nuclear Service Center. The Task Force process has helped illuminate the various interests and concerns of the community, increased the two-way flow of information between the site managers and the community, and provided an effective way for the Task Force members to establish a mutually agreed upon set of recommendations for the site managers to consider in their decision-making process.

Occupational Safety and Environmental Training. The occupational safety of personnel who are involved in industrial operations under DOE cognizance is protected by standards mandated by DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards, which directs compliance with specific Occupational Safety and Health Act (OSHA) requirements. This act governs diverse occupational hazards ranging from electrical safety and protection from fire to the handling of hazardous materials. The purpose of OSHA is to maintain a safe and healthy working environment for employees.

Hazardous Waste Operations and Emergency Response regulations require that employees at treatment, storage, and disposal facilities, who may be exposed to health and safety hazards during hazardous waste operations, receive training appropriate to their job function and responsibilities. The WVDP Environmental, Health, and Safety training matrix identifies the specific training requirements for affected employees.

The WVDP provides the standard twenty-four-hour hazardous waste operations and emergency response training. (Emergency response training includes spill response measures and controlling contamination of groundwater.) Training programs also contain information on waste minimization, pollution prevention, and the WVDP environmental management program. Besides this standard training, employees working in radiological areas receive additional training on subjects such as understanding radiation and radiation warning signs, dosimetry, and respiratory protection. In addition, qualification standards for specific job functions at the site are required and maintained. These programs have evolved into a comprehensive curriculum of knowledge and skills necessary to maintain the health and safety of employees and ensure the continued compliance of the WVDP.

The WVDP maintains a hazardous materials response team that is trained to respond to spills of hazardous materials. This team maintains its proficiency through classroom instruction and scheduled training drills.

Medical emergencies on-site are handled by the WVDP Emergency Medical Response Team. This team consists of on-site professional medical staff, volunteer New York State-certified emergency medical technicians, and main plant operators who are certified as New York State First Responders.

Any person working at the WVDP who has a picture badge receives general employee training covering health and safety, emergency response, and environmental compliance issues. All visitors to the WVDP receive a site-specific briefing on safety and emergency procedures before being admitted to the site.

ISMS Implementation. An integrated environmental, safety, and health (ES&H) management system (ISMS) was implemented at the WVDP during 1998. The original implementation plan comprised eight key areas to be improved and included writing a safety management system description, developing two new site-specific procedures, and integrating more than thirty key procedures.

Enhanced work planning (EWP) closely matches the core elements of ISMS and was one of the more important areas identified for improvement to successfully implement ISMS at the Project. Organizing the site-wide work review group (WRG) was the most significant EWP initiative. The WRG provides review and input for proposed work documents and, along with other improvements such as up-front worker involvement, satisfied EWP and ISMS requirements. As a result, the EWP and ISMS programs received verification from the DOE Ohio Field Office (i.e., DOE accepted these programs).

Environmental management at the WVDP is integrated with other safety-management processes at the site. Existing environmental management procedures provide the basic policy and direction for accomplishing work through proactive management, environmental stewardship, and integration of appropriate technologies across all Project functions. Potential threats to the environment are evaluated through environmental assessments (EAs) or environmental impact statements (EISs), which are required by the National Environmental Policy Act (NEPA).

The two predominant environmental management systems are the Code of Environmental Management Principles for Federal Agencies (CEMP) and the ISO/DIS 14001, Environmental Management Systems - Specification for Guidance and Use. CEMP was developed by the EPA in response to Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements. CEMP uses five broad principles and underlying performance objectives as the basis for federal agencies to move toward responsible environmental management. These principles help ensure environmental performance that is proactive, flexible, cost-effective, integrated, and sustainable. ISO/DIS 14001, developed by the International Organization for Standardization (ISO), provides a comparable environmental management system that is being implemented throughout the world. The elements of an environmental management system correspond to the guiding principles and core functions of an integrated safety management system.

EMS Implementation. The environmental management system at the WVDP encompasses the requirements of both the CEMP and ISO 14001. This system allows the effects of site activities on the environment to be considered; follows practices that eliminate or minimize negative effects; includes monitoring and compliance with all applicable environmental laws, regulations, and requirements; and requires the management of programs, projects, and activities in a manner that protects the environment and public health.

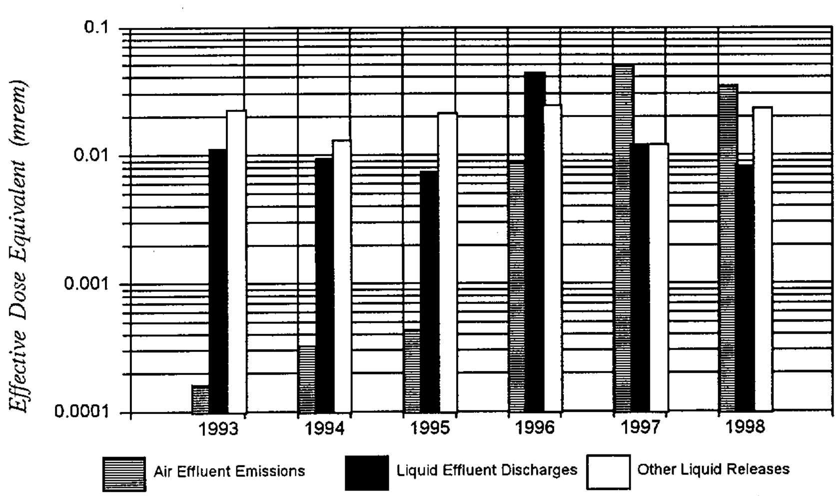


Figure 1-1. Annual Effective Dose Equivalent to the Maximally Exposed Off-site Individual

Performance Measures

Performance measures can be used to evaluate effectiveness, efficiency, quality, timeliness, productivity, safety, or other areas that reflect achievements related to organization or process goals and can be used as a tool to identify the need to institute changes.

Several performance measures applicable to operations conducted at the WVDP are discussed below. These measures reflect process performance related to wastewater treatment in the low-level waste treatment facility, the identification of spills and releases, the reduction in the generation of wastes, the potential radiological dose received by the maximally exposed off-site individual, and the transfer of high-level waste to the vitrification system.

Radiation Doses to the Maximally Exposed Off-Site Individual. One of the most important pieces of information derived from environmental monitoring program data is the potential radiological dose to an off-site individual from on-site activities. As an overall assessment of Project activities and the effectiveness of the as-low-as-reasonably achievable (ALARA) concept, the effective radiological dose to the maximally exposed off-site individual is an indicator of well-managed radiological operations. The effective dose equivalent for air effluent emissions, liquid effluent discharges, and other liquid releases (such as swamp drainage) from 1993 through 1998 are graphed in Figure 1-1 (*this page*). Note that the sum of these values is well below the DOE standard of 100 mrem. These consistently low results indicate that radiological activities at the site are well-controlled. (See also Table 4-2 [p.4-7] in Chapter 4, Radiological Dose Assessment.)

SPDES Permit Limit Exceedances. Effective operation of the site wastewater treatment facilities is indicated by compliance with the applicable discharge permit limitations. Approximately sixty parameters are monitored regularly as part of the SPDES permit requirements. The analytical results are reported to the state via Discharge Monitoring Reports required under the SPDES program.

Although the goal of the low-level waste treatment facility (LLWTF) and wastewater treatment facility (WWTF) operations is to maintain effluent water quality consistently within the permit requirements, occasionally SPDES permit limit exceedances do occur. A Water Task Team composed of WVDP personnel with expertise in wastewater engineering, treatment plant operations and process monitoring, and NPDES/SPDES permitting and compliance was formed in 1995 to address the causes of these exceptions.

All SPDES permit limit exceedances are evaluated to determine their cause and to identify corrective measures. In recent years, virtually all of the recorded exceptions were for parameters such as nitrite, pH, and five-day biochemical oxygen demand (BOD_5), which regulate or are greatly influenced by natural (microbiological) treatment processes occurring at the site's industrial and sanitary WWTF and the LLWTF. However, there were no exceedances during 1998.

Although exceedances are not always related to operating deficiencies, corrective actions may include improved operation or treatment techniques. Some examples of the problems solved over the last four years are as follows:

- Elevated concentrations of nitrogen-based nutrients (nitrite, in particular) at the LLWTF

  Nitrite is normally an intermediate compound formed during microbiological conversion of ammonia to nitrate. The conversion process was inhibited by excess nitrate, pH below 6.0 standard units, and cold weather. This was remedied through better control of pH in the open-air lagoons, enhanced process monitoring to detect substantial changes in nutrient concentrations in the lagoons, and elimination of nitric acid from the filter backflush (cleaning) procedure. Eliminating nitric acid became feasible when the anthracite filter media was replaced with sand filter media, which can be effectively backflushed with softened water. Since the replacement filter began operating, nitrate (as nitrogen) concentrations have been reduced by approximately 90% and no permit exceptions for nitrite (as nitrogen) have occurred.

- Excess algae in the LLWTF lagoons

  Seasonal algal growth caused elevated oxygen demand and fluctuating pH conditions in the LLWTF effluent holding lagoons. This was remedied by adding hydrogen peroxide to the water treatment process, consistent sparging (aeration) of the lagoons to increase dissolved oxygen content, using filter socks to capture particulates entrained in the effluent water column, and modifying the SPDES permit with a revised method for determining compliance with the limit for BOD_5 that takes into consideration the cumulative contribution of all Project-regulated effluents rather than individual discharges.

- Elevated nitrite and BOD_5 at the WWTF

  Sudden weather-induced temperature changes in the WWTF influent, which was stored in an open-air flow equalization basin, affected the performance of this microbiological (activated sludge)-based treatment process. An underground influent surge tank was installed in 1997 to make efficient use of the insulating effect of the surrounding soil. Since that time, discharge monitoring results for these parameters have remained within permit limits.

- Changes in receiving stream conditions between sample collection events causing elevated total dissolved solids in Frank's Creek

  Augmentation water from the site reservoirs is used to control the total dissolved solids concentrations in Frank's Creek during lagoon discharges. The delay associated with off-site shipment and analysis of permit-required process control samples created a significant time interval for stream conditions to change without an appropriate adjustment in augmentation flow to ensure compliance. On-site analysis for total dissolved solids was implemented, which shortened the time interval from sample collection and analysis to flow adjustment and reduced the associated risk for undetected changes in receiving stream conditions during this time period.

- Surface Water Infiltration Projects

  Two projects were implemented to divert surface water away from the main plume area on the north plateau. These projects involved capturing surface water runoff from the north parking lot area and placing a low permeability soil layer east of the north parking area.

The Water Task Team's efforts have produced significant results, as shown in Figure 1-2 (*this page*), which graphs the number of SPDES permit exceedances from calendar years 1993 through 1998. The annual number of exceptions to the numerical discharge limits in the site's SPDES permit have been substantially reduced, and in 1998, for the first time since the DOE began operating the Project (in 1982), no exceptions occurred.

Waste Minimization and Pollution Prevention. The WVDP has initiated a program to reduce the quantities of waste generated from site activities. Reductions in the generation of low-level radioactive waste, radioactive mixed waste, hazardous waste, industrial wastes, and sanitary wastes such as paper, glass, plastic, wood, and scrap metal were targeted. To demonstrate the effectiveness of the waste minimization program, a graph of the percentage of waste reduction achieved above the annual goal for each category is presented in Figure 1-3 (p.1-16) for calendar years 1993 through 1998. Not all waste streams have been tracked over this period. Note that the low-level radioactive waste figures from 1993 through 1995 include the volume of drummed waste produced in the cement solidification system. The hazardous waste quantity for 1994 also includes about 1,900 kilograms (4,200 lbs) of waste produced in preparing for vitrification. Hazardous waste and industrial waste volumes have been tracked separately for vitrification-related and nonvitrification-related waste streams since vitrification began in 1996. To maintain historical comparability, the percentages in Figure 1-3 include only the nonvitrification portions of these two waste streams.

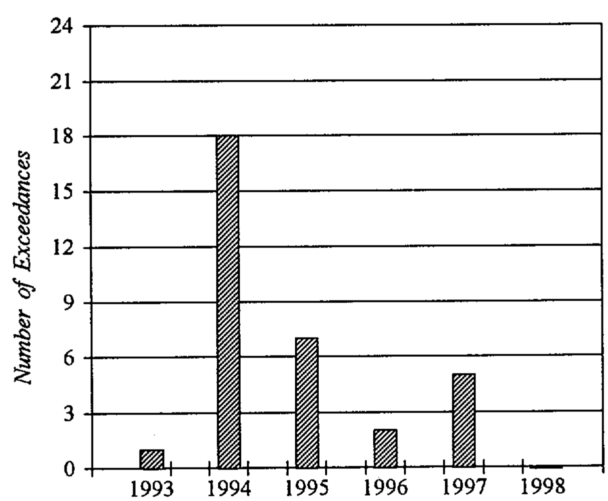


Figure 1-2. Yearly SPDES Permit Exceedances

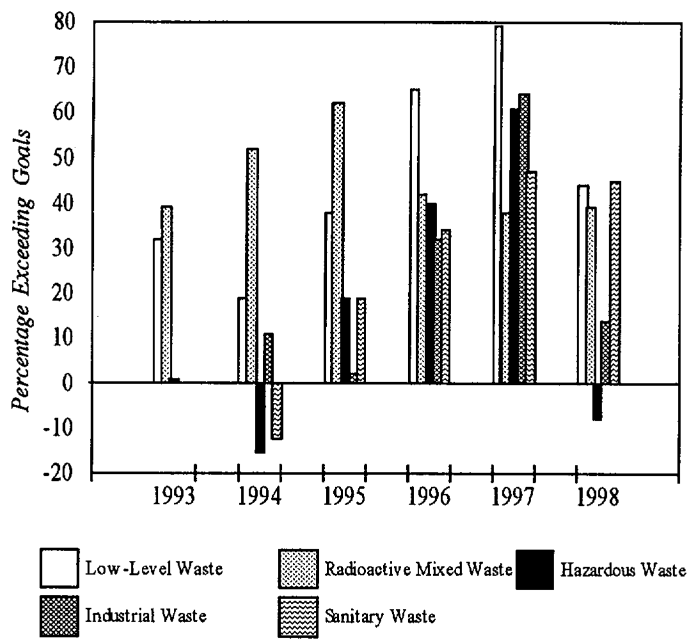


Figure 1-3. Percentage of Waste Reduction Exceeding Annual Goals

Spills and Releases. Chemical spills greater than the applicable reportable quantity must be reported immediately to NYSDEC and the National Response Center and other agencies as required. There were no reportable chemical spills during 1998.

Petroleum spills greater than 5 gallons or of any amount that travel to waters of the state must be reported immediately to the NYSDEC spill hotline and entered in the monthly log. There were two minor spills of petroleum immediately reportable to NYSDEC in 1998. Each of these two releases included less than 1 gallon of diesel fuel that was spilled on paved areas and was promptly contained and cleaned up by site personnel. Figure 1-4 (*this page*) is a bar graph of immediately reportable spills from 1992 to 1998.

Prevention is the best means of protection against oil, chemical, and hazardous substance spills or releases. WVDP employees are trained in applicable standard operating procedures for equipment that they use, and best management practices have been developed that identify potential spill sources and present measures to reduce the potential for releases to occur. Spill training, notification, and reporting policies have also been developed to emphasize the responsibility of each employee to report spills immediately upon discovery. This first-line reporting helps to ensure that spills will be properly documented and mitigated in accordance with applicable regulations.

Vitrification. A primary objective of the West Valley Demonstration Project is to safely solidify the high-level radioactive waste at the site in borosilicate glass. To do this, the high-level waste sludge is transferred in batches from the tank where it currently is stored to the vitrification facility. After transfer, the waste is solidified into a durable glass for safe storage and future transport to a federal repository. It is estimated that 11 million to 12 million curies of strontium and cesium radioactivity in the high-level waste even-

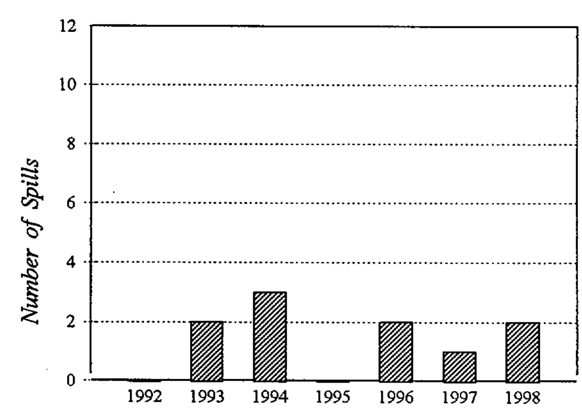


Figure 1-4. Number of Immediately Reportable Spills or Releases

tually will be vitrified. (Radioactive cesium and strontium isotopes account for 98% of the long-lived radioactivity.) To quantify the progress made toward completing the vitrification goal, Figure 1-5 (*this page*) shows the number of curies transferred per month to the vitrification facility in 1998.

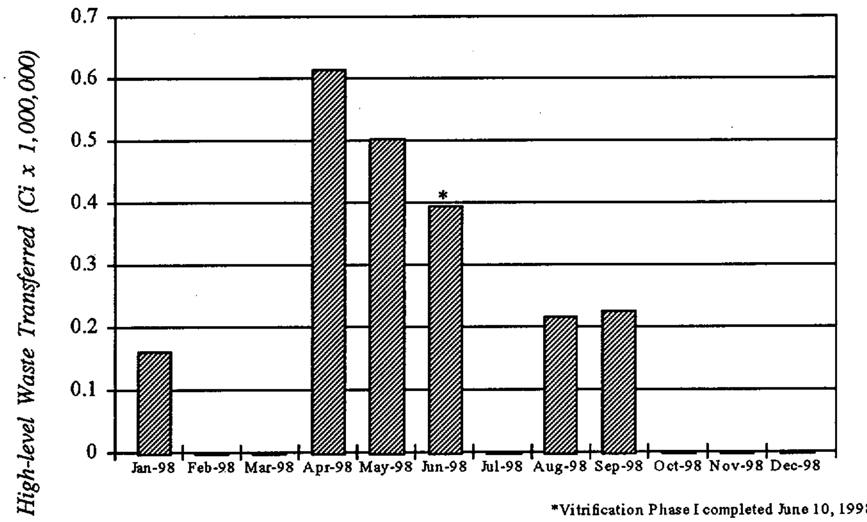


Figure 1-5. Number of Curies Transferred to the Vitrification Facility per Month

On June 10, 1998, the WVDP marked completion of the Project's production phase (Phase I) of high-level waste processing. This milestone included safely vitrifying 85% of the high-level waste inventory in 210 canisters of solidified waste glass and immobilizing more than 9.3 million curies of radioactivity. A total of 230 canisters were filled and more than 10.3 million curies were immobilized through vitrification by year end, bringing the cumulative Project total of immobilized liquid high-level waste to more than 20 million curies, including pretreatment and vitrification.

CHAPTER 2
ENVIRONMENTAL MONITORING

Routine Monitoring Program

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

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

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

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

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

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

Sampling Program Overview

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

Water Sampling Locations. Automatic samplers collect surface water at points along drainage channels within the WNYNSC that are most likely to show any radioactivity released from the site. These automatic samplers collect a 50-milliliter (mL) aliquot (a small volume of water) every half-hour. The aliquots are pumped into a large container from which samples are collected. The samplers operate on-site at four locations: WNSP006, the point in Frank's Creek where Project drainage leaves the security-fenced area; WNNDADR, the drainage point downstream of the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA); WNSWAMP, the northeast drainage; and WNSW74A, the north swamp drainage.

Off-site, automatic samplers collect surface waters from Buttermilk Creek at a background station upstream of the site (WFBCBKG), from Buttermilk Creek downstream of the site at Thomas Corners (WFBCTCB), and from Cattaraugus Creek at Felton Bridge (WFFELBR).

Grab samples are collected at several other surface water locations both on-site and off-site, including a background location on Cattaraugus Creek at Bigelow Bridge (WFBIGBR).

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

Air Sampling Locations. Air samplers are located on-site, at the perimeter of the site, and at points remote from the WVDP. Figure A-4 (p.A-6) shows the locations of the on-site air effluent monitors and samplers and the on-site ambient air samplers; Figure A-5 (p.A-7) and Figure A-12 (p.A-14 in Appendix A) show the locations of the perimeter and remote air samplers.

Radiological Monitoring: Surface Water

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

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

Two liquid effluents, from the low-level waste treatment facility and from the northeast and north swamp drainage, contribute to site dose estimates. (See Chapter 4, Radiological Dose Assessment, Table 4-2, [p.4-7] for an estimate of the dose attributable to these waterborne releases.)

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.A-2 [p.A-4]) into Erdman Brook, a tributary of Frank's Creek. There were six batch releases totaling about 43.5 million liters (11.5 million gal) in 1998. Composite samples were collected near the beginning and end of each discharge and one effluent grab sample was collected during each day of discharge. Samples were analyzed for gross alpha and gross beta radioactivity, for gamma-emitting radionuclides, and for specific radionuclides as noted in Appendix B, p.B-7.

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

The combined annual average of radionuclide concentrations from the lagoon 3 effluent discharge weir in 1998 was approximately 23% of the DCGs. (See Table C-2 [p.C-4].) The average radioactivity concentrations from 1994 through 1997 at WNSP001 were 44%, 43%, 35%, and 22% of the DCG, respectively. The reduction over this period is mostly attributable to improved removal of strontium-90.

In 1998 the low-level waste treatment facility (LLWTF) was replaced by a new facility (LLW2). Both the LLWTF and the LLW2 were designed to efficiently remove strontium-90 and cesium-137, the more prevalent of the long-lived fission products in WVDP wastewaters.

Other radionuclides are also removed to a lesser extent by the low-level waste treatment facility. For example, one other major contributor to the total combined DCG is uranium-232, which averaged 10% of its DCG in 1998. Uranium-232 and other uranium isotopes are found in WVDP liquid waste because they were present in the nuclear fuel that was once reprocessed at the site. Variations in liquid effluent radionuclide ratios continue to reflect the dynamic nature of the waste streams being processed through the low-level waste treatment facility.

(Outfall WNSP001 also is monitored for nonradiological parameters under the New York State Pollutant Discharge Elimination System [SPDES] program. [See Nonradiological Monitoring: Surface Water, p.2-24].)

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

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

Samples from WNSWAMP and WNSW74A are collected weekly and analyzed for radiological parameters. Other than gross beta and strontium-90 at WNSWAMP, concentrations of all measured radiological parameters at WNSWAMP and WNSW74A were less than 5% of the applicable DCGs. The maximum and minimum gross alpha and gross beta results from WNSWAMP and WNSW74A are noted on Tables 2-1 and 2-2 (p.2-5). Complete data from these two locations are found in Tables C-7 and C-8 (pp.C-8 and C-9 in Appendix C).

An upward trend in gross beta concentrations at WNSWAMP, first noted in 1993, continued through 1998. Gross beta activity at this location is largely attributable to strontium-90.(See Special Groundwater Monitoring, p.3-15.) Strontium-90 concentrations at WNSWAMP in 1998 ranged from a low of 7.92E-07 μCi/mL to a high of 2.25E-06 μCi/mL (29.3 Bq/L to 83.2 Bq/L), with an annual average of 1.37E-06 μCi/mL (50.7 Bq/L). This average is 137% of the DCG for strontium-90, 1E-06 μCi/mL (37 Bq/L). (See Chapter 3, Fig. 3-4, p. 3-16, for a graph of the annualized average strontium-90 concentration at WNSWAMP in 1998.) Even though waters exceeding the strontium-90 DCG drain from WNSWAMP into Frank's Creek, waters collected from the creek downstream at the first point of public access (WFFELBR) averaged less than 1% of the DCG. (See Off-site Surface Water, p.2-8.)

Other Surface Water Sampling Locations. Samples from the sanitary and industrial wastewater treatment facility discharge (WNSP007), from subsurface drainage from the perimeter of the low-level waste treatment facility storage lagoons (WNSP008), and from a point in Frank's Creek (WNSP006, where discharges from WNSP001, WNSP007, and WNSP008 leave the site) are routinely monitored for radiological parameters. (See Fig.A-2 [p.A-4].) Radiological results of analyses from WNSP006, WNSP007, and WNSP008 are summarized in Tables C-4, C-5, and C-6 (pp.C-6 and C-7.) Samples from these points also are monitored for nonradiological parameters as part of the site's SPDES program. (See Nonradiological Monitoring: Surface Water [p.2-24].)

WNSP006 is located more than 4.0 kilometers (2.5 mi) upstream from Thomas Corners Road, the last monitoring point before Buttermilk Creek leaves the WNYNSC. Samples from WNSP006 are retrieved weekly and composited both monthly and quarterly and are analyzed for the same radionuclides as the effluent samples from WNSP001. The highest monthly concentration of a beta-emitting radionuclide at WNSP006 was strontium-90 at 2.16E-08 μCi/mL (0.80 Bq/L), which corresponds to 2.2% of the DCG for strontium-90. Average concentrations of gross alpha (as americium-241), gross beta (as strontium-90), strontium-90, cesium-137, and tritium were each less than 5% of the comparable DCG, as were 1998 averages for the radiological parameters monitored at WNSP007 and WNSP008. Gross beta concentrations at WNSP008 have decreased over time.

The average gross alpha and gross beta data from location WNSP006 and the maximum and minimum results are noted in Tables 2-1 and 2-2 (*facing page*) for comparison with results from other on- and off-site surface water locations.

The twelve-year trends of gross alpha, gross beta, and tritium concentrations at location WNSP006 are shown on Figure 2-1 (p.2-6). The long-term trend plot for WNSP006 shows fluctuations that reflect variable concentrations in treated WVDP liquid effluent being released from the site. 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 close to or indistinguishable from background.

Sampling point WNSP005, which monitors drainage from land on the east side of the main plant, and WNCOOLW, which monitors facility coolant water, are sampled monthly for gross alpha, gross beta, and tritium concentrations. Radiological data for WNSP005 and WNCOOLW are found in Tables C-3 and C-11 (pp.C-5 and C-10). Average gross alpha and tritium concentrations for both locations were below detection levels in 1998. Average gross beta concentrations at WNSP005 and WNCOOLW were considerably lower than the applicable DCGs (<9% and <3% respectively).

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 contamina-

Table 2-1

1998 Gross Alpha Concentrations at Surface Water Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(μCi/mL)	*(Bq/m³)*	*(μCi/mL)*	*(Bq/m³)*
Off-site					
WFBCBKG	12	<3.41E-10—1.42E-09	<1.26E-02—5.27E-02	5.83±6.37E-10	2.16±2.36E-02
WFBCTCB	12	<5.27E-10—1.51E-09	<1.95E-02—5.57E-02	5.87±7.35E-10	2.17±2.72E-02
WFBIGBR	12	<5.82E-10—1.99E-09	<2.15E-02—7.37E-02	7.53±8.23E-10	2.78±3.04E-02
WFFELBR	52	<6.16E-10—5.82E-09	<2.28E-02—2.16E-01	1.74±1.16E-09	6.42±4.29E-02
On-site					
WNNDADR	15	<8.35E-10—1.91E-09	<3.09E-02—7.08E-02	0.75±1.22E-09	2.76±4.51E-02
WNSP006	52	6.75E-10—8.57E-09	2.50E-02—3.17E-01	1.35±1.31E-09	4.99±4.84E-02
WNSW74A	52	<8.49E-10—5.61E-09	<3.14E-02—2.08E-01	0.55±1.44E-09	2.04±5.31E-02
WNSWAMP	52	<7.25E-10—3.13E-09	<2.68E-02—1.16E-01	0.52±1.36E-09	1.91±5.02E-02

Table 2-2

1998 Gross Beta Concentrations at Surface Water Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(μCi/mL)	*(Bq/m³)*	*(μCi/mL)*	*(Bq/m³)*
Off-site					
WFBCBKG	12	<8.76E-10—3.15E-09	<3.24E-02—1.17E-01	1.72±1.18E-09	6.37±4.35E-02
WFBCTCB	12	3.76E-09—1.30E-08	1.39E-01—4.80E-01	5.94±1.48E-09	2.20±0.55E-01
WFBIGBR	12	<9.96E-10—4.08E-09	<3.69E-02—1.51E-01	2.10±0.98E-09	7.78±3.64E-02
WFFELBR	52	1.10E-09—1.78E-08	4.07E-02—6.57E-01	3.59±1.53E-09	1.33±0.57E-01
On-site					
WNNDADR	18	1.14E-07—1.58E-07	4.20E+00—5.85E+00	1.36±0.06E-07	5.04±0.21E-00
WNSP006	52	1.14E-08—1.36E-07	4.20E-01—5.04E+00	3.46±0.37E-08	1.28±0.14E-00
WNSW74A	52	<2.83E-09—1.23E-08	<1.05E-01—4.54E-01	7.25±2.44E-09	2.68±0.90E-01
WNSWAMP	52	1.34E-06—4.51E-06	4.97E+01—1.67E+02	2.72±0.03E-06	0.10±9.98E-01

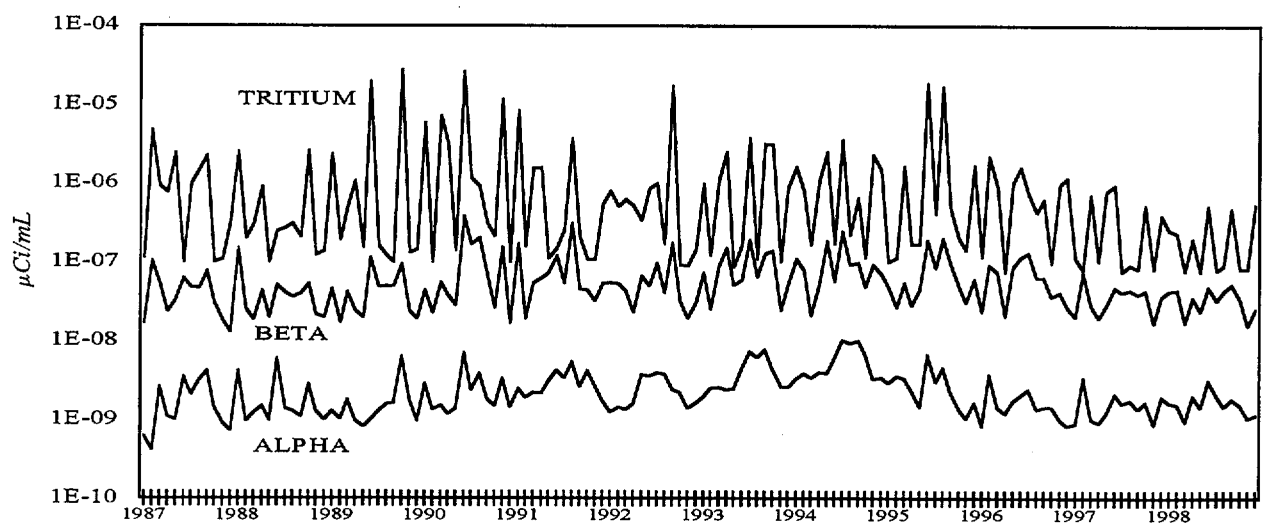


Figure 2-1. Twelve-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNSP006

tion, were described in previous annual site environmental reports.) In July 1993 the access was valved off from the original high-level waste tank farm drainage area to prevent collected waters from rising freely to the surface. Although samples from this location are not thought to be representative of either local groundwater or surface water, weekly sampling for gross alpha, gross beta, and tritium continues at this point. A monthly composite is analyzed for gamma radionuclides and strontium-90.

Average gross alpha, cesium-137, and tritium concentrations from WN8D1DR were all below detection levels in 1998. Gross beta concentrations, attributable largely to strontium-90, were less than 2% of the applicable DCG. Radiological data for WN8D1DR are found in Table C-13 (p.C-11).

SDA and NDA Sampling Locations. Two inactive underground disposal areas lie on the south plateau of the site, the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) and the state-licensed disposal area (SDA). (The SDA is managed by the New York State Energy and Research Development Authority [NYSERDA].) The drum cell, an aboveground structure used to store drums of processed low-level radioactive waste, is located nearby. Surface waters, which flow from the south to the north, are routinely monitored at several points around these sites. (See Fig.A-2 [p.A-4].)

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

Averages for most radiological parameters at these sampling points were below detection levels in 1998. For those parameters having averages above detection limits, only gross beta results at WNDCELD were higher than background levels at WFBCBKG. Even so, the gross beta concentration was less than 2% of the most restrictive beta DCG. Although some positive tritium values were noted at WNSDADR in 1998, the average concentration of tritium was below the detection level. Tritium concentrations at this location have been steadily decreasing since 1993. Radiological concentrations at WNFRC67, downstream of the SDA, were statistically the same as those at background location WFBCBKG.

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

Surface water drainage downstream of the NDA is monitored at WNNDADR, and sampling point WNERB53 in Erdman Brook monitors surface waters further downstream from the NDA before they join with drainage from the main plant and lagoon areas. Results from WNNDATR are in Table C-20 (p.C-16), from WNNDADR in Table C-19 (p.C-15), and from WNERB53 in Table C-10 (p.C-10). Gross alpha and gross beta results from WNNDADR are included in Tables 2-1 and 2-2 (p.2-5) for comparison with results from other surface water locations.

In addition to the routine samples collected by the WVDP, samples are collected and analyzed by the New York State Department of Health (NYSDOH) at the two stream sampling points that receive drainage from the south plateau, WNFRC67 and WNERB53.

Average concentrations of radiological parameters at WNNDATR, WNNDADR, and WNERB53 were well below applicable DCGs in 1998:

- Gross beta concentrations at WNNDATR averaged 1.17E-07μCi/mL (4.3 Bq/L), which is just under 12% of the DCG for strontium-90 in water (1E-06 μCi/mL)

- Gross beta concentrations at WNNDADR averaged 1.36E-07μCi/mL (5.0 Bq/L). Assuming that the gross beta concentration originates entirely from strontium-90, this average is close to 14% of the DCG for strontium-90. (The actual average strontium-90 concentration — 6.83E-08 μCi/mL [2.5 Bq/L] — was

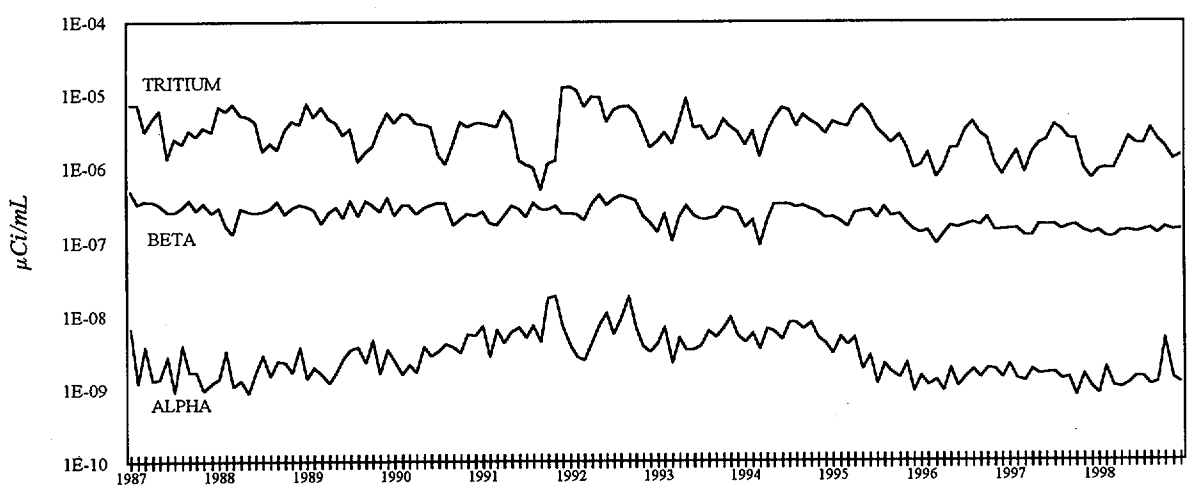


Figure 2-2. Twelve-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNNDADR

about 7% of the DCG.) Gross beta concentrations were higher downstream of the NDA at WNNDADR than in waters from the interceptor trench, WNNDATR. However, gross beta concentrations at WNNDADR appear to be steady or declining. (See Fig. 2-2, p. 2-7.) Residual contamination from past waste burial activities in soils outside the NDA is the likely source of gross beta activity in samples from WNNDADR.

• Although average tritium concentrations at both WNNDATR and WNNDADR were elevated with respect to background concentrations (WFBCBKG), these were less than 1% of the DCG for tritium in water (2E-03 μCi/mL). The average tritium concentration at WNNDATR was 8.53E-06 μCi/mL (316 Bq/L), and at WNNDADR it was 1.79E-06 μCi/mL (66 Bq/L). Allowing for seasonal variations, the overall trends of tritium concentrations at WNNDADR and WNNDATR have shown a slight decrease over time. (See Fig. 2-2 [p.2-7].) Since the half-life of tritium is slightly longer than twelve years, decreasing tritium concentrations may be partially attributed to radioactive decay.

• A key indicator of any possible migration of nonradiological organic contaminants from the NDA would be the continued presence of measurable iodine-129 in samples from WNNDADR. Iodine-129 is known to travel with the organic contaminants present in the NDA, but it is typically more soluble in water. In 1998 there were no positive detections of iodine-129 in water samples collected at this location.

• Iodine-129 was not detected in waters from the NDA interceptor trench (WNNDATR) in the first quarter of 1998. However, it was detected during the last three quarters of the year, and the result of the fourth-quarter analysis (7.03E-09 μCi/mL [0.26 Bq/L]) was the highest yet noted at this location. (See Appendix C, Table C-20 [p.C-16].) Even this maximum result from the fourth quarter was less than 2% of the DCG for iodine-129 in water (5E-07μCi/mL). The average iodine-129 concentration at this location in 1998 was 2.83E-09 μCi/mL (0.10 Bq/L), which is less than 1% of the DCG. Analytical results for volatile and semivolatile organic compounds do not indicate measurable organic contamination in waters from WNNDATR.

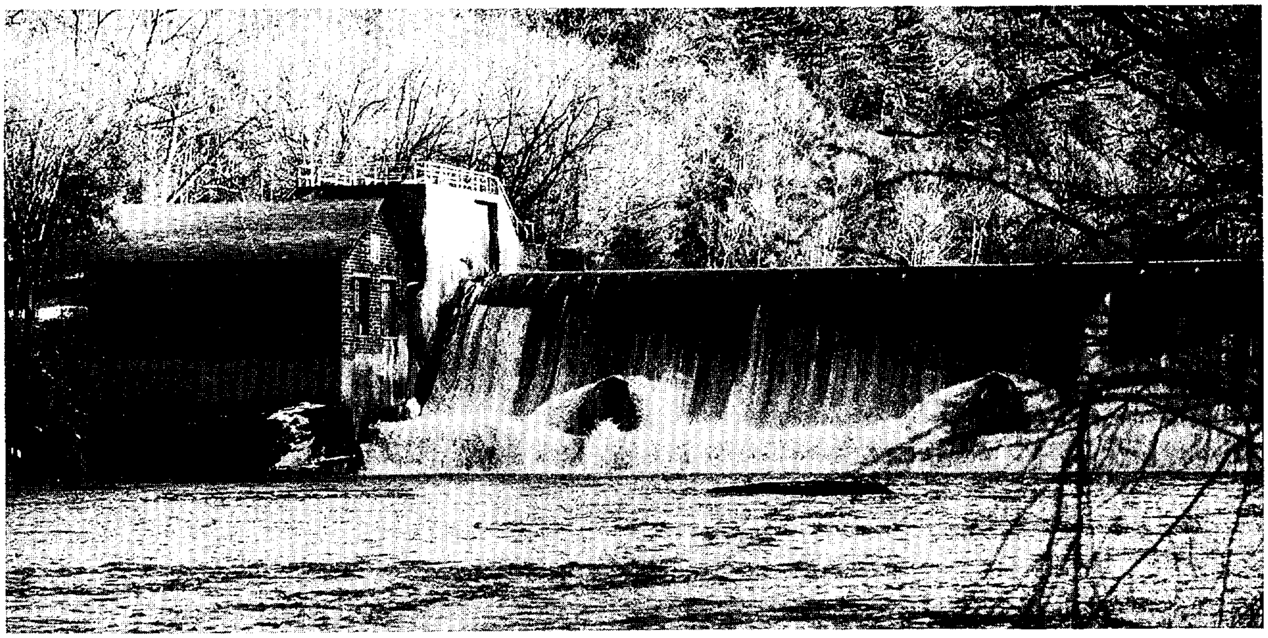
• No cesium-137 was detected at either WNNDADR or WNNDATR in 1998.

• Elevated total organic halides (TOX) concentrations were noted in samples from both WNNDATR and WNNDADR in July and August 1998. (TOX is used to indicate the presence of certain organic compounds.) It is suspected that the elevated TOX, although of indeterminate origin, may have been associated with the heavy rainfall at the end of June. (See Meteorological Monitoring [p.2-23].)

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

Four ponds near the site were tested in 1998. For comparison, a background pond 14.1 kilometers (8.8 mi) north of the Project was also tested. See Figs.A-2 and A-3 (pp.A-4 and A-5) for locations of the five ponds and Table C-21 (p.C-17) for a summary of the results. Gross alpha, gross beta, and tritium concentrations in samples from the on-site ponds were not significantly different than those from the background pond. No long-term trends were noted.

Off-site Surface Water. Samples of surface water are collected at four off-site locations,



Springville Dam on Cattaraugus Creek

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

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

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

Table C-22 (C-18) lists radionuclide concentrations at the Fox Valley Road background location; Table C-23 (p.C-19) lists radionuclide concentrations downstream of the site at Thomas Corners Bridge. With the exception of gross beta results, radionuclide concentrations at Thomas Corners Bridge were statistically the same as background concentrations. The 1998 average gross beta concentration at Thomas Corners Bridge was slightly higher than the concentration upstream of the site. This may be attributed to small amounts of radioactivity from the site entering Buttermilk Creek via Frank's Creek. However, even if the average gross beta concentration (5.94E-09 μCi/mL [0.22 Bq/L]) were attributable entirely to strontium-90, it would represent less than 1% of the DCG.

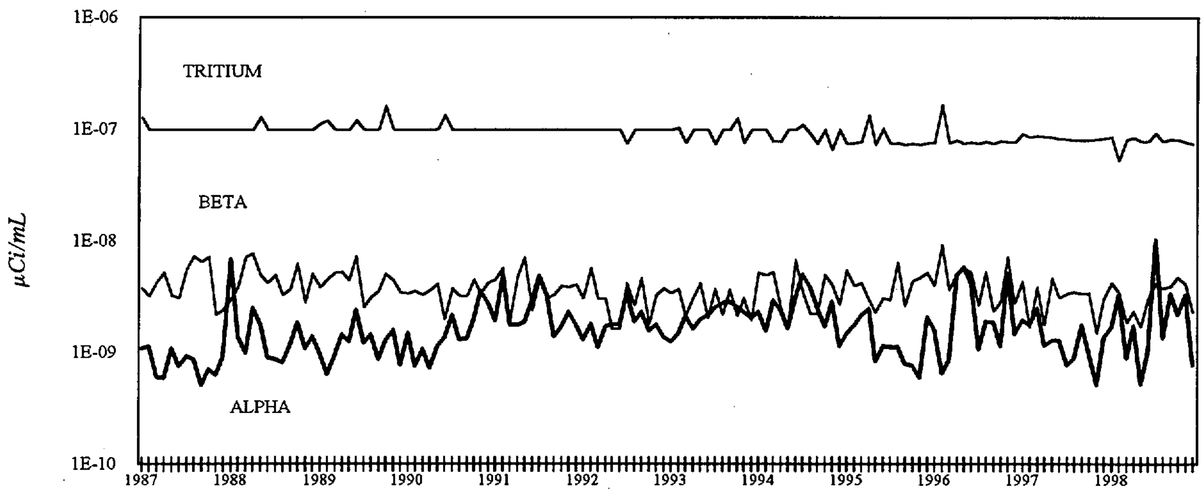


Figure 2-3. Twelve-year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WFFELBR

Cattaraugus Creek at Felton Bridge and Bigelow Bridge Sampling Locations. Buttermilk Creek flows through the WNYNSC and then off-site, where it flows into Cattaraugus Creek. An automated sampler is located on Cattaraugus Creek at Felton Bridge (WFFELBR), just downstream of the point where Buttermilk Creek enters. Samples are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. A chart recorder registers the stream depth during the sampling period so that a flow-weighted weekly sample can be proportioned into a monthly composite, which is analyzed for gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-24 [p.C-19].)

Background samples are collected monthly from Cattaraugus Creek at Bigelow Bridge (WFBIGBR), which is upstream of the point where Buttermilk Creek enters. These samples are analyzed for concentrations of gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides. (See Table C-25 [p.C-20].)

No differences were noted between upstream and downstream concentrations of tritium, strontium-90, and cesium-137 in 1998. However, average gross alpha and gross beta concentrations were higher at the Felton Bridge location than at the Bigelow Bridge background location. It is suspected that the gross alpha average at Felton Bridge was elevated because of naturally occurring alpha activity in suspended sediments washed from surface soils in a severe flooding episode at the end of June 1998. (See Meteorological Monitoring [p.2-23].) The July 1998 composite sample, which included floodwaters from Cattaraugus Creek, had the highest gross alpha result for the year (1.04E-08 μCi/mL [0.4 Bq/L]). The samples from Bigelow Bridge did not capture sediments from this episode because the June 1998 grab sample had been collected just before the flood and the July 1998 grab sample was collected a month after the flood.

The average weekly gross alpha concentration at Felton Bridge in 1998 was 1.74E-09 μCi/mL (0.06 Bq/L), which was less than 6% of the most conservative alpha DCG, and the average weekly gross beta concentration was 3.59E-09 μCi/mL (0.13 Bq/L), which was less than 1% of the most conservative beta DCG.

Figure 2-3 (*above*) shows gross alpha, gross beta, and tritium results over the past twelve years in Cattaraugus Creek samples taken at Felton Bridge. For the most part, tritium concentrations represent method detection limits and not detected radioactivity. (Method detection limit values reported are levels below which the analytical measurement could not detect any radioactivity above background. [See Data Reporting in Chapter 1, p.1-4].) Taking into account seasonal fluctuation, gross beta activity appears to have remained constant at this location since 1987.

Drinking Water Sampling. Nine off-site private, residential wells between 1.5 kilometers (0.9 mi) and 7 kilometers (4.3 mi) from the facility were sampled for radiological parameters in 1998. The wells represent the nearest unrestricted use of groundwater near the Project; none draw drinking water from groundwater units underlying the site. A tenth private well, 29 kilometers (18 mi) south of the site, provides a background sample. Sampling locations are shown in Figures A-9 and A-12 (pp.A-11 and A-14) in Appendix A.

Results from the sampling are presented in Table C-26 (p.C-20). Radiological results from near-site wells are within the historical range of values measured at the background well.

On-site drinking water sources were also monitored for radionuclides in 1998 at four locations: the Environmental Laboratory (WNDNKEL); the maintenance shop (WNDNKMS); the main plant (WNDNKMP); and the utility room (WNDNKUR). Monthly samples were analyzed for gross alpha, gross beta, and tritium concentrations. Results were consistent with those from the off-site background drinking water well. (See Appendix C, Tables C-15 through C-18 [pp.C-12 through C-14].)

Radiological Monitoring: Sediments

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

Sediments are collected on-site at the three points where liquid effluents leaving the site are most likely to be radiologically contaminated: Frank's Creek where it leaves the security fence (SNSP006); the north swamp (SNSW74A); and the northeast swamp (SNSWAMP). Figure A-2 (p.A-4) shows the on-site sediment sampling locations. (Note that swamp sediment samples may be partially composed of soils.) Background samples are also collected at off-site locations upstream of the site. Results from radiological analyses of these samples are listed in Table C-28 (p.C-22). As expected, gross beta, cesium-137, and strontium-90 results were higher at the on-site sediment sampling points than at the off-site background sampling points; gross alpha concentrations were similar to background values.

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

Although gross alpha, gross beta, and strontium-90 concentrations in sediments downstream of the WVDP are not statistically different from background concentrations, cesium-137 concen-

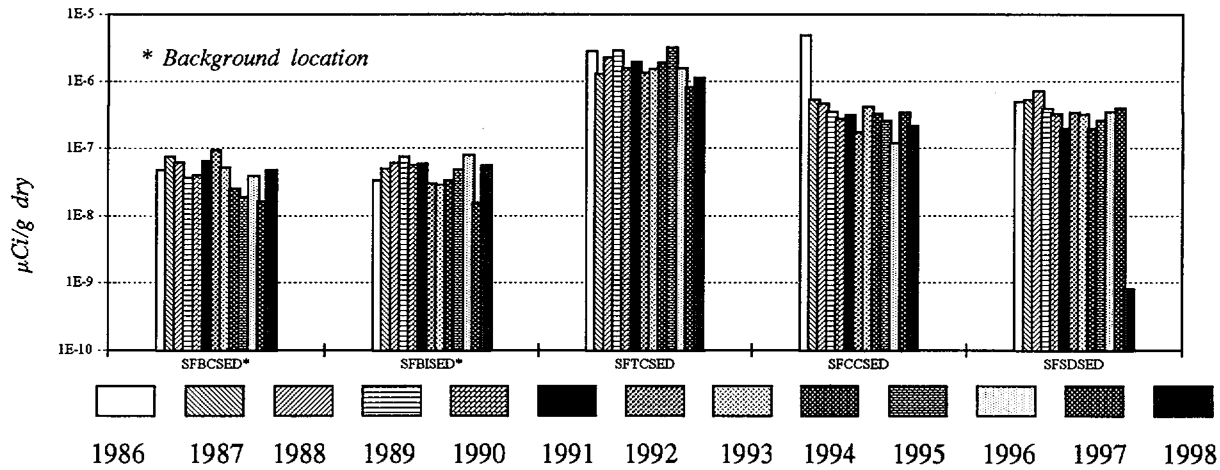


Figure 2-4. Thirteen-year Trends of Cesium-137 in Stream Sediments at Two Locations Upstream and Three Locations Downstream of the WVDP

trations in downstream sediments historically have been higher. A comparison of annual averaged cesium-137 concentrations from 1986 through 1998 for the five off-site sampling locations is illustrated in Figure 2-4 (*above*). As the figure indicates, with the exception of the 1998 cesium-137 concentration behind the Springville dam, concentrations appear to have leveled off with time at the downstream locations. Note that in 1998 sediment samples from the two background locations and from two of the downstream locations (SFTCSED and SFCCSED) were collected in May. However, the sample at the Springville dam (SFSDSED) was collected in July, almost three weeks after a major flood. (See Meteorological Monitoring [p.2-23].) It is possible that the flood scoured out sediments from behind the dam and deposited sediments from further upstream and that the sample was not representative of the sediments historically found at this point. Annual samples to be taken in 1999 will help to determine if the flooding resulted in lowered concentrations at the other downstream points also or in sustained changes above the dam.

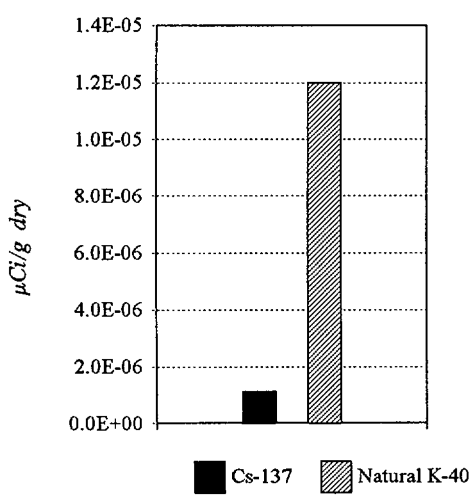


Figure 2-5. Comparison of Cesium-137 with Naturally Occurring Postassium-40 Concentrations in 1998 at Downstream Sampling Location SFTCSED

Although cesium-137 activity historically is elevated in downstream Cattaraugus Creek sediments, relative to upstream sediments (see Appendix C, Table C-30 [p.C-24]), the levels are far lower than those of naturally occurring gamma emitters such as potassium-40. (Fig. 2-5 [*this page*] is a graphic comparison of cesium-137 to potassium-40 at the downstream location nearest the WVDP, i.e., Buttermilk Creek at Thomas Corners Road — SFTCSED.) In addition, these downstream-sediment cesium-137 concentrations are still within the historical range of cesium-137 concentrations in background surface soil (Great Valley [SFGRVAL] and Nashville [SFNASHV]). (See Appendix C, Table C-29 [p.C-23].)

Radiological Monitoring: Air

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

Unlike NESHAP dose criteria, the DCGs established by the DOE, although generally less stringent than NESHAP criteria, may be directly compared to radionuclide concentrations in air and are used in this chapter to evaluate concentrations of radionuclides in WVDP air emissions. DOE standards and DCGs for radionuclides of interest at the WVDP are found in Appendix K (p.K-3).

Radiological parameters measured in air emissions include concentrations of gross alpha and gross beta, tritium, strontium-90, cesium-137, and other radionuclides. When comparing concentrations with dose limits for screening purposes, gross alpha and beta radioactivities are assumed to come from americium-241 and strontium-90, respectively, because the dose effects for these radionuclides are the most limiting for major particulate emissions at the WVDP.

On-site Ventilation Systems. The exhaust from each EPA-permitted fixed ventilation system on-site is continuously filtered, monitored, and sampled as it is released to the atmosphere. Because concentrations of radionuclides in air emissions are quite low, a large volume of air must be sampled at each point in order to measure the quantity of specific radionuclides released from the facility.

Specially designed sampling nozzles continuously remove a representative portion of the exhaust air, which is then drawn through very fine glass fiber filters to trap particulates. Sensitive detectors continuously monitor these filters and provide readouts of alpha and beta radioactivity levels.

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

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

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

Samples from the main plant stack are collected weekly and analyzed for gross alpha, gross beta, and tritium concentrations. Weekly filters are composited quarterly and analyzed for strontium-90, gamma-emitting radionuclides, total uranium, uranium isotopes, plutonium isotopes, and americium-241. Charcoal cartridges collected weekly are composited quarterly and analyzed for iodine-

129. In addition, filters from the main plant ventilation stack are routinely analyzed for strontium-89 and cesium-137 as part of operational-safety monitoring.

Monthly and quarterly total curies released from the main stack in 1998 are summarized in Table D-1 (p.D-3). Total curies released, annual averages, and a comparison of total curies released with the applicable DCGs are summarized in Table D-2 (p.D-4). As in previous years, 1998 results show that average radioactivity levels at the point of discharge from the stack were already below concentration guidelines for airborne radioactivity in an unrestricted environment. Airborne concentrations from the stack to the site boundary are further reduced via dispersion by a factor of about 200,000. Results from air samples taken just outside the site boundary confirm that WVDP operations had no discernible effect on off-site air quality. (See Perimeter and Remote Air Sampling, p.2-16.)

Figure 2-6 (*below*) shows the gross alpha and gross beta curies released per month from the main stack during the past twelve years. The figure indicates a steady five-year downward trend in both gross alpha and gross beta activity from 1987 to mid-1992 and a stabilization through mid-1995. Pre-vitrification transfers of cesium-loaded zeolite from waste tank 8D-1 to 8D-2 began in late 1995, and releases increased. Since radioactive vitrification operations began in mid-1996 both gross alpha and gross beta releases have fluctuated while generally remaining higher than pre-vitrification levels.

In June 1998 the WVDP completed the first phase of high-level waste vitrification, processing the bulk of the waste in tank 8D-2. In the latter part of 1998 the focus of the vitrification program shifted to vitrifying waste from the "heel" remaining in the tank. The number of canisters of vitrified waste generated in the last half of 1998 was considerably lower than that generated during the first half of the year. This reduction in the rate of waste transfers and canister production was reflected in the reduced gross alpha and gross beta releases at the end of 1998.

Vitrification Facility Sampling System. Sampling point ANVITSK and the seismically protected backup sample point ANSEISK monitor emissions from the vitrification heating, ventilation,

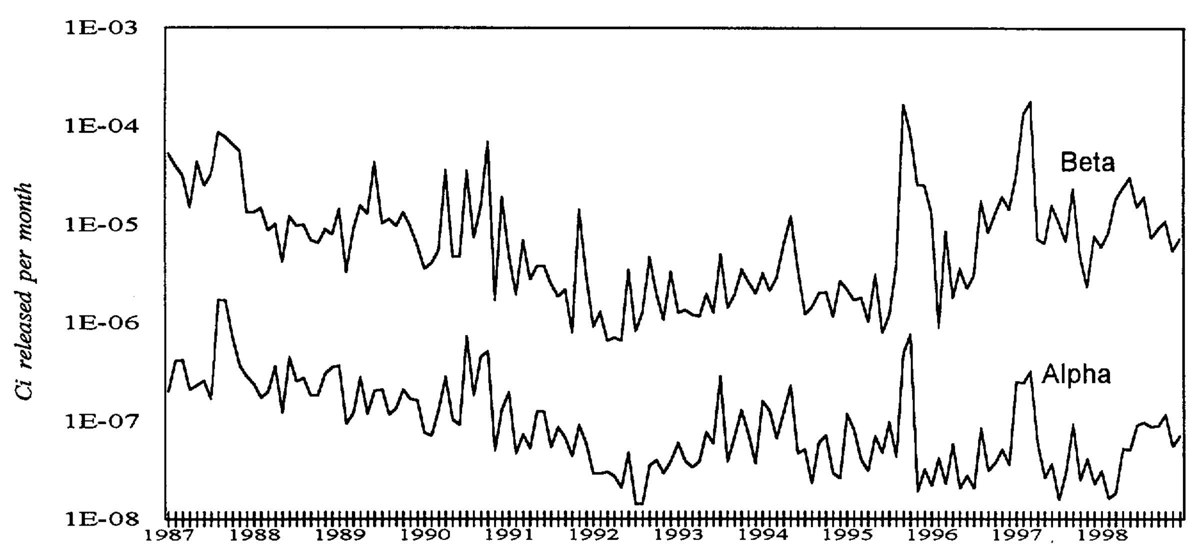


Figure 2-6. Twelve-year Trends of Gross Alpha and Gross Beta Activity at the Main Stack Sampling Location (ANSTACK)

and air conditioning (HVAC) system. (Off-gas ventilation from the vitrification system itself is released through the main plant stack.)

Radioactivity concentrations were monitored at ANVITSK and ANSEISK before actual radioactive vitrification began in July 1996. The previtrification levels provide a baseline for comparison with concentrations of radionuclides in emissions during vitrification. Results from 1998 are found in Tables D-3 and D-4 (pp.D-5 and D-6). As expected, 1998 results are statistically the same as the baseline results.

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

Tables D-5 through D-8 (pp.D-7 through D-10) show monthly totals of gross alpha and beta radioactivity and quarterly total radioactivity released for specific radionuclides at each of these sampling locations. The 1998 samples from ANCSSTK, ANCSRFK, ANSTSTK, and ANCSPFK showed detectable concentrations of gross radioactivity in some cases as well as specific beta- and alpha-emitting radionuclides, but none approached any DOE effluent limitations.

Three other operations are routinely monitored for airborne radioactive releases: the new low-level waste treatment facility ventilation system (ANLLW2V), which came on-line in 1998; the old low-level waste treatment facility ventilation (ANLLWTVH); and the contaminated clothing laundry ventilation system (ANLAUNV). (A former sampling location, the supercompactor ventilation [ANSUPCV], was removed from the monitoring program when the unit was dismantled in 1998. The supercompactor had not been used since August 1995.)

The old and new low-level waste treatment facility ventilation points and the laundry ventilation system are sampled for gross alpha and gross beta radioactivity. These emission points are not required to be permitted because the potential magnitude of the emissions is so low. Although only semiannual grab sampling is required to verify the low level of emissions, all three points are sampled continuously while discharging to the environment. Data for these three facilities are presented in Tables D-9 through D-11 (p.D-11 and D-12). Average results in 1998 were all less than detectable.

Permitted portable outdoor ventilation enclosures (OVEs) are used occasionally to provide the ventilation necessary for the safety of personnel working with radioactive materials in areas outside permanently ventilated facilities. Air samples from OVEs are collected continuously while those emission points are discharging, and data from these units are included in annual airborne emission evaluations. (See Table D-15 [p.D-16].) In 1998 average discharges from OVEs were well below DOE guidelines for alpha and beta radioactivity in an unrestricted environment.

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

With the exception of marginally elevated tritium at ANSDAT9, radiological results for these locations are statistically the same as results from background air monitoring location AFGRVAL. Note that even the highest positive tritium result from ANSDAT9 (1.71E-12 μCi/mL [6.3E-05 Bq/L]) was less than 0.002% of the DOE DCG for tritium in air (1E-07 μCi/mL).

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

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

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

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

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

The twelve-year trends of gross alpha and gross beta concentrations at the Rock Springs Road location are shown in Figure 2-7 (*below*). Within a range of seasonal and weekly fluctuations, the concentrations have been relatively constant over the twelve-year period.

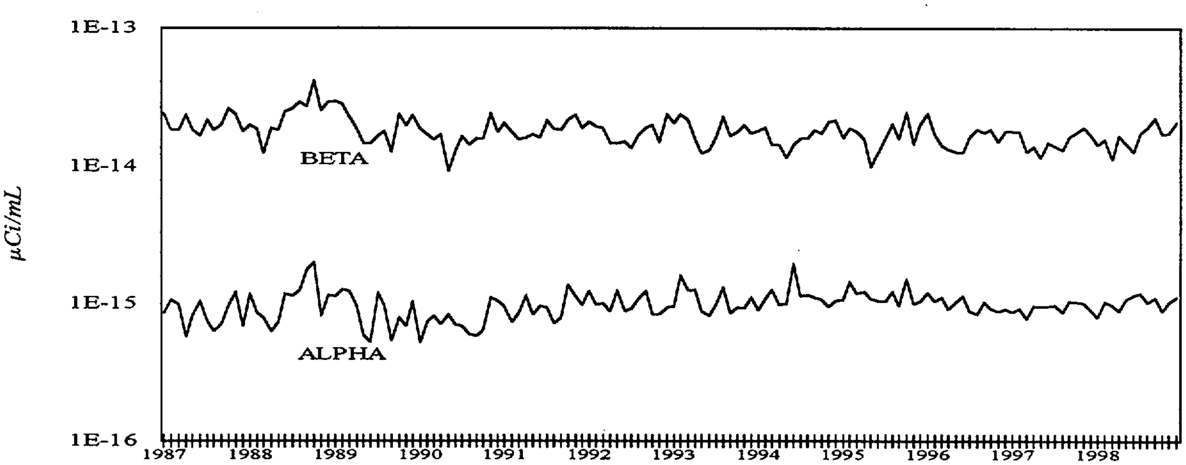


Figure 2-7. Twelve-year Trends of Gross Alpha and Gross Beta Concentrations at the Rock Springs Road Sampling Location (AFRSPRD)

Table 2-3

1998 Gross Alpha Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(μCi/mL)	*(Bq/m³)*	*(μCi/mL)*	*(Bq/m³)*
AFBLKST	52	<5.36E-16—3.51E-15	<1.98E-05—1.30E-04	5.47 ± 9.82E-16	2.02±3.63E-05
AFBOEHN	52	<6.58E-16—2.05E-15	<2.44E-05—7.58E-05	0.77 ± 1.08E-15	2.83±3.98E-05
AFFXVRD	52	<6.42E-16—1.86E-15	<2.38E-05—6.89E-05	5.93 ± 9.59E-16	2.19±3.55E-05
AFGRVAL	52	<5.51E-16—2.11E-15	<2.04E-05—7.81E-05	0.78 ± 1.02E-15	2.89±3.76E-05
AFNASHV	52	<5.59E-16—2.15E-15	<2.07E-05—7.97E-05	0.79 ± 1.02E-15	2.94±3.76E-05
AFRSPRD	52	<6.01E-16—2.06E-15	<2.22E-05—7.64E-05	6.89 ± 9.98E-16	2.55±3.69E-05
AFRT240	52	<6.15E-16—3.02E-15	<2.28E-05—1.12E-04	0.81 ± 1.11E-15	2.99±4.10E-05
AFSPRVL	52	<5.06E-16—1.82E-15	<1.87E-05—6.74E-05	5.88 ± 9.62E-16	2.18±3.56E-05
AFTCORD	52	<5.41E-16—3.46E-15	<2.00E-05—1.28E-04	6.29 ± 9.84E-16	2.33±3.64E-05
AFWEVAL	52	<6.22E-16—2.55E-15	<2.30E-05—9.42E-05	0.75 ± 1.02E-15	2.76±3.76E-05
ANLAGAM	52	<4.19E-16—2.77E-15	<1.55E-05—1.03E-04	6.67 ± 7.19E-16	2.47±2.66E-05
ANNDAAM	52	<3.95E-16—3.29E-15	<1.46E-05—1.22E-04	6.62 ± 6.97E-16	2.45±2.58E-05

Table 2-4

1998 Gross Beta Concentrations at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	No. of Samples	Range		Annual Average	
		(μCi/mL)	*(Bq/m³)*	*(μCi/mL)*	*(Bq/m³)*
AFBLKST	52	5.62E-15—3.09E-14	2.08E-04—1.14E-03	1.58±0.32E-14	5.83±1.20E-04
AFBOEHN	52	5.58E-15—3.51E-14	2.07E-04—1.30E-03	2.07±0.36E-14	7.67±1.34E-04
AFFXVRD	52	<1.93E-15—3.54E-14	<7.12E-05—1.31E-03	1.73±0.33E-14	6.41±1.20E-04
AFGRVAL	52	5.96E-15—3.05E-14	2.21E-04—1.13E-03	1.74±0.33E-14	6.44±1.22E-04
AFNASHV	52	5.71E-15—3.27E-14	2.11E-04—1.21E-03	1.76±0.33E-14	6.50±1.22E-04
AFRSPRD	52	5.80E-15—2.72E-14	2.15E-04—1.01E-03	1.65±0.32E-14	6.12±1.20E-04
AFRT240	52	5.13E-15—3.33E-14	1.90E-04—1.23E-03	1.82±0.35E-14	6.74±1.31E-04
AFSPRVL	52	5.39E-15—2.67E-14	1.99E-04—9.86E-04	1.60±0.32E-14	5.94±1.18E-04
AFTCORD	52	6.49E-15—2.96E-14	2.40E-04—1.09E-03	1.70±0.33E-14	6.30±1.22E-04
AFWEVAL	52	6.52E-15—3.32E-14	2.41E-04—1.24E-03	1.92±0.34E-14	7.12±1.27E-04
ANLAGAM	52	5.64E-15—3.00E-14	2.09E-04—1.11E-03	1.70±0.25E-14	6.30±0.93E-04
ANNDAAM	52	5.14E-15—2.97E-14	1.90E-04—1.09E-03	1.66±0.24E-14	6.15±0.90E-04

The gross alpha and gross beta ranges and annual averages for each of the off-site sampling points are noted on Tables 2-3 and 2-4 (p.2-17). All gross alpha averages were below detection levels. Gross beta results from samples taken at two near-site communities and from the site perimeter were similar to those from the background samplers, suggesting that there is no adverse site influence on the air quality at these near-site locations. Gross beta concentrations at all off-site locations averaged about 1.75E-14 μCi/mL, which is about 0.2% of the DCG for strontium-90 in air (9E-12 μCi/mL). The highest average gross beta concentration (2.07E-14 μCi/mL) was at Boehn Road. This represents less than 0.3% of the DCG.

Additional radionuclide data from these samplers are provided in Tables D-16 through D-25 (pp. D-17 to D-23). Average concentrations of these other radionuclides in 1998 were statistically the same at near-site and background locations. Although low levels of tritium, strontium-90, iodine-129, and cesium-137 were detected in emissions from the main stack on-site, average results at near-site locations for these radionuclides were all below detection levels, confirming that site releases did not affect near-site air quality.

Fallout Pot Sampling. Short-term global fallout is sampled for radionuclide concentrations each month at four of the perimeter air sampler locations and at one on-site location near the rain gauge outside the Environmental Laboratory. (See Figs.A-4 and A-5 [pp.A-6 and A-7]). Monthly gross alpha, gross beta, potassium-40, and cesium-137 results are reported in nCi/m^2 and tritium results are reported in μCi/mL. The 1998 results from on-site and perimeter locations are similar to each other and are within the ranges noted in previous years. Tritium and cesium-137, both of which were detected in main stack emissions, were not detected in precipitation fallout in 1998.The 1998 data from these analyses and the pH in precipitation are summarized in Tables D-26 through D-30 (pp.D-24 through D-26).

Off-Site Surface Soil Sampling. In order to assess long-term fallout deposition, surface soil near the off-site air samplers is collected annually and analyzed for radioactivity. Samples were collected in 1998 from ten locations: six near-site points on the perimeter of the WNYNSC, two in nearby communities, and two in locations 30 to 40 kilometers distant from the Project. Maps of the off-site surface soil sampling locations are on Figures A-5 and A-12 (pp.A-7 and A-14).

Concentrations of gross alpha and beta radioactivity, strontium-90, cesium-137, plutonium-239/240, and americium-241 were determined at all ten locations; concentrations of uranium radionuclides and total uranium were determined at two perimeter locations and one background location.

The measured concentrations of radionuclides in soils from the perimeter and community locations (Table C-29 [p.C-23]) were statistically indistinguishable from normal regional background concentrations, with two exceptions: Cesium-137 concentrations in soil from the Rock Springs Road and Route 240 perimeter samplers — northwest and northeast of the site — were higher than background concentrations in 1998. However, these two cesium-137 concentrations, although elevated with respect to 1998 background concentrations, were still within the range of historical background values. In 1997 both sites also showed higher than background values. The Rock Springs Road air sampler has consistently shown higher than background cesium-137 concentrations.

Radiological Monitoring: Food Chain

Each year food and forage samples are collected from locations near the site (Fig. A-9 [p.A-11]) and from remote locations (Fig.A-12 [p.A-14] in Appendix A). Fish and

Electrofishing in Cattaraugus Creek

deer are collected during periods when they would normally be taken by sportsmen for consumption. Most milk samples are collected monthly; beef is collected semiannually. Hay, corn, apples, and beans are collected at the time of harvest.

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

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

Twenty fish samples were collected in 1998 (ten the first half of the year and ten the second half of the year) immediately downstream (above the Springville dam at BFFCATC), and another twenty were collected from the control location upstream of the site (BFFCTRL). Ten fish samples were collected from Cattaraugus Creek below the dam (BFFCATD), including species that migrate more than 60 kilometers (nearly 40 mi) upstream from Lake Erie. These specimens are representative of sport fishing catches in the creek downstream of the Springville dam.

The edible portion of each fish was analyzed for strontium-90 content and the gamma-emitting radionuclide cesium-137. See Table F-4 (pp. F-6 through F-8) in Appendix F for a summary of the results.

No statistically significant differences were found in strontium-90 concentrations between fish collected upstream of the site and fish collected downstream of the site. Cesium-137 concentrations in fish taken immediately downstream (above the Springville dam at BFFCATC) also were no different statistically than cesium-137 concentrations in background fish samples. However, cesium-137 concentrations in fish taken below the dam (BFFCATD) were higher than those in fish taken from the background location. Even so, all positive cesium-137 concentrations were very close to the analytical detection limits (see Glossary) and were within the range of historical background concentrations. The highest cesium-137 concentrations were found in hognose suckers, a species not commonly consumed by humans.

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

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

For the fifth year, during the large-game hunting season, hunters were allowed access to the WNYNSC, excluding the WVDP premises, in a controlled hunting program established by NYSERDA. Historically, concentrations of radioactivity in deer flesh have been very low and Project activities have been shown to have little or no effect on the local herd.

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

Milk. Monthly milk samples were taken in 1998 from dairy farms near the site to the north and west — downwind in the prevailing wind direction from the WVDP — and from control farms at some distance from the site. Annual milk samples were collected at two near-site farms to the south and east of the site. For locations of near-site and remote sampling points, see Figure A-9 (p.A-11) and Figure A-12 (p.A-14) in Appendix A.

Monthly samples from each location were composited into single quarterly samples for analysis. Quarterly composites and annual samples were analyzed for tritium, potassium-40, strontium-90, iodine-129, and cesium-137. Results are presented in Table F-1 (p.F-3) in Appendix F. Average results were within the range of historical background values.

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

No tritium, cobalt-60, or cesium-137 were found in any of the samples; positive strontium-90 results were noted in all but one sample, a background corn sample. Strontium-90 was higher in near-site than in background corn. However, strontium-90 concentrations were higher in background beans and hay than in near-site beans and hay. All results were within the range noted in previous years.

Direct Environmental Radiation Monitoring

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

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

Quarterly and annual averages of TLD measurements at off-site and on-site locations are noted in Appendix H, Tables H-1 and H-2 (pp.H-3 and H-4). The results from 1998 measurements show typical seasonal variations and are similar to results from previous years.

On-Site Radiation Monitoring. Table H-2 (p.H-4) shows the average quarterly exposure rate at each on-site TLD. The on-site monitoring point with the highest dose readings was location #24. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby. The storage area is well within the WNYNSC boundary, just outside the WVDP fenced area, and is not accessible by the public.

The average exposure rate at location #24 was about 688 milliroentgens (mR) per quarter (0.32 mR/hr) during 1998, which is almost identical to the exposure rate noted at this location in 1997 (0.31 mR/hr). Recent exposure rates at this loca-

TLD Locations and Identification Numbers

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

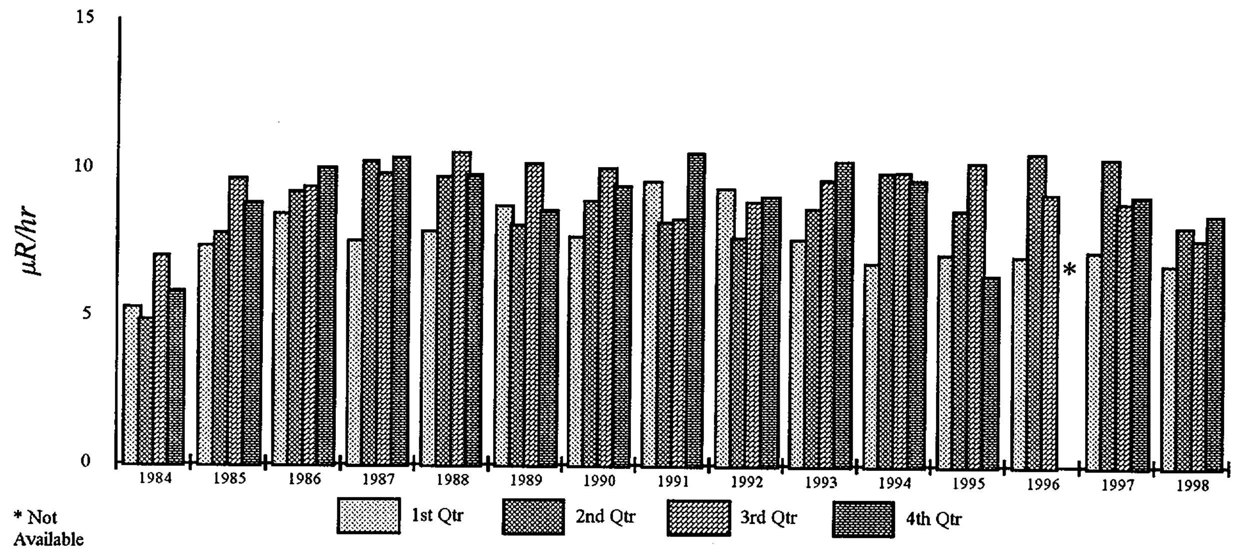


Figure 2-8. Fifteen-year Trend of Environmental Radiation Levels at Perimeter TLDs

tion are lower than those in previous years because the radioactivity in the materials stored nearby is decaying.

The average 1998 dose rate at locations around the integrated radwaste treatment storage building — the drum cell — including TLDs #18, #32, #34, #35, #36, and #43 was 0.02 mR/hr, about the same as in 1997. Exposure rates around the drum cell are above background levels because the building contains drums filled with 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 TLD #42, near a waste tank that stores SDA leachate, are also above background. However, results from on-site TLDs farther away from radioactive waste storage areas approach background levels. For example, results from location #27 (near Frank's Creek northeast of the NDA, SDA, and drum cell), and #28 and #31 (near Rock Springs Road west of the drum cell at the security fence) are statistically indistinguishable from background exposure rates.

Perimeter and Off-Site Radiation Monitoring. Table H-1 (p.H-3) lists the average quarterly exposure rate at each off-site TLD location. The perimeter TLDs (TLDs #1-16 and #20) are located in the sixteen compass sectors around the facility near the WNYNSC boundary. Results from the background and community TLDs were essentially the same as results from the perimeter TLDs. The perimeter TLD quarterly averages since 1985 (expressed in microroentgen per hour [μR/hr]), shown on Figure 2-8 (*above*) indicate seasonal fluctuations but no long-term trends.The quarterly average of the seventeen WNYNSC-perimeter TLDs was 17.3 mR per quarter (8.0 μR/hr) in 1998, slightly lower than in 1997.

Confirmation of Results. The performance of the environmental TLDs is confirmed periodically using a portable high-pressure ion chamber (HPIC) detection system. In August 1998 the HPIC was taken to each of the forty-three environmental TLD locations and ten instantaneous dose readings were obtained. The ten readings were averaged to determine the dose rate (in μR/hr) at each location. These averages are listed with the comparable third-quarter environmental TLD results in Table H-3 (p.H-5). TLD results showed a close correlation with HPIC readings.

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 to develop dispersion models used to calculate the effective dose equivalent to off-site residents.

Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which is a function of the difference in temperature between two elevations), these parameters are closely monitored and are available to the emergency response organization at the WVDP.

The on-site 60-meter meteorological tower (Fig. A-1 [p.A-3]) continuously monitors wind speed 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-12 [p.A-14].) Dewpoint, precipitation, and barometric pressure are also monitored at the on-site meteorological tower.

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 1998 the on-site system data recovery rate (time valid data were logged versus total elapsed time) was approximately

Checking Data from the Meteorological Tower

98%. Regional data at the 10-meter elevation are shown on Figure I-1 (p.I-3). Figures I-2 and I-3 (pp. I-4 and I-5) illustrate 1998 mean wind speed and wind direction at the 10-meter and 60-meter elevations on the on-site tower.

Weekly and cumulative total precipitation data are illustrated in Figures I-4 and I-5 (p.I-6) in Appendix I. Precipitation in 1998 was approximately 109 centimeters (43 in), about 5% above the annual average of 104 centimeters (41 in). A single major rainfall occurred the morning of June 26, 1998, when 3.75 inches of rain fell. This deluge washed out bridges and roads, eroded roadsides and fields, scoured sediments from stream channels, and flooded low-lying areas near Cattaraugus Creek.

Documentation 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.

The meteorological system was evaluated in 1998 and equipment and software were upgraded in 1999 to ensure year-2000 compliance.

Special Monitoring

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

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

Iodine-129 emissions from the main stack continued at elevated levels throughout the year. (See Table D-1 [p.D-3].) Iodine-129 was monitored closely during 1998 and the results compared to the operation of the vitrification facility. Weekly iodine-129 concentrations were within the range of values observed since vitrification began. In 1998 the total quantity of iodine-129 decreased slightly from the 1997 total. (For more information on the off-site effective dose from airborne emissions see Predicted Dose from Airborne Emissions [p.4-9] in Chapter 4.)

Gross Beta and Tritium at the NDA. A report evaluating the results of a special six-month sampling program at monitoring locations WNNDATR, WNNDADR, and well 909 was recently completed (West Valley Nuclear Services Co., Inc. and Dames & Moore December 1998). It was determined from samples collected every month from these three monitoring points and analyzed for gross beta, tritium, and strontium-90 that gross beta and tritium activities at WNNDATR and WNNDADR appeared to be either decreasing or remaining at a relatively consistent level but that gross beta and tritium activities at well 909 appear to have been increasing steadily over the last several years.

The fact that increasing activities were not seen at all three monitoring points suggests that contamination is not migrating beyond the NDA interceptor trench. The increasing activities in well 909 are presumed to be related to localized residual activity in soils surrounding the well. A discussion of options for future actions led to the decision that no action other than continued monitoring is warranted at this time.

Nonradiological Monitoring: Surface Water

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook (Fig.A-2 [p.A-4]) and specifies the sampling and analytical requirements for each outfall. The current SPDES permit (effective June 1995) was administratively renewed without changes by NYSDEC and was issued to the WVDP in September 1998 with an effective date of February 1, 1999 and an expiration date of February 1, 2004. The conditions and requirements of the SPDES permit are summarized in Table G-1 (pp.G-3 and G-4) in Appendix G. The permit identifies four outfalls:

- outfall WNSP001, discharge from the low-level waste treatment facility
- outfall WNSP007, discharge from the sanitary and industrial wastewater treatment facility
- outfall WNSP008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons
- outfall 116, a sampling location in Frank's Creek that represents the confluence of outfalls WNSP001, WNSP007, and WNSP008 as well as storm water runoff, groundwater surface seepage, and augmentation water. Samples from upstream sources (WNSP001, WNSP007, and WNSP008) are used to calculate total dissolved solids at this location and to demonstrate compliance with the SPDES permit limit for this parameter. (Outfall 116 is referred to as a "pseudo-monitoring" point on the SPDES permit. See Glossary, p.7.)

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

The SPDES monitoring data for 1998 are displayed in Tables G-3A through G-8 (pp.G-5 through G-15). The WVDP reported no permit exceedances in 1998. See the Environmental Compliance Summary: Calendar Year 1998, SPDES-permitted Outfalls (pp. ECS-10 through ECS-11).

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 1998. These samples are screened for organic constituents and selected anions, cations, and metals. Results of these measurements for all of these locations are found in Table C-27 (p.C-21).

Nonradiological Monitoring: Drinking Water

Site drinking water is monitored to verify compliance with EPA and NYSDOH regulations. (See Safe Drinking Water Act [p.ECS-13] in the Environmental Compliance Summary: Calendar Year 1998.) Samples are collected annually and analyzed for nitrate, fluoride, and metals concentrations. Sampling and analysis for copper and lead are conducted according to Cattaraugus County Health Department guidance. The 1998 monitoring results indicated that the Project's drinking water met NYSDOH, EPA, and Cattaraugus County Health Department drinking water quality standards.

Nonradiological Monitoring: Air

Nonradiological air emissions and plant effluents are permitted under NYSDEC and EPA regulations. (The regulations that apply to the WVDP are listed in Table K-2 [p.K-4] in Appendix K. The individual air permits [certificates to operate] held by the WVDP are identified and described in Table K-3 [pp.K-5 and K-6]). 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 1998 were approximately 8.9 tons; sulfur dioxide emissions were approximately 0.3 tons.

Although monitoring of these parameters currently is not required, the WVDP has developed an opacity observation program: If nitrogen oxides (NO_x) are emitted at sufficient concentrations, the air discharged from the main stack will take on a yellow-brown color. The intensity of this color (opacity) is in proportion to NO_x concentration. In order to be capable of assessing and documenting such potential emissions, selected staff environmental scientists and engineers completed a New York State-certified opacity observation training course.

CHAPTER 3
GROUNDWATER MONITORING

Groundwater Monitoring Program Overview

Groundwater at the West Valley Demonstration Project (WVDP) is monitored according to a comprehensive program developed to comply with all applicable state and federal regulations and to meet the following requirements of Department of Energy (DOE) Order 5400.1:

- obtain data for determining baseline conditions of groundwater quality and quantity

- provide data that will allow the early detection of groundwater contamination

- identify existing and potential groundwater contamination sources and maintain surveillance of these sources

- provide data upon which decisions can be made concerning the integrity of existing disposal areas and the management and protection of groundwater resources.

Current groundwater monitoring activities at the WVDP are summarized in two primary documents, the Groundwater Monitoring Plan (West Valley Nuclear Services Co., Inc. December 1998) and the Groundwater Protection Plan (West Valley Nuclear Services Co., Inc. April 1997). The Groundwater Monitoring Plan outlines the WVDP's plans for groundwater characterization, current groundwater monitoring, and support of long-term monitoring requirements identified in the Resource Conservation and Recovery Act (RCRA) facilities investigation (RFI) and DOE programs. The Groundwater Protection Plan provides additional information regarding protection of groundwater from on-site activities.

Geologic History of the West Valley Site

The Western New York Nuclear Service Center (WNYNSC) is located on the Allegheny Plateau near the northern border of Cattaraugus County in Western New York. Underneath the WNYNSC site is a sequence of Holocene (recent age) and Pleistocene (ice age) sediments in a steep-sided valley of bedrock. The bedrock is composed of shales and interbedded siltstones of the upper Devonian Canadaway and Conneaut Groups and dips southward at about 5 m/km (Rickard 1975).

The Holocene and Pleistocene sediments overlying the bedrock typically consist of a sequence of three glacial tills of Lavery, Kent, and possibly Olean age. The tills are separated by stratified fluvio-lacustrine deposits. In the northern part of the site the till is capped by alluvial-fluvial coarse-grained deposits.

Glaciation of the ancestral valley occurred between 24,000 and 15,000 years ago (Albanese et al. 1984), ending with the deposition of up to 40 meters (130 ft) of Lavery till. Post-Lavery outwash and alluvial fans, including the sand and gravel unit that covers the northern portion of the WVDP site, were deposited on the Lavery till between 15,000 and 14,200 years ago (La Fleur 1979).

Surface Water Hydrology of the West Valley Site

The WNYNSC lies within the Cattaraugus Creek watershed, which empties into Lake Erie about 43 kilometers (27 mi) southwest of Buffalo. Buttermilk Creek, a tributary of Cattaraugus Creek, drains most of the WNYNSC and all of the WVDP site.

The 80-hectare (200-acre) WVDP site, located on the WNYNSC, is contained within the smaller Frank's Creek watershed. Frank's Creek, a tributary of Buttermilk Creek, forms the eastern and southern boundary of the WVDP, and Quarry Creek, a tributary of Frank's Creek, forms the northern boundary. (See Fig.A-6 (p.A-8].)

Another tributary of Frank's Creek, Erdman Brook, bisects the WVDP into a north and south plateau. The main plant, waste tanks, and lagoons are located on the north plateau. The drum cell, the U.S. Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA), and the New York State-licensed disposal area (SDA) are located on the south plateau.

Hydrogeology of the West Valley Site

Glacial deposits. As noted above, the WVDP site area is underlain by a sequence of glacial tills comprised primarily of clays and silts separated by coarser-grained interstadial layers. The bottommost layer, the Kent till, is less permeable than the other geological units and does not provide a pathway for contaminant movement from the WVDP and so it is not discussed here. The sediments above the Kent till — the Kent recessional sequence, the Lavery till and the intra-Lavery till-sand, and the surficial sand and gravel — are generally regarded as containing all of the potential routes for the migration of contaminants (via groundwater) from the WVDP site. (See Figs.3-1 and 3-2 [*facing page*], which show the relative locations of these sediments on the north and south plateaus.) The Kent recessional sequence and the Lavery till are common to both the north and south plateaus.

Kent recessional sequence. The Kent recessional sequence consists of a fine-grained lacustrine unit of interbedded clay and silty clay layers locally overlain by coarse-grained glacial sands and gravels. These deposits underlie the Lavery till beneath most of the site, pinching out along the southwestern margin of the site where the walls of the bedrock valley intersect the sequence.

Groundwater flow in the Kent recessional sequence is predominantly to the northeast, towards Buttermilk Creek. The mean hydraulic conductivity generally ranges from 10^{-6} cm/sec (10^{-3} ft/day) to 10^{-5} cm/sec (10^{-2} ft/day). Recharge comes from the overlying Lavery till and the bedrock in the southwest, and discharge is to Buttermilk Creek.

Lavery till. The Lavery till is predominantly an olive-gray, silty clay glacial till with scattered lenses of silt and sand. The Lavery till underlies both the north and south plateaus and ranges up to 40 meters (130 ft) in thickness beneath the active areas of the site, generally increasing northeastward towards Buttermilk Creek and the center of the bedrock valley. (On the south plateau the upper zone of the Lavery till is weathered and fractured. See description of the south plateau below.)

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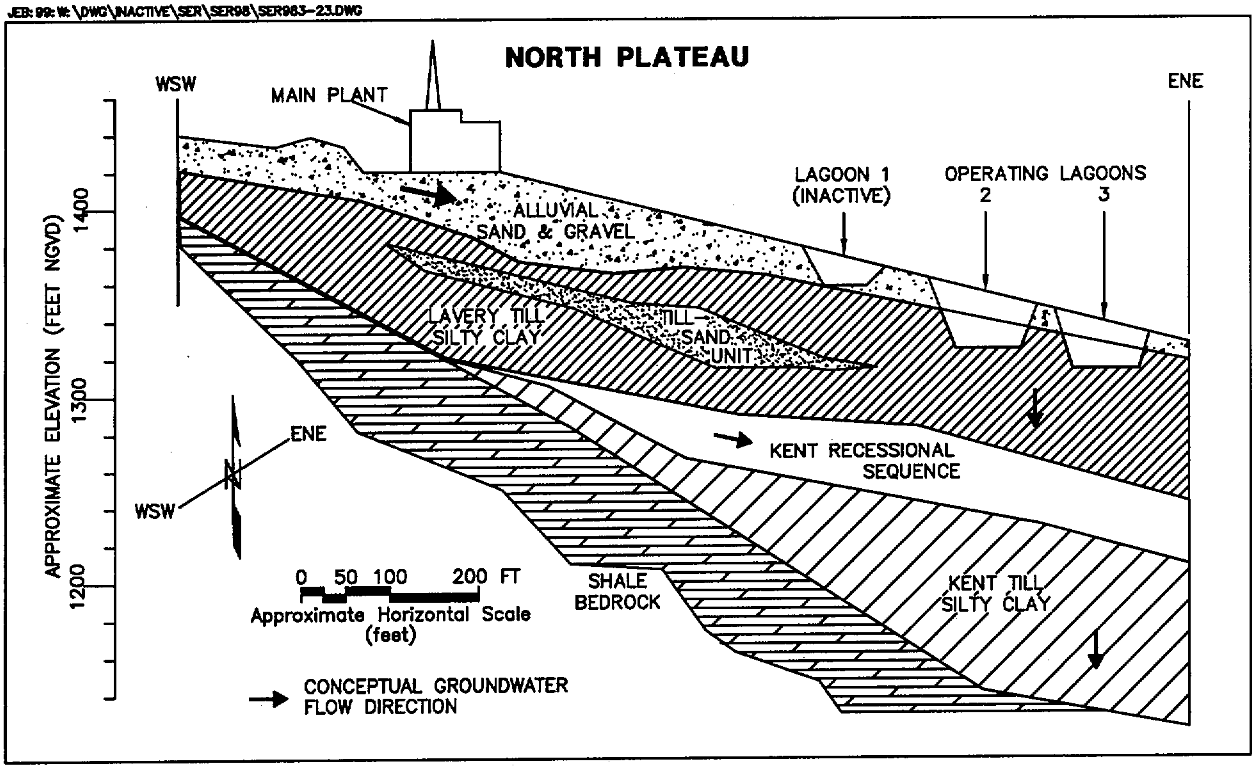

Figure 3–1. Geologic Cross Section through the North Plateau

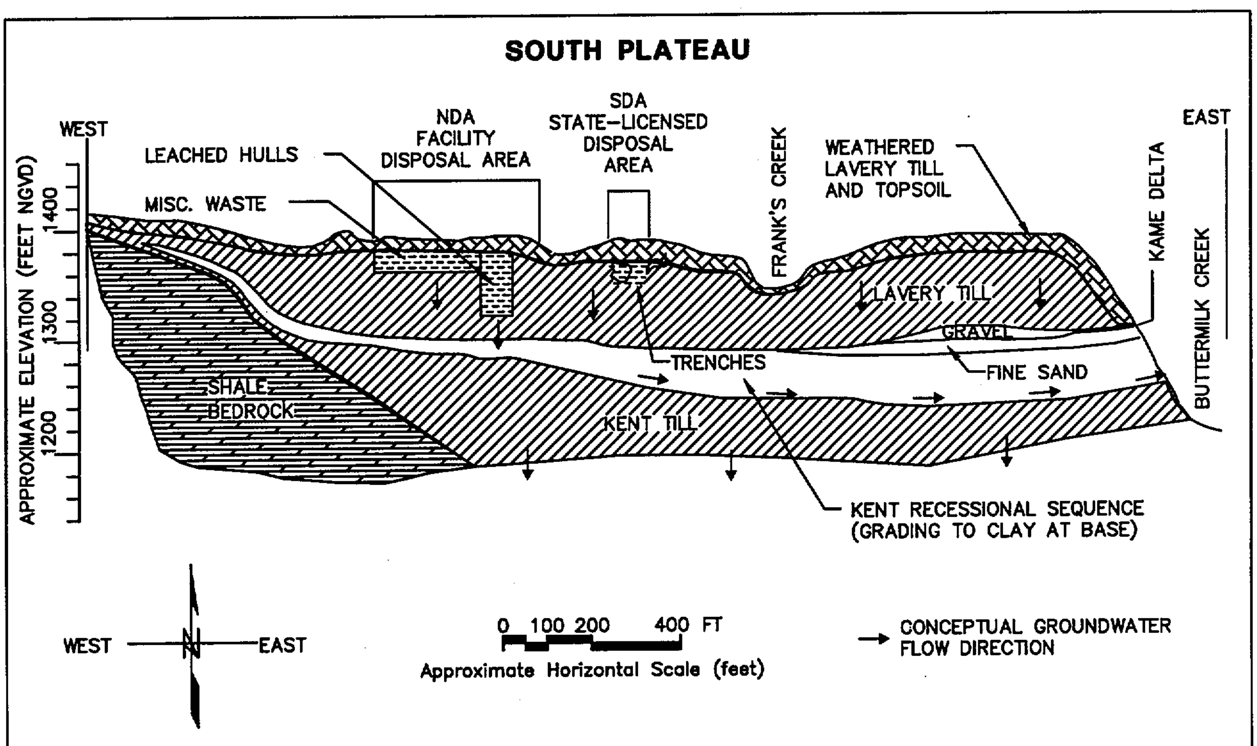

Figure 3–2. Geologic Cross Section through the South Plateau

Hydraulic head distributions in the *unweathered* Lavery till indicate that groundwater flow is predominantly vertically downward at a relatively slow rate, towards the underlying Kent recessional sequence. The mean hydraulic conductivity of this unweathered till generally ranges from 10^{-8} cm/sec (10^{-5} ft/day) to 10^{-7} cm/sec (10^{-4} ft/day).

South Plateau. On the south plateau the upper portion of the Lavery till is exposed at the ground surface and is weathered and fractured to a depth of 0.9 meters to 4.9 meters (3 to 16 ft). This layer is referred to as the *weathered* Lavery till and is unique to the south plateau. The weathered Lavery till has been oxidized to a brown color and contains numerous fractures and root tubes.

Groundwater flow in the weathered till has both horizontal and vertical components. This enables the groundwater to move laterally across the south plateau before moving downward into the unweathered Lavery till or discharging to nearby incised stream channels. The hydraulic conductivity of the weathered till generally ranges from 10^{-7} cm/sec (10^{-4} ft/day) to 10^{-5} cm/sec (10^{-2} ft/day). The highest conductivities are associated with the dense fracture zones found within the upper 2 meters (7 ft) of the unit.

North Plateau. On the north plateau, where the main plant, waste tanks, and lagoons are located, the weathered till layer is much thinner or nonexistent and the *unweathered* Lavery till is immediately overlain by the sand and gravel unit.

The sand and gravel unit and the Lavery till-sand are unique to the north plateau. The sand and gravel unit is a silty sand and gravel layer composed of younger Holocene alluvial deposits that overlie older Pleistocene-age glaciofluvial deposits. Together these two layers range up to 12.5 meters (41 ft) in thickness near the center of the plateau and pinch out along the northern, eastern, and southern edges of the plateau, where they have been truncated by the downward erosion of stream channels. Depth to groundwater within the sand and gravel unit varies from 0 meters to 5 meters (0 ft to 16 ft), being deepest generally beneath the central north plateau (beneath the main plant facilities) and intersecting the ground surface farther north towards the security fence. Groundwater in this unit generally flows northeastward across the north plateau towards Frank's Creek. Groundwater near the northwestern and southeastern margins of the sand and gravel layer also flows radially outward toward Quarry Creek and Erdman Brook, respectively. There is minimal groundwater flow downward into the underlying Lavery till. The mean hydraulic conductivity generally is from 10^{-6} cm/sec (10^{-3} ft/day) to 10^{-3} cm/sec (3 ft/day).

Within the unweathered Lavery till on the north plateau is another unit, the *till-sand*. On-site investigations from 1989 through 1990 identified this lenticular sandy unit of limited areal extent and variable thickness within the Lavery till, primarily beneath the southeastern portion of the north plateau. Groundwater flow through this unit is in an east-southeast direction. Surface discharge locations have not been observed. Results of the most recent hydraulic testing in 1996 and 1998 of eight wells monitoring this unit indicate a mean hydraulic conductivity of 10^{-3} cm/sec (3 ft/day).

Routine Groundwater Monitoring Program

The purpose of groundwater monitoring is to detect changes in groundwater quality within the five different hydrogeologic units described above: the sand and gravel, the weathered Lavery till, the unweathered Lavery till, the Lavery till-sand, and the Kent recessional sequence.

Monitoring Well Network. Table E-1 (Appendix E [p.E-3]) lists the eleven super solid waste management units (SSWMUs) monitored by the well network; the hydraulic position of each well relative to the waste management unit; the geologic unit monitored; and the analytes measured in 1998. Note that monitoring of certain wells, marked by an asterisk, is required by the RCRA 3008(h) Administrative Order on Consent for the WVDP. (See the Environmental Compliance Summary: Calendar Year 1998, RCRA Facility Investigation [RFI] Program [p. ECS-4].)

Figure A-6 (p.A-8) shows the boundaries of the eleven super solid waste management units at the WVDP. (Twenty-one additional wells monitor the SDA and are the responsibility of the New York State Energy Research and Development Authority [NYSERDA]. Locations of NYSERDA wells are shown on Fig.A-8 [p.A-10] in Appendix A.) Although the SDA, a closed radioactive waste landfill, is contiguous with the Project premises, the WVDP is not responsible for the facilities or activities relating to it. Under a joint agreement with the DOE, NYSERDA contracts with the Project to obtain specifically requested technical support in SDA-related matters. The 1998 groundwater monitoring results from the SDA are reported in this document in Appendix L (pp.L-3 through L-14) but are not discussed here.

Four designations can be used to indicate the function of a monitoring well in the WVDP groundwater monitoring program:

Upgradient well. A well installed hydraulically upgradient of a SSWMU that is capable of yielding groundwater samples that are representative of local conditions and that are not affected by the SSWMU being monitored.

Downgradient well. A well installed hydraulically downgradient of a SSWMU that is capable of detecting the migration of contaminants from the SSWMU.

Background well. A well installed hydraulically upgradient of all SWMUs and SSWMUs that is capable of yielding groundwater samples that are representative of conditions not affected by site activities. In some cases upgradient wells may be downgradient of other SSMWUs or SWMUs, which makes them unsuitable for use as true background wells.

Crossgradient well. A well installed to the side of the major downgradient flow path such that the well is neither upgradient nor downgradient of the monitored SSWMU.

Table E-1 (pp.E-3 through E-6) identifies the positions of monitoring locations relative to the SSWMUs. The wells monitoring a given hydrogeologic unit (e.g., sand and gravel, weathered Lavery till) also are arranged in a generalized upgradient to downgradient order based upon their location within the entire hydrogeologic unit. The hydraulic position of a well relative to a SSWMU, i.e., upgradient or downgradient, does not necessarily match that same well's position within a hydrogeologic unit. For example, a well that is upgradient in relation to a SSWMU may be located at any position within a hydrogeologic unit within the boundaries of the WVDP, depending on the geographic position of the SSWMU relative to the hydrogeologic unit. In general, the following text and graphics refer to the hydraulic position of monitoring wells within their respective hydrogeologic units, thus providing a site-wide perspective rather than a perspective centered on SSWMUs.

Potentiometric (water level) measurements also are collected from the wells listed in Table E-1 in conjunction with the quarterly analytical sampling schedule. (See Table 3-1, p.3-6.) Groundwater elevation data are used to produce groundwater contour maps (which delineate flow directions and gradients) and long-term trend graphs (which illustrate seasonal fluctuations and identify changes in the groundwater system).

Table 3-1
1998 Groundwater Sampling and Analysis Agenda

Analyte Group	*Description of Parameters* [1]	*Location of Sampling Results in Appendix E*
Contamination Indicator Parameters (I)	pH, specific conductance (field measurement)	Tables E-2 through E-8 (pp. E-7 through E-15)
Radiological Indicator Parameters (RI)	Gross alpha, gross beta, tritium	Tables E-2 through E-8 (pp. E-7 through E-15)
Volatile Organic Compounds (V)	Appendix 33 VOCs (See Table E-15 [p. E-23])	Table E-9 (p. E-16)
Semivolatile Organic Compounds (SV)	Appendix 33 SVOCs (See Table E-15 [p. E-24])	Table E-10 (p. E-16)
Appendix 33 Metals (M33)	Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, zinc	Table E-11 (pp. E-17 and E-18)
Pilot Program for Investigating Chromium and Nickel Concentrations (M)	Chromium, nickel	Table E-12 (p. E-19)
Special Monitoring Parameters for Early Warning Wells (SM)	Aluminum, iron, manganese	Table E-13 (p. E-20)
Radioisotopic Analyses: alpha-, beta-, and gamma-emitters (R)	C-14, Cs-137, I-129, Ra-226, Ra- 228, Sr-90, Tc-99, U-232, U-233/234, U-235/236, U-238, total uranium	Table E-14 (pp. E-20 through E-22)
Strontium-90 (S)	Sr-90	Table E-14 (pp. E-20 through E-22)

1998 Quarterly Sampling Schedule:
1st Qtr - December 1, 1997 to December 22, 1997
2nd Qtr - March 2, 1998 to March 13, 1998
3rd Qtr - June 1, 1998 to June 12, 1998
4th Qtr - September 1, 1998 to September 14, 1998

[1]Analysis performed at selected active monitoring locations only. See Table E-1 (pp. E-3 through E-6) for the analytes sampled at each monitoring location.

Groundwater Sampling Methodology

Groundwater samples are collected from monitoring wells using either dedicated Teflon® well bailers or bladder pumps. (Dedicated bailers are equipped with Teflon®-coated stainless steel leaders.)

The method of collection depends on well construction, water depth, and the water-yielding characteristics of the well. Bailers are used in low-yield wells; bladder pumps are used in wells with good water-yielding characteristics.

To ensure that only representative groundwater is sampled, three well volumes are removed (purged) from the well before the actual samples are collected. If three well volumes cannot be removed because of limited recharge, purging the well to dryness provides sufficient purging. Conductivity and pH are measured before sampling and after sampling, if sufficient water is still available, to confirm the geochemical stability of the groundwater during sampling.

The bailer, a tube with a check valve at the bottom, is lowered into the well until it reaches the desired point in the water column. The bailer is lowered slowly to minimize agitation of the water column and is then withdrawn from the well with a sample and emptied into a sample container. The bailer, bailer line, and bottom-emptying device used to drain the bailer are dedicated to the well, i.e., are not used for any other well.

Bladder pumps use compressed air to gently squeeze a Teflon® bladder that is encased in a stainless steel tube located near the bottom of the well. When the pressure is released, new groundwater flows into the bladder. A series of check valves ensures that the water flows only in one direction. The operating air is always separated from the sample and is expelled to the surface by a separate line.

Bladder pumps reduce mixing and agitation of the water in the well. Each bladder pump system is dedicated to an individual well to reduce the likelihood of sample contamination from external materials or cross contamination. The air compressor and pump control box can be used from well to well because they do not contact the sample.

Immediately after the samples are collected they are put into a cooler and returned to the Project's Environmental Laboratory. The samples are preserved with chemicals, if necessary, and stored under controlled conditions to minimize chemical and/or biological changes after sample collection. The samples are then either packaged for expedited delivery to an off-site contract laboratory or kept in controlled storage to await on-site testing. A strict chain-of-custody protocol is followed for all samples.

Eleven surface water elevation stakes were installed in August 1998 in areas of the north plateau where groundwater in the sand and gravel unit is believed to intersect the ground surface. Surface water elevation measurements taken at these locations will be evaluated to determine how well they correlate with groundwater elevation measurements taken at monitoring wells. If the correlation is acceptable, then the surface water elevations will be used to improve the definition of groundwater flow-direction and gradients in the sand and gravel unit.

Groundwater Monitoring Program Highlights 1982 to 1998. The groundwater monitoring program is designed to support DOE Order 5400.1 requirements and the RCRA 3008(h) Administrative Order on Consent for the WVDP. In general, the content of the program is dictated by these requirements in conjunction with current operating practices and historical knowledge of previous site activities.

• WVDP groundwater monitoring activities began in 1982 with the monitoring of tritium in the sand and gravel unit in the area of the lagoon system.

• By 1984 twenty wells in the vicinity of the main plant and the NDA provided monitoring coverage.

• Fourteen new wells, a groundwater seep location, and the french drain outfall were added in 1986 to monitor additional site facilities.

• Ninety-six new wells were installed in 1990 to support data collection for the environmental impact statement and RCRA facility investigations.

• A RCRA facility investigation expanded-characterization program was conducted during 1993 and 1994 to fully assess potential releases of hazardous wastes or constituents from on-site SSWMUs. This investigation, which consisted of two rounds of sampling for a wide range of radiological and chemical parameters, yielded valuable information regarding the presence or absence of groundwater contamination near each SSWMU and was also used to guide later monitoring program modifications.

Measuring Water Levels in a Groundwater Monitoring Well

• In 1993 monitoring results indicated elevated gross beta activity in groundwater in the sand and gravel unit on the north plateau. Subsequent investigation of this area delineated a plume of contamination with a southwest to northeast orientation. (See Special Groundwater Monitoring, p. 3-15, for more detail.)

• Long-term monitoring needs were the focus of a 1995 groundwater monitoring program evaluation. After a comprehensive assessment the number of sampling locations was reduced from ninety-one to sixty-five and analytical parameters were tailored for each sampling location, for a more focused, efficient, and cost-effective program.

• From 1996 through 1998, in response to current sampling results and to DOE and RCRA monitoring requirements, wells, analytes, and sampling frequencies were modified. In 1996 other sampling locations, the seeps on the north plateau, were added to the program.

Annual Analytical Trigger Limit Review. A computerized data evaluation program using "trigger limits" for chemical and radiological analytes was instituted in 1995. These pre-set limits — conservative values for chemical or radiological concentrations — were developed to expedite a prompt focus on any monitoring anomalies. Trigger limits are recalculated and updated every year, if necessary, using all pre-existing data as well as data collected during the year. The trigger limits were updated in early 1998. Initially, only upper trigger limits had been used, but in early 1998 lower trigger limits for selected wells and analytes also were instituted.

In addition, upper and lower trigger limits for groundwater elevation measurements were introduced this year. These limits are used to identify field measurement anomalies, allowing prompt investigation and remeasurement, if necessary.

Results of Routine Groundwater Monitoring

Groundwater monitoring program components are completed in accordance with regulatory protocols. These components include placing and installing wells properly, collecting groundwater samples appropriately, incorporating quality assurance methods, and evaluating data appropriately.

The tables in Appendix E (pp.E-7 through E-22) present the results of groundwater monitoring grouped according to the five hydrogeologic units monitored: the sand and gravel unit, the Lavery till-sand unit, the weathered Lavery till unit, the unweathered Lavery till unit, and the Kent recessional sequence. These tables contain the results of 1998 sampling for the radiological and nonradiological analyte groups noted on Table 3-1 (p.3-6). Table E-15 (pp.E-23 through E-25) lists the practical quantitation limits (PQLs) for individual NYCRR [New York Official Compilation of Codes, Rules, and Regulations] Title 6, Appendix 33 analytes.

Appendix E tables also display each well's hydraulic position relative to other wells within the same hydrogeologic unit. Wells identified as UP refer to either background or upgradient wells that are upgradient of all other wells in the same hydrogeologic unit. Downgradient locations are designated B, C, or D to indicate their positions along the groundwater flow path relative to each other. Wells denoted as DOWN - B are closest to the UP wells. Wells denoted as DOWN - C are downgradient of DOWN - B wells but are upgradient of DOWN - D wells. DOWN - D wells are downgradient of all other wells in that hydrogeologic unit. Grouping the wells by hydraulic position provides a logical basis for presenting the groundwater monitoring data in the tables and figures in this report.

The Appendix E tables also list the sample collection periods. The 1998 sampling year covers the period from December 1997 (the first quarter of 1998) through September 1998 (the fourth quarter of 1998).

Graphs showing the highest and lowest measurements of contamination and radiological indicator parameters (pH, conductivity, gross alpha, gross beta, and tritium) have been prepared for all active monitoring locations in each geologic unit. (See Appendix E [pp.E-26 through E-35].) These *high-low* graphs allow results for all wells within a given hydrogeologic unit to be compared to each other. All the high-low graphs present the upgradient wells on the left side of the figure. Downgradient locations are plotted to the right according to their relative position along the groundwater flow path.

On the high-low graphs depicting nonradiological results (pH and conductivity), the upper and lower tick marks on the vertical bar indicate the highest and lowest measurements recorded during 1998. The middle tick represents the arithmetic mean of all 1998 results. The vertical bar thus represents the total range of the data set for each monitoring location during the year.

On the high-low graphs depicting radiological results (gross alpha, gross beta, and tritium), the middle tick is again used to represent the arithmetic mean of all 1998 results. However, the upper and lower tick marks on the vertical bar indicate the upper and lower ranges of the pooled error terms for all 1998 results. This format illustrates the relative amount of uncertainty associated with the radiological measurements. By displaying the uncertainty together with the mean, a more realistic perspective is obtained. (See also Data Reporting [p.1-4] in Chapter 1, Environmental Monitoring Program Information.)

The sample counting results for gross alpha, gross beta, and tritium, even if below the minimum detectable concentrations, were used to generate the high-low graphs. Thus, negative values were included. This is most common for the gross alpha analyses, where sample radiological counting results may be lower than the associated instrument background.

The wells used to provide background values are noted on each graph. All the geologic units except the sand and gravel unit use a single well for background, and in previous years well NB1S was used as the single background reference well for the sand and gravel unit. However, in 1997 the collective monitoring results from three upgradient wells (301, 401, and 706) were substituted for comparison with other sand and gravel wells as a way of better representing the natural spatial variability within the geologic unit. Both the DOE and NYSDEC have accepted the use of this collective background reference instead of well NB1S.

Trend-line graphs have been used to show concentrations of a particular parameter over time at monitoring locations that have historically shown radiological concentrations above background values or volatile organic compound (VOC) concentrations above practical quantitation limits. Graphs are included for gross beta and tritium at selected groundwater monitoring locations (104, 111, 408, 501, 502, 801, 8603, 8604, 8605, and GSEEP) and for the VOCs 1,1-dichloroethane (1,1-DCA) at wells 8609 and 8612; dichlorodifluoromethane (DCDFMeth) at wells 803 and 8612; 1,2-dichloroethylene (1,2-DCE) and 1,1,1-trichloroethane (1,1,1-TCA) at well 8612. (See Volatile and Semivolatile Organic Compounds Sampling [p.3-14].)

Long-term Trends of Gross Beta and Tritium at Selected Groundwater Monitoring Locations. Figures 3-5 through 3-8 (pp.3-19 through 3-20) show the trends of gross beta activity and tritium at selected monitoring locations in the sand and gravel unit. These specific groundwater monitoring locations were selected for trending because they have shown elevated or rising levels of gross beta activity or steady or falling levels of tritium. Results are presented on a logarithmic scale to adequately represent locations of differing concentrations and can be compared to the average background concentrations plotted on each graph.

Gross Beta. The groundwater plume of gross beta activity in the sand and gravel unit on the north plateau (Fig.3-3 [p.3-12]) continues to be monitored closely. The source of the plume's activity can be traced to the subsurface beneath the southwest corner of the former process building. Nine wells (104, 111, 408, 501, 502, 801, 8603, 8604, and 8605) contain elevated levels of gross beta activity, i.e., activity that exceeds the DOE DCG for strontium-90, 1.0E-06 μCi/mL. Gross beta results for wells 804 and 105 were one order of magnitude less than the DOE DCG, thereby indicating the downgradient limits of the plume.

• Figure 3-5 (p.3-19) shows gross beta concentrations in wells 104, 111, 408, 501, 502, and 801 over the eight-year period that the WVDP's current groundwater monitoring program has been in place.

As in previous years, samples from well 408 continued to show the highest gross beta levels of all the wells within the north plateau gross beta plume area. The yearly average gross beta concentration at well 408 increased slightly in 1998 after showing a small decrease in 1997. The gross beta concentrations in wells 501 and 502 have remained relatively consistent over the last several years. Concentrations in well 104 continued to increase but at a slower rate than in previous years.

Gross beta concentrations in well 801 decreased slightly this year. Gross beta concentrations in well 111 increased slightly after showing decreases during the past two years.

• Figure 3-6 (p.3-19) is a graph of gross beta activity at sand and gravel unit monitoring locations 8603, 8604, 8605, and GSEEP. After several years of steep increases in gross beta concentrations in well 8604, the trend leveled off in 1997 and in 1998 showed a slight decrease. Results from well 8603 have continued to show a steady upward trend, apparently due to migration of the eastern lobe of the north plateau plume.

Lagoon 1, formerly part of the low-level waste treatment facility, has been identified as a source of the gross beta activity at wells 8605 and 111. The gross beta concentrations at well 8605 have been slowly but steadily decreasing over the past several years.

Tritium. Tritium in sand and gravel wells also is monitored under the routine monitoring program.

• Figure 3-7 (p. 3-20) shows the tritium concentrations in wells 104, 111, 408, 501, 502, and 801 over the eight-year period that the WVDP's current groundwater monitoring program has been in place. The figure shows that tritium concentrations in well 111 apparently have decreased over recent years. Other monitoring points show slight decreases or relatively steady concentration trends.

• Figure 3-8 (p.3-20) shows the thirteen-year trend of tritium concentrations at monitoring locations 8603, 8604, 8605, and GSEEP. Wells 8603 and 8604 indicate gradually declining trends in tritium, and 8605 shows a significant decrease over time.

North Plateau Seeps. Five of the nine seep sampling points were repaired and upgraded in August 1998 by clearing the sampling pipe interiors of accumulated sediment and roots and inserting the pipes into new holes to optimize water flow. Flow from the pipes was improved, ensuring the collection of high-quality samples and minimizing sample time.

Analytical results for radiological parameters from semiannual sampling of the sand and gravel unit seepage locations were compared to the results from GSEEP, a seep monitored since 1991 that apparently is not influenced by the gross beta plume. (See Fig.A-7 [p.A-9].) Results thus far appear to indicate that gross beta activity from the north plateau plume has not migrated to these seepage areas. Gross alpha and gross beta concentrations at most of the seep sampling locations were generally similar to results from GSEEP. Gross beta concentrations from SP02

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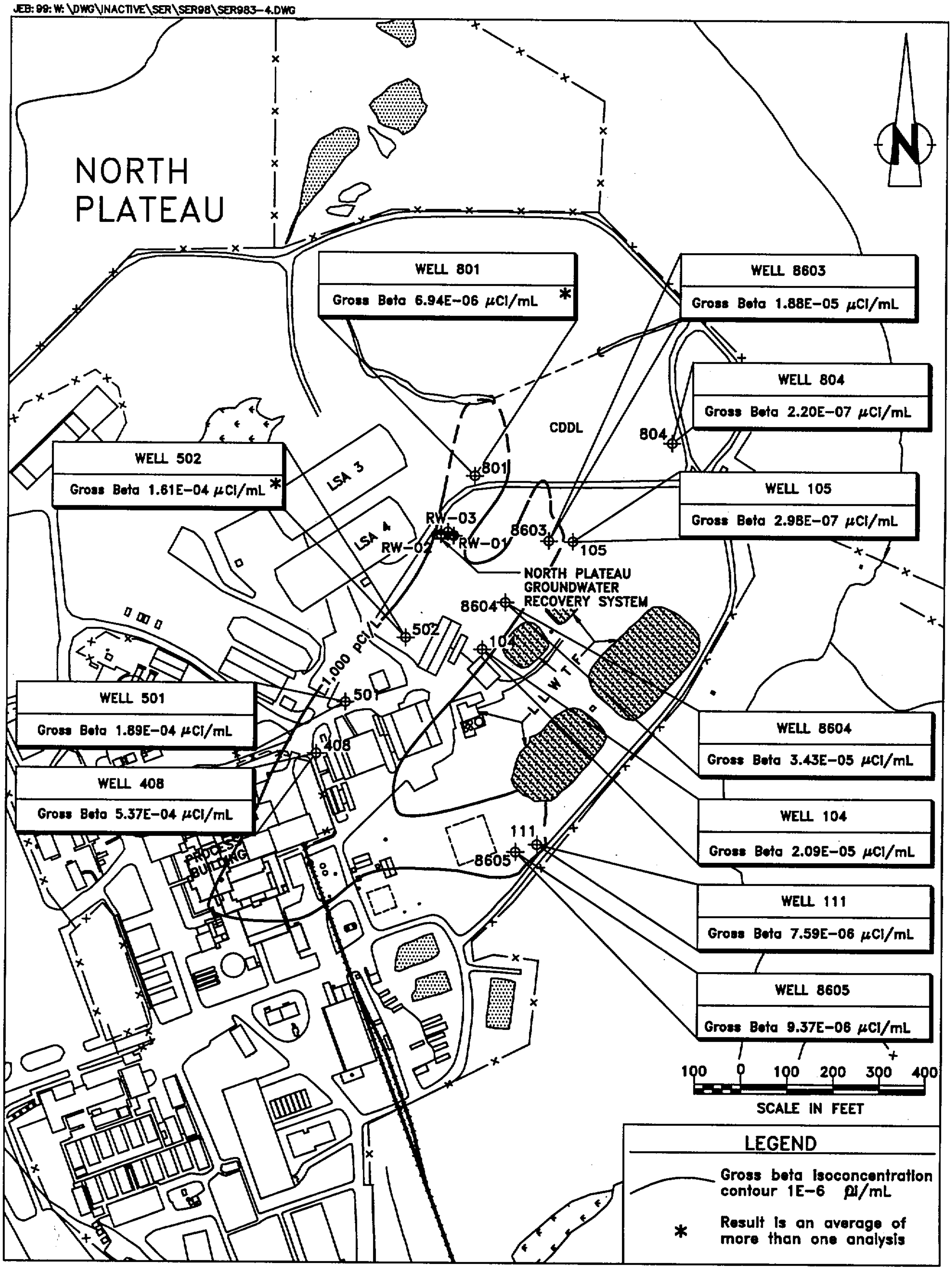


Figure 3-3. North Plateau Gross Beta Plume Area: Fourth-Quarter 1998 Results.

and gross alpha and gross beta results from SP04 were slightly above GSEEP concentrations during 1998 but still were well below the DCGs. (See Table E-7 [p.E-15].)

Tritium concentrations at the seeps remained similar in magnitude or were less than concentrations at GSEEP. Minor seasonal fluctuations over time also are apparent. Concentrations at all the seeps were slightly above background but were generally consistent with tritium levels seen in sand and gravel wells on the north plateau.

North Plateau Well Points. Seven well points were installed in 1990 downgradient of the process building and were sampled annually between 1993 and 1998 for radiological indicator parameters. Data from these well points were used to supplement data collected from groundwater monitoring wells.

Well points A, C, and H (Fig.A-6 [p.A-8]) have yielded samples with concentrations of tritium that are elevated with respect to historical monitoring of wells in the area. However, the tritium concentrations are well below the DOE derived concentration guide of 2.0E-03 μCi/mL. Data from downgradient monitoring wells have not indicated similarly elevated levels of tritium. (See Table E-8 [p.E-15].)

This area east of the process building and west of inactive lagoon 1 may be an area of localized contamination, and it will continue to be monitored annually for contamination indicator and radiological indicator parameters. Sampling will continue at well points A, C, and H to further evaluate the presence of tritium in this localized area.

Results of Monitoring at the NDA. Gross beta and tritium concentrations in samples from well 909 and location NDATR (Fig.A-6 [p.A-8]) continued to be elevated with respect to other locations monitoring the NDA but remained well below the DCGs. Radiological indicator results have historically fluctuated at these locations but, in general, upward trends in gross beta and tritium are discernible at well 909. Gross beta concentrations from well 909 are considerably higher than at NDATR; residual soil contamination near this well is the suspected source.

A trench was constructed around two sides of the NDA to collect groundwater that may contain a mixture of n-dodecane and tributyl phosphate (TBP). (For more information see Chapter 1, Environmental Monitoring Program Information, NRC-licensed Disposal Area [NDA] Interceptor Trench and Pretreatment System [p.1-8].) There were no monitoring results in 1998 that indicated the presence of TBP or n-dodecane.

Procedures for collecting water samples from location NDATR (the NDA interceptor trench manhole sump) were recently modified. Previously, the water in the manhole had been sampled anywhere from immediately after it was pumped out to up to nineteen days after being pumped out. Because the manhole is not purged before sampling, the varying age of the water may have induced occasional variability in analytical results from this location. The modified procedures include sampling the water within forty-eight hours after pumping is completed. This approach is expected to minimize potential variability in future analytical results (Dames & Moore May 1998). An evaluation of the effectiveness of this strategy will be made after a minimum of four quarterly sampling rounds have been completed.

Results of Radioisotopic Sampling. Groundwater samples for radioisotopic analyses are collected regularly from sixteen monitoring points in the sand and gravel unit and the weathered Lavery till. (See Table E-14 [pp.E-20 through E-22]. Results from 1998 generally confirmed historical findings. Strontium-90 remained the major contributor to elevated gross beta activity in the plume on the north plateau.

Technetium-99, iodine-129, and carbon-14 radionuclides, which have been noted at several monitoring locations at concentrations above background levels (in specific wells within the gross beta plume and downgradient of inactive lagoon 1 and the NDA), have been demonstrated to contribute very small percentages to total gross beta concentrations. None of these concentrations have been above DCGs, and gross beta analyses continue to provide surveillance on a quarterly basis.

Volatile and Semivolatile Organic Compounds Sampling

Volatile and semivolatile organic compounds were sampled at specific locations (wells 8612, 8609, 803, and SP12 [Fig.A-6, p.A-8]) that have shown historical results above their respective practical quantitation levels (PQLs). (The PQL is the lowest level of an analyte that can be measured within specified limits of precision during routine laboratory operations [New York State Department of Environmental Conservation 1991]. See Table E-15 [pp.E-23 through E-25] for a list of PQLs.) Other monitoring locations are sampled for volatile and semivolatile organic compounds because they are downgradient of locations showing positive results.

1,1-dichloroethane. Trends in concentrations of the compound 1,1-dichloroethane (1,1-DCA) from 1991 through 1998 are illustrated in Figure 3-9 (p.3-21). Concentrations of 1,1-DCA at well 8612 remained consistent with results from previous years but were not detected at wells 8609, 803, or groundwater seep SP-12 during 1998. (See Table E-9 [p. E-16].)

Dichlorodifluoromethane. Trends of dichlorodifluoromethane (DCDFMeth) concentrations are shown in Figure 3-10 (p.3-21). The concentrations of DCDFMeth at well 8612 remained at low levels in 1998 — near the detection limit. DCDFMeth was identified at well 803 at concentrations below the PQL. DCDFMeth was not detected at SP-12 during 1998.

1,2-dichloroethylene. Another positive VOC detection (Fig.3-11 [p.3-22]) was 1,2-dichloroethylene (1,2-DCE) at well 8612, which showed an increasing trend during 1998. (This compound was first detected in 1995.)

1,1,1-trichloroethane. Concentrations of the compound 1,1,1-trichloroethane (1,1,1-TCA) also were detected at well 8612 below the PQL.

The VOCs 1,1-DCA, DCDFMeth, and 1,1,1-TCA are often found in combination with each other and with 1,2-DCE. In well 8612 each of these three compounds first exhibited an increasing trend that, over the past few years, was then followed by a decreasing trend. It is expected that 1,2-DCE will exhibit similar behavior, and continued routine monitoring will evaluate future trends.

Tributyl phosphate. Aqueous concentrations of tributyl phosphate (TBP) were detected at well 8605, near lagoon 1, at concentrations similar to those in 1997. TBP was detected once in well 111 during 1998 at levels below the PQL. (See Table E-10 [p.E-16].) This well is next to and downgradient of well 8605, and positive detections of TBP have been reported in the past.

The ongoing detection of TBP in this localized area may be related to previously detected low, positive concentrations of iodine-129 and uranium-232 in wells 111 and 8605, as noted in previous annual Site Environmental Reports. The presence of all three contaminants indicates that these results reflect residual contamination from previous waste disposal activities in the former lagoon 1 area during historical fuel reprocessing. Future trends of TBP will be evaluated as part of the routine groundwater monitoring program.

Special Groundwater Monitoring

Gross Beta Plume on the North Plateau. Elevated gross beta activity has been detected in groundwater from the surficial sand and gravel unit in localized areas north and east of the building where NFS reprocessed nuclear fuel (Fig. 3-3 [p.3-12]). In December 1993 elevated gross beta concentrations were detected in surface water at former sampling location WNDMPNE, located at the edge of the plateau. This detection initiated a subsurface investigation in 1994. Groundwater and soil were sampled using the Geoprobe®, a mobile sampling system. The investigation was used to define the extent of the gross beta plume beneath and downgradient of the process building. The gross beta plume delineated was approximately 300 feet wide and 800 feet long.

The highest gross beta concentrations in groundwater and soil were near the southeast corner of the process building. The maximum activity in groundwater was 3.6E-03 μCi/mL, and the maximum activity in soil reached 2.4E-02 μCi/g. Strontium-90 and its daughter product, yttrium-90, were determined to be the isotopes responsible for most of this elevated gross beta activity. (West Valley Nuclear Services Co., Inc. 1995). In 1995 the north plateau groundwater recovery system (NPGRS) was installed to minimize the spread of the gross beta plume.

The NPGRS was located near the leading edge of the main lobe of the plume where groundwater flows preferentially towards the edge of the plateau. The NPGRS initially consisted of two extraction wells (RW-01 and RW-02) to recover the contaminated groundwater. In September 1996 a third well (RW-03) was added to the NPGRS along with other system upgrades. The upgraded recovery system more effectively captures the contaminant plume in this area.

Water recovered by the NPGRS is treated by ion exchange to remove strontium-90. Treated water is transferred to lagoon 4 or 5 and then to lagoon 3 for ultimate discharge to Erdman Brook.

The north plateau groundwater recovery system operated successfully throughout 1998, processing more than 4.4 million gallons, and has recovered and processed more than 14 million gallons since November 1995.

Northeast Swamp Drainage Monitoring. Routine surface water sampling during 1998 continued to monitor radiological discharges through the northeast swamp drainage at location WNSWAMP. (See Appendix C, Table C-7 [p.C-8].) Gross beta and strontium-90 concentrations continued to fluctuate due to seasonal effects. The annualized average strontium-90 concentrations trended upward to some extent during 1998. (Fig. 3-4 [p.3-16].) This increase was expected and is attributable to groundwater downgradient of the influence of the NPGRS.

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 public access (WFFELBR) continued to show strontium-90 concentrations to be nearly indistinguishable from background (WFBIGBR) concentrations. (See also Off-site Surface Water, p.2-8, in Chapter 2, Environmental Monitoring.)

1998 Geoprobe® Investigation in the Core Area of the North Plateau Plume. As a result of recommendations from a 1997 external review of WVDP response actions on the north plateau, more attention was given in 1998 to the core area of the plume. (The core area is the portion of the gross beta plume beneath or immediately downgradient of the former process building suspected to be the source of the plume.) A Geoprobe® sampling program subsequently was developed to further characterize the core area. The program's goals were as follows:

- characterize the soil and groundwater in the strontium-90 plume core and compare the results with 1994 data

- collect data for a geochemical evaluation of the core and for strontium-90-transport modeling

- collect data to be used to evaluate the feasibility of various treatment and mitigative technologies for groundwater and saturated soil within the strontium-90 plume core

- collect soil grain-size distribution data

- evaluate the potential for strontium-90 to migrate into the Lavery till within the strontium-90 plume core.

The 1998 Geoprobe® field program began in June 1998 and was completed in September 1998. Geoprobe® groundwater and soil samples also were collected downgradient of the north plateau groundwater recovery system (NPGRS) to provide further characterization of this area. A summary report will be completed in 1999.

North Plateau Groundwater Quality Early Warning Sampling. An early warning evaluation of selected monitoring well data was devised to identify possible changes in the quality of the groundwater recovered by the NPGRS that might affect compliance with site effluent limitations on pollutants specified in the SPDES permit for outfall 001. This monitoring is important because water recovered by the NPGRS ultimately is discharged through outfall 001.

The early warning system compares quarterly monitoring results from three wells (116, 602, and 502) in the vicinity of the NPGRS to early warning levels (multiples of the SPDES permit levels) in order to identify concentrations that may affect compliance with SPDES effluent limits. Two of the wells, 116 and 602, are used to monitor groundwater in the area affected by NPGRS drawdown. The third well, 502, is directly upgradient of the NPGRS and is sampled for additional metals not routinely analyzed under the groundwater monitoring program. Analytical re-

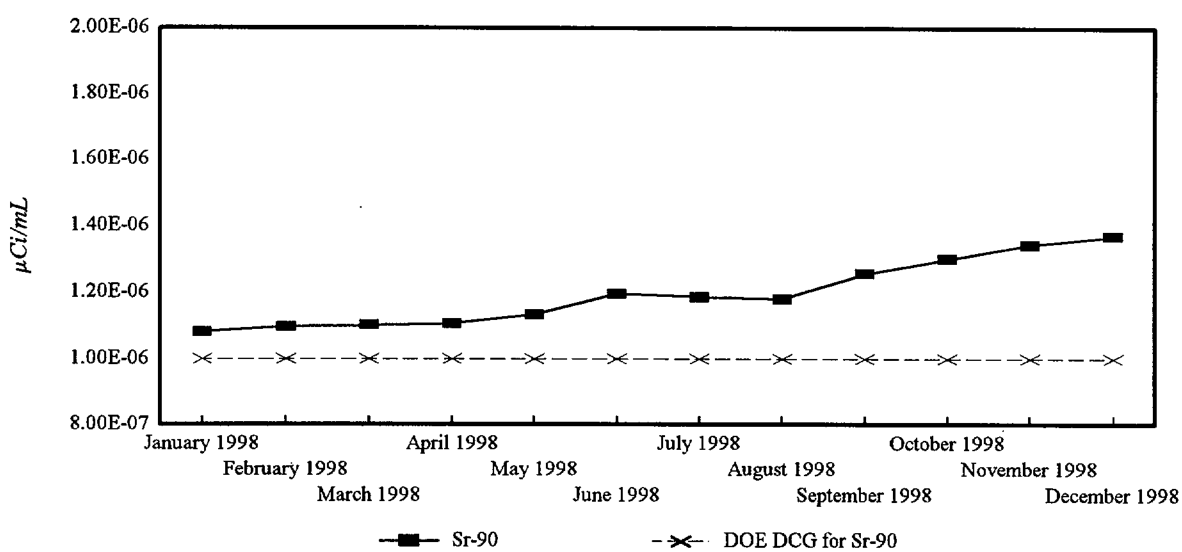


Figure 3-4. Annualized Average Strontium-90 Concentrations at WNSWAMP

sults from the early warning sampling can be found in Tables E-11 through E-13 (pp.E-17 through E-20 in Appendix E).

Pilot Program Investigating Chromium and Nickel in the Sand and Gravel Unit. Long-term groundwater monitoring results have shown a wide spatial and temporal range of chromium and nickel concentrations in the sand and gravel unit. The randomness of these elevated concentrations indicated that the source probably was not related to a release from an on-site facility.

However, a possible source of elevated metals in groundwater samples is corrosion of stainless steel monitoring well screens and casings: Metals leached from the well materials can adsorb to sediment particles within the well and these particles can then become entrained in the groundwater sample by vigorous purging and sampling.

A study was initiated in 1997 to determine the effect of modifying sampling equipment and methodology on the concentrations of chromium and nickel in the groundwater. Twelve sand and gravel wells were selected for the investigation. The equipment and sampling methods for six of the wells were left unchanged and these wells were sampled according to routine procedures. The sampling equipment and methodology of the other six wells were modified in order to minimize the amount of solids collected during sampling.

The final report of this study, completed in June 1998, noted that modifications to sampling equipment and methodology produced decreases in chromium and nickel concentrations. This supported the hypothesis that the elevated concentrations were not representative of actual groundwater conditions but presumably were caused by the release of metals from subsurface corrosion of stainless steel well materials, which is well-documented in the technical literature.

To ensure continued well integrity, WVNS currently is evaluating the extent of corrosion of stainless steel wells in the sand and gravel unit. The evaluation will include a review of historical information and well performance data, downhole video inspections, and well redevelopment and/or cleaning, and will determine recommendations for continued well monitoring, maintenance, or replacement, as necessary, to maintain well integrity and sample quality.

NYSDEC Sample-splitting Program. During the fourth quarter of 1998 groundwater sampling, NYSDEC collected split samples, which were independently analyzed for selected metals and radiological indicator parameters by WVDP and NYSDEC laboratories. Overall, agreement between the split sample results was favorable.

Summary of Site Groundwater Monitoring

One of the primary functions of routine groundwater monitoring at the WVDP is to provide timely detection of contaminant release, if any, from SSWMUs to site groundwater. Program specifications such as monitoring well locations and selection of analytes were designed for this purpose. Groundwater monitoring data collected during 1998 did not indicate new releases from SSWMUs or any other new groundwater concerns.

Groundwater seep samples from the sand and gravel unit are collected semiannually from several points near the northeast corner of the north plateau. These points are hydraulically downgradient of the site. Analytical results from seep samples obtained during 1998 indicated no concentrations of radiological or chemical parameters above regulatory guidelines.

The 1998 groundwater monitoring program reflects continuous refinements of a systematic routine based on historic groundwater data, site-use information, and recent trends. These data and information are also used to make responsible, proactive decisions such as the Geoprobe® investigations to better define the core area of the north plateau gross beta plume, installation and operation of the NPGRS, and the pilot study to investigate chromium and nickel in groundwater.

Groundwater monitoring will continue on a quarterly basis during 1999. If items of concern are discovered, they will be addressed promptly in order to protect groundwater resources in the vicinity of the WVDP.

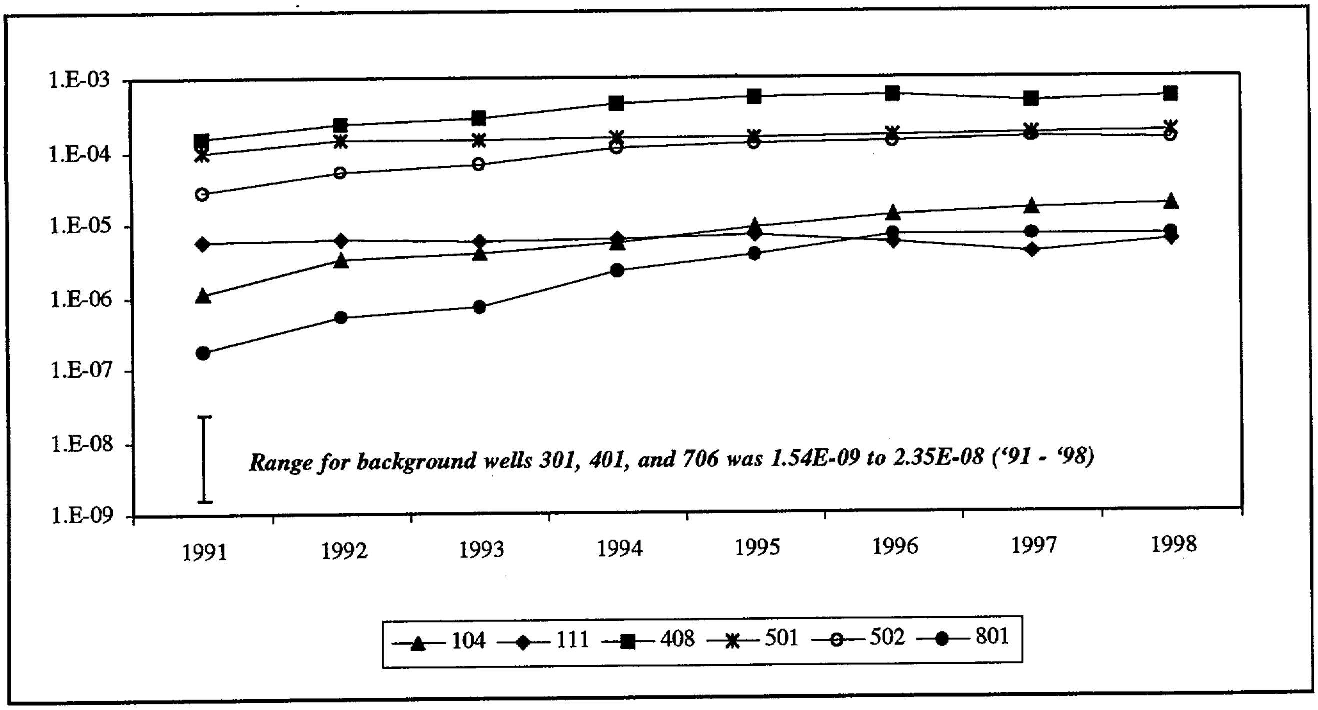


Figure 3-5. Eight-Year Trends of Averaged Gross Beta Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

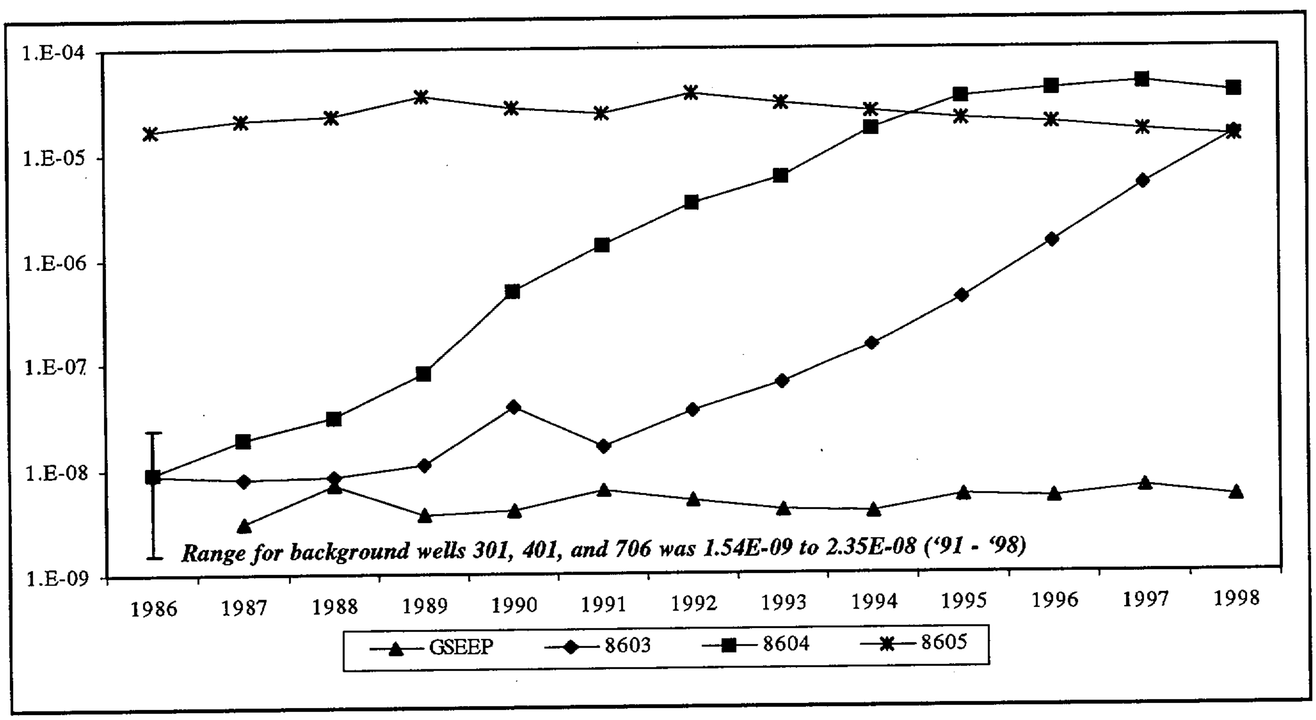


Figure 3-6. Thirteen-Year Trends of Averaged Gross Beta Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

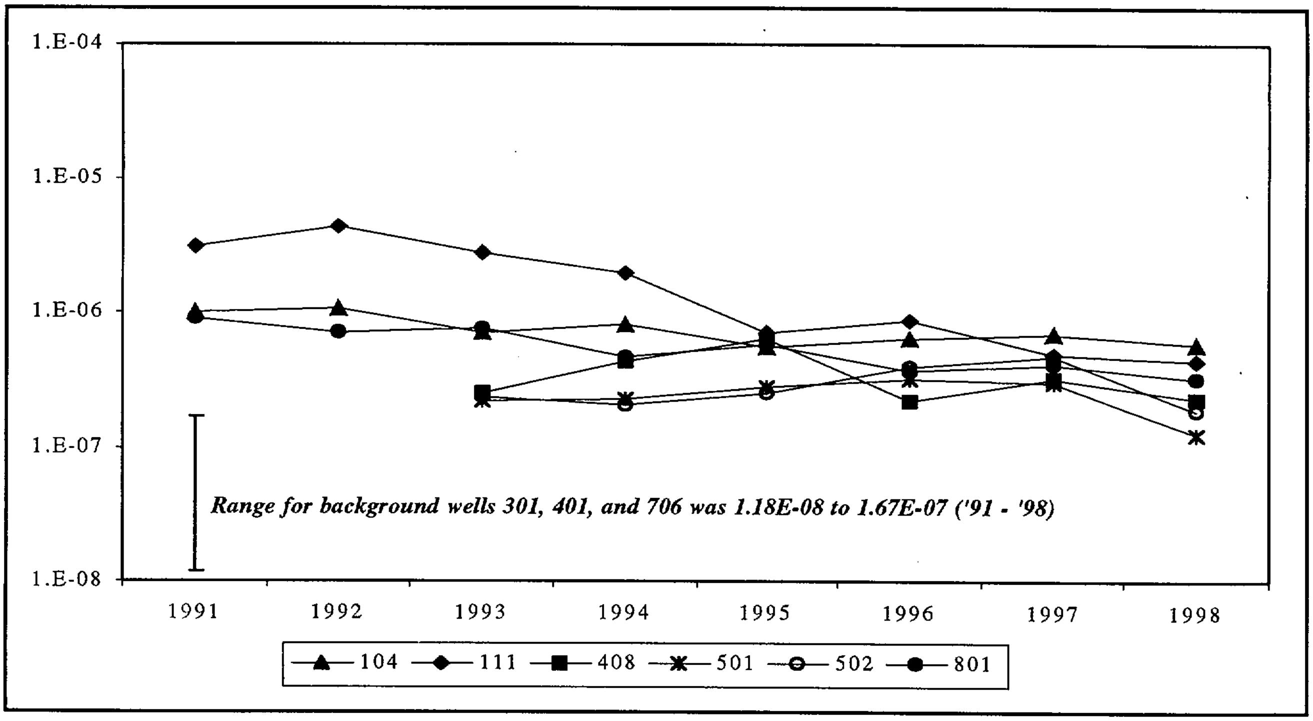


Figure 3-7. Eight-Year Trends of Averaged Tritium Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

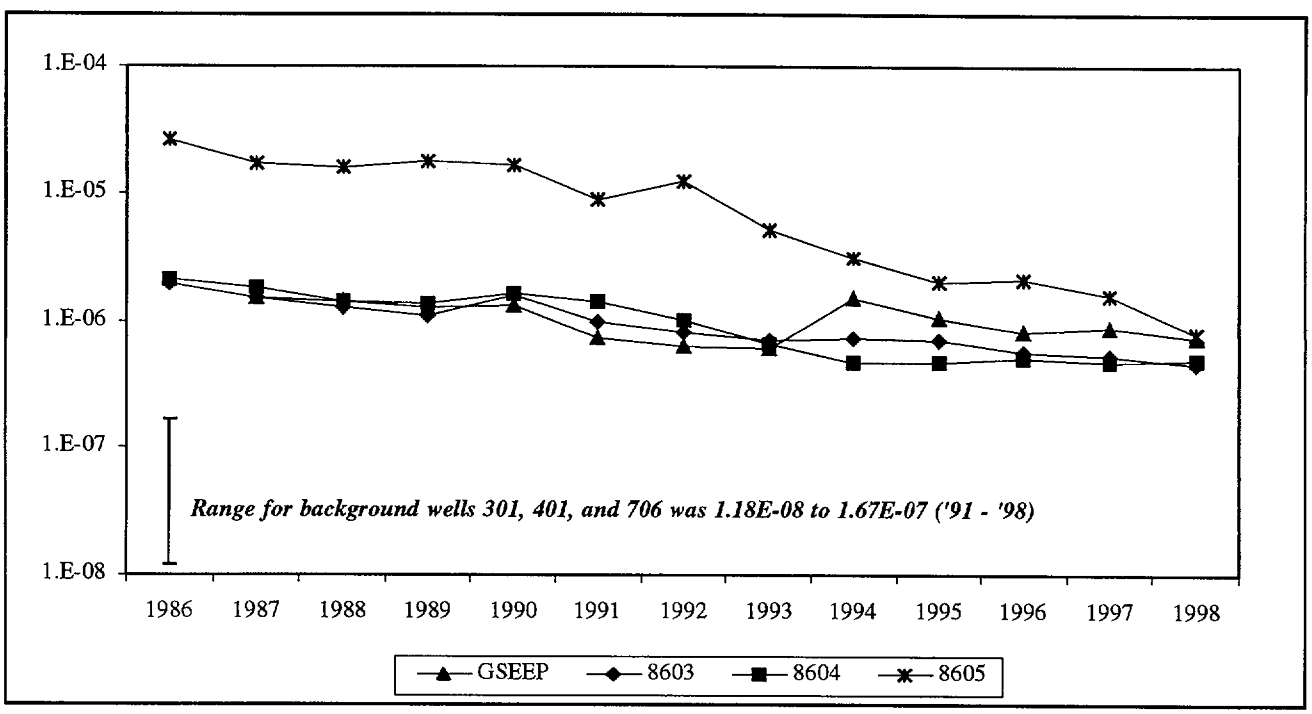


Figure 3-8. Thirteen-Year Trends of Averaged Tritium Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

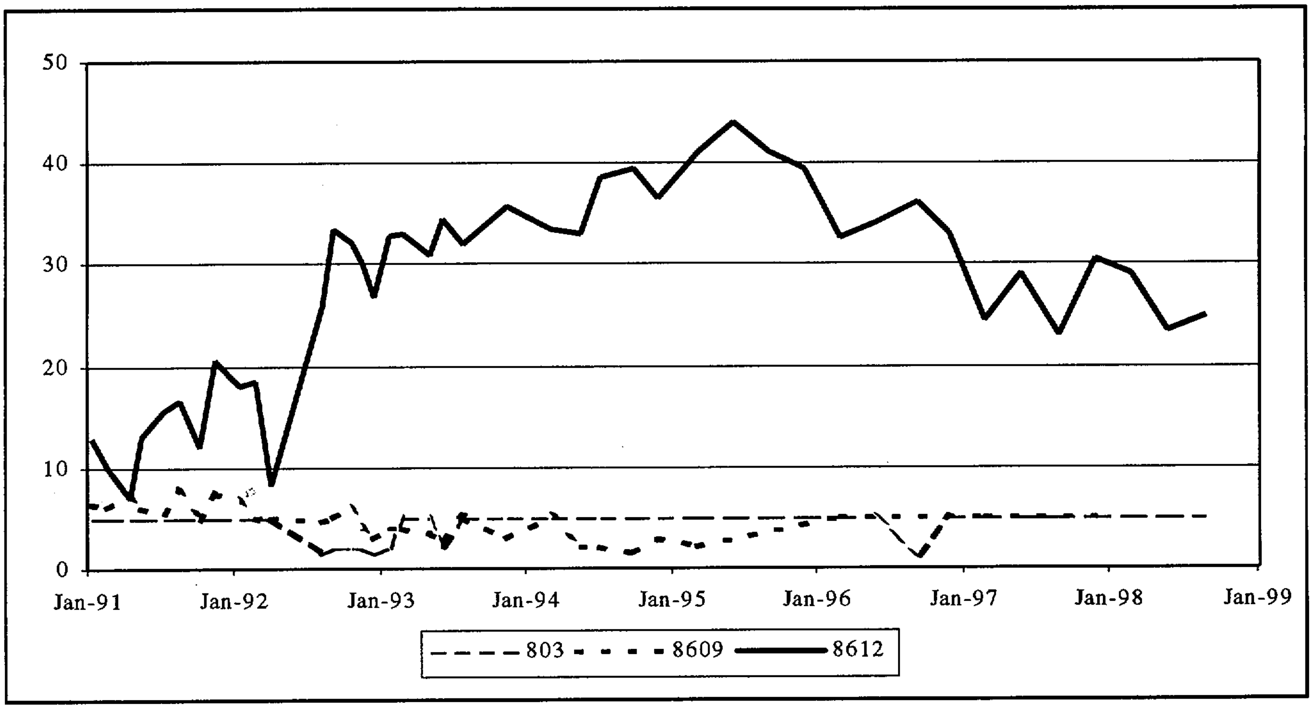


Figure 3-9. Eight-Year Trends (1991 through 1998) of 1,1-DCA (µg/L) at Selected Monitoring Locations

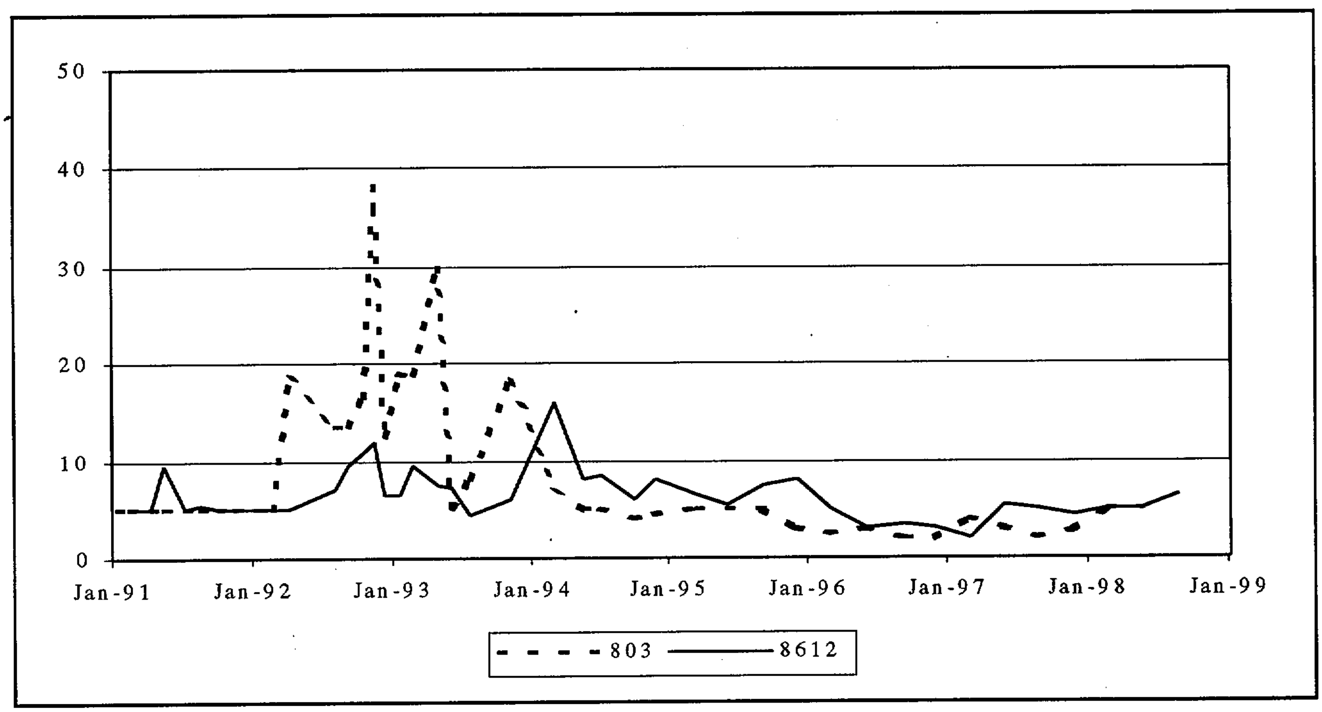


Figure 3-10. Eight-Year Trends (1991 through 1998) of Dichlorodifluoromethane (DCDFMeth) (µg/L) at Selected Monitoring Locations

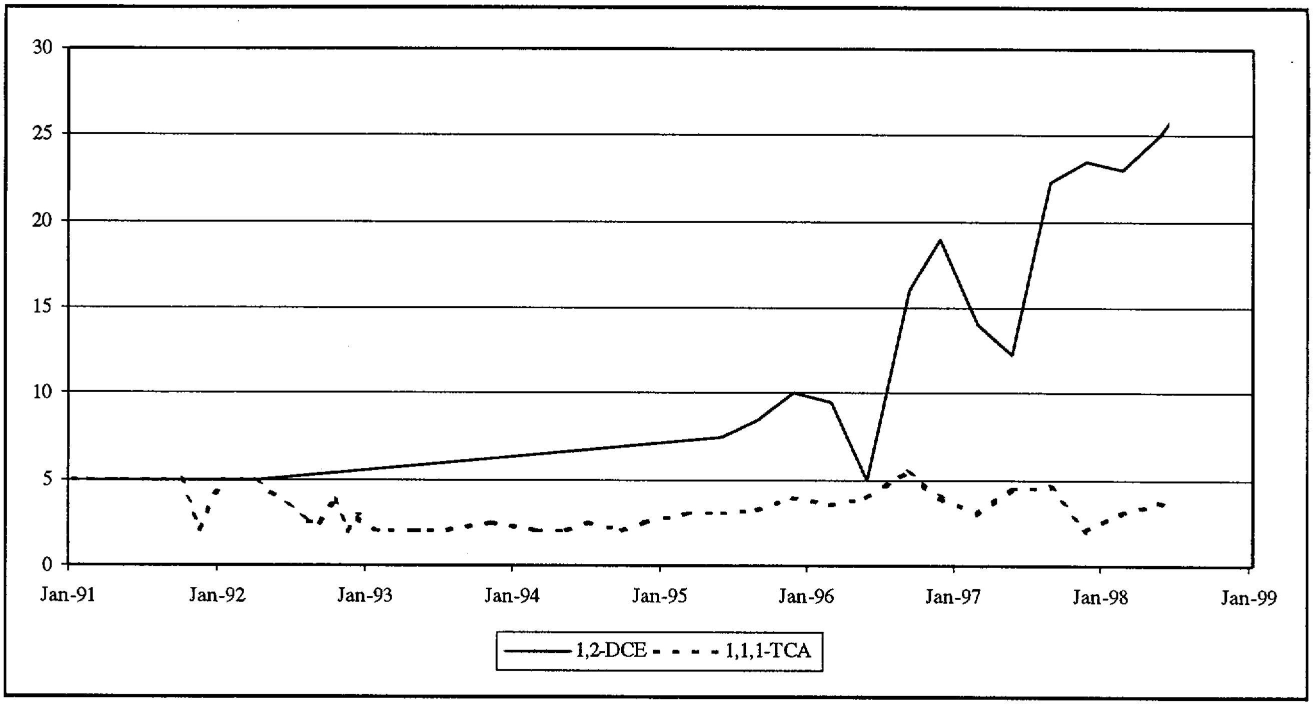


Figure 3-11. Eight-Year Trends (1991 through 1998) of 1,2-DCE and 1,1,1-TCA (µg/L) at Well 8612

Chapter 4
Radiological Dose Assessment

Introduction

Each year the potential radiological dose to the public that is attributable to operations and effluents from the West Valley Demonstration Project (WVDP) is assessed to verify that no individual could possibly have received a dose exceeding the limits established by the regulatory agencies. The results of these conservative dose calculations demonstrate that the potential maximum dose to an off-site resident was well below permissible standards and was consistent with the as-low-as-reasonably achievable (ALARA) philosophy of radiation protection.

This chapter describes the methods used to estimate the dose to the general public resulting from exposure to radiation and radionuclides released by the Project to the surrounding environment during 1998. Estimated doses are compared directly to current radiation standards established by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) for protection of the public. The values are also compared to the annual dose the average resident of the U.S. receives from natural background radiation and to doses reported in previous years for the Project.

Radioactivity. Atoms that emit radiation are called radionuclides. Radionuclides are unstable isotopes that have the same number of protons as any other isotope of the element but different numbers of neutrons, resulting in different atomic masses. For example, the element hydrogen has two stable isotopes, H-1 and H-2 (deuterium), and one radioactive isotope, H-3 (tritium). The numbers following the element's symbol identify the atomic mass, which is the number of protons plus neutrons in the nucleus. Thus, H-1 has one proton and no neutrons, H-2 has one proton and one neutron, and H-3 has one proton and two neutrons.

When radioactive atoms decay by emitting radiation, the daughter products that result may be either radioactive or stable. Generally, radionuclides with high atomic numbers, such as uranium-238 and plutonium-239, have many generations of radioactive progeny. For example, the radioactive decay of plutonium-239 creates uranium-235, thorium-231, protactinium-231, and so on through eleven progeny until only the stable isotope lead-207 remains.

Radionuclides with lower atomic numbers often have no more than one daughter. For example, strontium-90 has one radioactive daughter, yttrium-90, which finally decays into stable zirconium; cobalt-60 decays directly to stable nickel with no intermediate nuclide.

The time required for half of the radioactivity of a radionuclide to decay is referred to as the radionuclide's half-life. Each radionuclide has a unique half-life; both strontium-90 and cesium-137 have half-lives of approximately 30 years while plutonium-239 has a half-life of 24,400 years. Knowledge of radionuclide half-lives is often used to estimate past and future inventories of radioactive material. For example, a 1.0-millicurie source of cesium-137 in 1998 would have measured 2.0 millicuries in 1968 and will be 0.5 millicuries in 2028.

Radiation emitted by radionuclides may consist of electromagnetic rays such as x-rays and gamma rays or charged particles such as alpha and beta particles. A radionuclide may emit one or more of these radiations at characteristic energies that can be used to identify them.

Radiation Dose. The energy released from a radionuclide is eventually deposited in matter encountered along the path of the radiation. The radiation energy absorbed by a unit mass of material is referred to as the absorbed dose. The absorbing material can be either inanimate matter or living tissue.

Alpha particles leave a dense track of ionization as they travel through tissue and thus deliver the most dose per unit-path length. However, alpha particles are not penetrating and must be taken into the body by inhalation or ingestion to cause harm. Beta and gamma radiation can penetrate the protective dead skin layer of the body from the outside, exposing the internal organs.

Because beta and gamma radiations deposit much less energy in tissue per unit-path length relative to alpha radiation, they produce fewer biological effects for the same absorbed dose. To allow for the different biological effects of different kinds of radiation, the absorbed dose is multiplied by a quality factor to yield a unit called the dose equivalent. A radiation dose expressed as a dose equivalent, rather than as an absorbed dose, permits the risks from different types of radiation exposure to be compared to each other (e.g., exposure to alpha radiation compared to exposure to gamma radiation). For this reason, regulatory agencies limit the dose to individuals in terms of total dose equivalent.

Units of Measurement. The unit for dose equivalent in common use in the U.S. is the rem, which stands for roentgen-equivalent-man. The international unit of dose equivalent is the sievert (Sv), which is equal to 100 rem. The millirem (mrem) and millisievert (mSv), used more frequently to report the low dose equivalents encountered in environmental exposures, are equal to one-thousandth of a rem or sievert.

The effective dose equivalent (EDE), also expressed in units of rem or sievert, provides a means of combining unequal organ and tissue doses into a single "effective" whole body dose that represents a comparable probability of inducing a fatal cancer. The probability that a given dose will result in the induction of a fatal cancer is referred to as the risk associated with that dose. The EDE is calculated by multiplying the organ dose equivalent by the organ-weighting factors developed by the International Commission on Radiological Protection (ICRP) in Publications 26 (1977) and 30 (1979). The weighting factor is a ratio of the risk from a specific organ or tissue dose to the total risk resulting from an equal whole body dose. All organ-weighted dose equivalents are then summed to obtain the EDE.

The dose from internally deposited radionuclides calculated for a fifty-year period following intake is called the fifty-year committed effective dose equivalent (CEDE). The CEDE sums the dose to an individual over fifty years to account for the biological retention of radionuclides in the body. The total EDE for one year of exposure to radioactivity is calculated by adding the CEDE to the dose equivalent from external, penetrating radiation received during the year. Unless otherwise specified, all doses discussed here are EDE values, which include the CEDE for internal emitters.

A collective population dose is expressed in units of person-rem or person-sievert because the individual doses are summed over the entire potentially exposed population. The average individual dose can therefore be obtained by dividing the collective dose by the number in the population.

Sources of Radiation. Members of the public are routinely exposed to different sources of ionizing radiation from both natural and manmade sources. Figure 4-1 (*below*) shows the relative contribution to the annual dose in millirem from these sources in comparison to the estimated 1998 maximum individual dose from the WVDP. The National Council on Radiation Protection and Measurements (NCRP) Report 93 (1987) estimates that the average annual effective dose equivalent received by an individual living in the U.S. is about 360 mrem (3.6 mSv) from both natural and manmade sources of radiation.

While most of the radiation dose received by the general public is natural background radiation, manmade sources of radiation also contribute to the average dose. Such sources include diagnostic and therapeutic x-rays, nuclear medicine, fallout from atmospheric nuclear weapons tests, effluents from nuclear fuel cycle facilities, and consumer products such as smoke detectors and cigarettes.

As can be seen in Figure 4-1 (*below*), natural sources of radiation contribute 295 mrem (2.95 mSv) and manmade sources contribute 65 mrem (0.65 mSv) of the total annual U.S. average dose of 360 mrem (3.60 mSv). The WVDP contributed a very small amount (0.065 mrem [0.00065 mSv]) to the total annual manmade radiation dose to the maximally exposed individual residing near the WVDP. This is much less than the average dose received from using consumer products and is insignificant compared to the federal standard of 100 mrem from manmade sources or the 295 mrem received annually from natural sources.

Health Effects of Low-level Radiation. Radionuclides entering the body through air, water, or food are distributed in different organs of the body. For example, isotopes of iodine concentrate in the thyroid. Strontium, plutonium, and americium isotopes concentrate in the skeleton. When inhaled, uranium and plutonium isotopes remain in the lungs for a long period of time. Some radionuclides such as tritium, carbon-14,

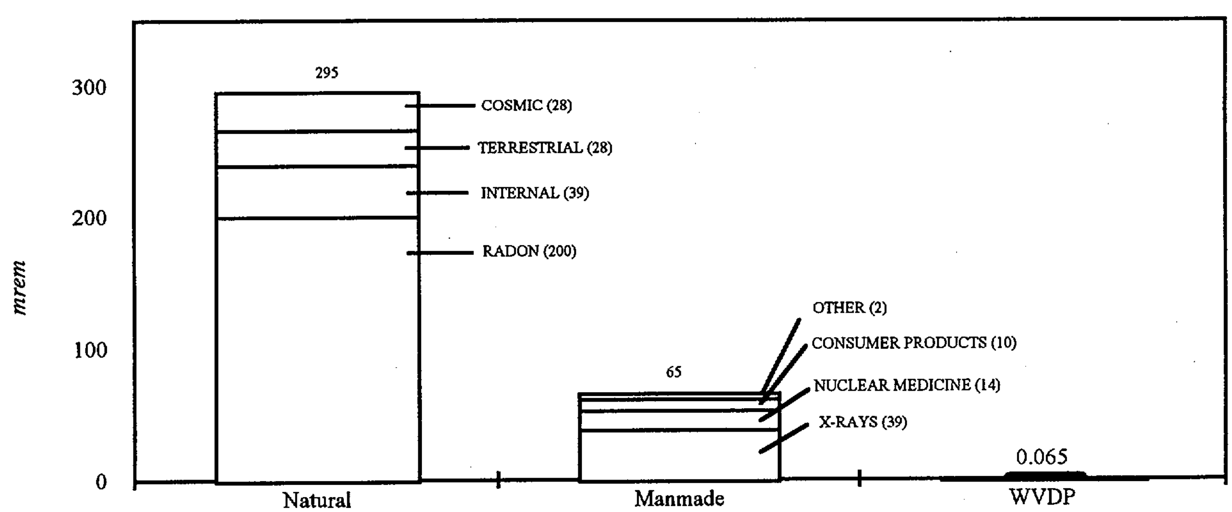


Figure 4-1. Comparison of Annual Background Radiation Dose to the Dose from 1998 WVDP Effluents

or cesium-137 are distributed uniformly throughout the body. Therefore, depending on the radionuclide, some organs may receive quite different doses. Moreover, at the same dose levels, certain organs (such as the breast) are more prone to developing a fatal cancer than other organs (such as the thyroid).

Because of the uncertainty and difficulty in measuring the incidence of increased cancer resulting from exposure to ionizing radiation, to be conservative, a linear model is used to predict health risk from low levels of radiation. This model assumes that there is a risk associated with all dose levels even though the body may effectively repair damage incurred from low levels of alpha, beta, and gamma radiations.

Exposure Pathways

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.

An exposure pathway consists of a source of contamination or radiation that is transported by environmental media to a receptor where exposure to contaminants may occur. For example, a member of the public could be exposed to low levels of radioactive particulates carried by prevailing winds.

The potential pathways of exposure from Project emissions are inhalation of gases and particulates, ingestion of local food products, ingestion of fish, beef, and deer tissues, and exposure to external penetrating radiations emanating from contaminated materials. The drinking water pathway was excluded from calculations of potential maximum dose to individuals because surveys revealed that local residents do not use water from Cattaraugus Creek as drinking water. Table 4-1 *(facing page)* summarizes the potential exposure pathways for the local off-site population.

Land Use Survey

Periodic surveys of local residents provide information about local family sizes, sources of food, and gardening practices. Information from the most recent survey, conducted in 1996, was used to confirm the locations of the nearest residences and other population parameters. These parameters are required for computer models that are used for the annual dose assessments. (See the discussion of Dose Assessment Methodology [p.4-6] for more information on the computer model used.)

1998 Deer Management Program

In 1997 NYSDEC biologists assisted the Project in collecting four on-site deer in order to obtain tissue samples for analysis. The data were used to determine whether radioactivity levels in on-site deer were sufficiently low to allow the animals to be moved from the Project premises to the WNYNSC. As described in the Deer Management Program Plan (West Valley Nuclear Services Co., Inc. October 27, 1997), the deer drives were necessary because on-site sources of food could not support the large number of deer.

The results of the analyses indicated that the average concentration of cesium-137 in venison samples collected from the north plateau was approximately thirty times higher than average concentrations in venison collected from control locations more than sixteen kilometers from the Project. As the element cesium has a biological half-life in deer of less than thirty days, once the deer were removed from the north plateau during the deer drives, which took place January 8 and 9, 1998, the cesium-137 in their bodies be-

Table 4-1
Potential Local Off-Site Exposure Pathways Under Existing WVDP Conditions

Exposure Pathway and Transporting Medium	Reason for Inclusion/Exclusion
Inhalation: gases and particulates in air (included)	Off-site transport of contaminants from WVDP stacks or resuspended particulates from soils
Ingestion: cultivated crops (included)	Local agricultural products irrigated with contaminated ground- or surface water; foliar deposition and uptake of airborne contaminants
Ingestion: surface and groundwater (excluded)	No documented use of local surface water or downgradient groundwater wells as drinking water by local residents
Ingestion: fish, beef, venison, and milk (included)	Fish exposed to contaminants in water or sediments may be consumed; beef, venison, and milk consumption following deposition of transported airborne and surface water contaminants
External exposure: radiation emanating from particulates and gases from air or surface water (included)	Transport of air particulates and gases to off-site receptors; transport of contaminants in surface water and direct exposure during stream use and swimming

gan to be naturally eliminated at a rate of at least half of the remaining amount each month. The calculated hypothetical effective dose equivalent that could have been received by an individual eating 100 pounds of venison taken from deer immediately after the deer drive was 0.76 mrem. However, the deer were not legally hunted again until mid-October 1998, at which time the estimated effective dose equivalent from exposure to the remaining cesium-137 in venison was no greater than that from consuming venison collected from control locations.

In March 1998 all but four of the deer remaining on the site after the January deer drives were baited off the WVDP premises using a commercial food source. These four deer were harvested and sampled, and the venison was analyzed for cesium-137. The average cesium-137 concentration was lower than that of venison from the deer collected in October 1997 (possibly because of the addition of commercial feed to the diet) and was statistically the same as that in background venison samples collected more than 20 kilometers (12 mi) from the site.

Radioactive Vitrification Operations

The start of radioactive vitrification operations in June/July 1996 resulted in an increase of radioactive emissions from the main plant stack. Specifically, the release rate of iodine-129 increased from a 1993-1995 average of 25 microcuries (μCi) per year to 1,200 μCi in 1996 and 7,430 μCi in 1997 as a result of the processing of the high-level waste. In 1998 the yearly release of iodine-129 fell to 4,970 μCi/yr due to the completion of Phase I of vitrification. (See Chapter 2, p. 2-24, Special Monitoring, for further discussion of iodine-129 emissions from the main plant stack.)

Dose Assessment Methodology

The potential radiation dose to the general public from activities at the WVDP is evaluated by using a two-part methodology and following the requirements in DOE Order 5400.5. The first part uses the measurements of radionuclide concentrations in liquid and air discharges from the Project. (See Appendix C and Appendix D.) These data, together with meteorological and demographic information, are input to computer models that calculate the potential or estimated doses, rather than actual radiation doses, from all credible pathways to individuals and the population.

Because of the difficulty of distinguishing the small amount of radioactivity emitted from the site from that which occurs naturally in the environment, computer codes are used to model the environmental dispersion of radionuclides emitted from on-site monitored ventilation stacks and liquid discharge points. The EDE to the maximally exposed off-site individual and the collective EDE to the population within a 50-mile radius is calculated using models that have been approved by the DOE and the EPA to demonstrate compliance with radiation standards.

Radiological dose is evaluated for all major exposure pathways, including external irradiation, inhalation, and ingestion of local food products. The dose contributions from each radionuclide and pathway combination are then summed to obtain the total dose estimates reported in Table 4-2 (*facing page*).

The second phase of the dose assessments is based on measurement of radioactivity in foodstuffs sampled in the vicinity of the WVDP and the comparison of these values with measurements of samples collected from locations well beyond the potential influence of site effluents. These measurements of environmental media show that the concentrations of radioactivity are small and usually are near the analytical detection limits, thereby providing additional assurance that operations at the WVDP are not adversely affecting the public.

If any of the near-site food samples contain radionuclide concentrations that are statistically higher than the concentrations in control samples, separate dose calculations are performed. However, these calculated doses are not added to the estimates that are based on predictive computer modeling (Table 4-2 [*facing page*]) because the models already include contributions from all environmental pathways.

Comparison of Near-site and Background Environmental Media Concentrations. Near-site and control (background) samples of fish, milk, beef, venison, and local produce were collected and analyzed for various radionuclides, including tritium, cobalt-60, strontium-90, iodine-129, and cesium-137. The measured radionuclide concentrations reported in Appendix F, Tables F-1 through F-4 (pp.F-3 through F-8) are the basis for comparing near-site and background concentrations.

If differences are found between near-site and background sample concentrations, the amount by which the near-site sample concentration ex-

Table 4-2

Summary of Annual Effective Dose Equivalents to an Individual and Population from WVDP Releases in 1998

Exposure Pathways	Annual Effective Dose Equivalent	
	Maximally Exposed Off-Site Individual [1] *mrem (mSv)*	*Collective Effective Dose Equivalent* [2] *person-rem (person-Sv)*
Airborne Releases [3]	3.4E-02 (3.4E-04)	2.6E-01 (2.6E-03)
% EPA standard (10 mrem)	0.34%	*NA*
Waterborne Releases [4]		
Effluents only	8.1E-03 (8.1E-05)	7.7E-03 (7.7E-05)
Effluents plus north plateau drainage	3.1E-02 (3.1E-04)	6.7E-02 (6.7E-04)
Total from all Pathways	6.5E-02 (6.5E-04)	3.3E-01 (3.3E-03)
% DOE standard (100 mrem) — air and water combined	0.065%	
% natural background (295 mrem; 380,000 person-rem) — air and water combined	0.022%	0.00009%

Exponents are expressed as "E" in this report: a value of 1.2 x 10^{-4} in scientific notation is reported as 1.2E-04 in the text and tables.

NA — Not applicable. Numerical regulatory standards are not set for the collective EDE to the population.

[1] *Maximum exposure to air discharges occurs at a residence 1.8 kilometers northwest of the main plant.*

[2] *Population of 1.3 million within 80 kilometers of the site.*

[3] *From atmospheric release point sources. Calculated using CAP88-PC for individual and population.*

[4] *Calculated using methodology described in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990).*

ceeded background is used to calculate a potential maximum individual dose for comparison with dose limits and the dose from background alone. If no differences in concentrations are found, then no further assessment is conducted.

The maximum potential dose to nearby residents from the consumption of foods with radionuclide concentrations above background is calculated by multiplying the excess concentrations by the maximum adult annual consumption rate for each type of food and the unit dose conversion factor for ingestion of the measured radionuclide. The consumption rates are based on site-specific data and recommendations in NRC Regulatory Guide 1.109 for terrestrial food chain dose assessments (U.S. Nuclear Regulatory Commission October 1977). The internal dose conversion factors were obtained from Internal Dose Conversion Factors for Calculation of Dose to the Public (U.S. Department of Energy July 1988).

Fish. Samples of fish were collected from Cattaraugus Creek from May 1998 through November 1998. Twenty fish were collected both at background locations upstream of the site and at locations downstream of the site above the Springville dam. Ten fish were collected at points downstream of the site below the dam.

Edible portions of all fish samples were analyzed for strontium-90 and cesium-137, and the values were compared to background values. (See Table F-4 [pp.F-6 through F-8].) Average values for cesium-137 were either below detection limits or not statistically different from control concentrations. Strontium-90 concentrations in some individual fish collected downstream of the site, above the Springville dam, were higher than control sample concentrations. The calculated maximum dose to an individual from consuming 21 kilograms (46 lbs) of near-site fish was 0.008 mrem (0.00008 mSv). This annual dose is roughly equivalent to the dose received every fifteen minutes from natural background radiation.

Milk. Milk samples were collected from various nearby dairy farms throughout 1998. Control samples were collected from farms 25 to 30 kilometers (15-20 mi) to the south and north of the WVDP. Milk samples were analyzed for tritium, strontium-90, iodine-129, cesium-137, and potassium-40. (See Table F-1 [p.F-3].) Ten near-site milk samples were collected and compared with eight background samples. Average values for tritium, iodine-129, and cesium-137 were either below detection limits or not statistically different from control concentrations.

The average strontium-90 concentration in milk at a near-site sample location was above the average background concentration. The hypothetical maximum dose to an individual from consuming 310 liters (82 gal) of near-site milk was 0.22 mrem (0.0022 mSv). This annual dose is roughly equivalent to the dose received every seven hours from natural background radiation.

Beef. Near-site and control samples of locally raised beef were collected in 1998. These samples were analyzed for tritium, strontium-90, and cesium-137. Two samples of beef muscle tissue were collected from background locations and two from near-site locations.

Individual concentrations of tritium and cesium-137 in near-site samples were either below detection limits or not statistically different from concentrations at control locations. (See Table F-2 [p.F-4].) The strontium-90 concentration in one near-site beef sample was higher than the control concentration. The hypothetical maximum dose to an individual from consuming 110 kilograms (243 lbs) of beef from this location was 0.022 mrem (0.00022 mSv). This annual dose is roughly equivalent to the dose received every forty minutes from natural background radiation.

Venison. Meat samples from three near-site and three control deer were collected in 1998. (See Table F-2 [p.F-4].) These samples were measured for tritium, strontium-90, cesium-137, and other gamma-emitting radionuclides. Individual concentrations of tritium and strontium-90 in near-site venison samples were either below detection limits or not statistically different than concentrations at control locations. One near-site venison sample contained cesium-137 concentrations higher than the control sample concentrations. The calculated maximum dose to an individual from consuming 45 kilograms (100 lbs) of near-site venison was 0.20 mrem (0.0020 mSv). This annual dose is roughly equivalent to the dose received every six hours from natural background radiation.

Produce (corn, beans, and apples). Near-site and background samples of corn, beans, and apples were collected during 1998 and analyzed for tritium, cobalt-60, strontium-90, potassium-40, and cesium-137. (See Appendix F, Table F-3 [p.F-5].)

Individual concentrations of tritium, cobalt-60, and cesium-137 in near-site produce samples were either below detection limits or not statistically different from concentrations at control locations. Strontium-90 concentrations in annual near-site corn samples were above the control concentrations. The hypothetical maximum dose to an individual from consuming 52 kilograms (115 lbs) of near-site corn was 0.013 mrem (0.00013 mSv). This annual dose is roughly equivalent to the dose received every twenty-five minutes from natural background radiation.

See Appendix B (pp.B-37 through B-40) for the locations from which background biological samples are collected.

Predicted Dose from Airborne Emissions

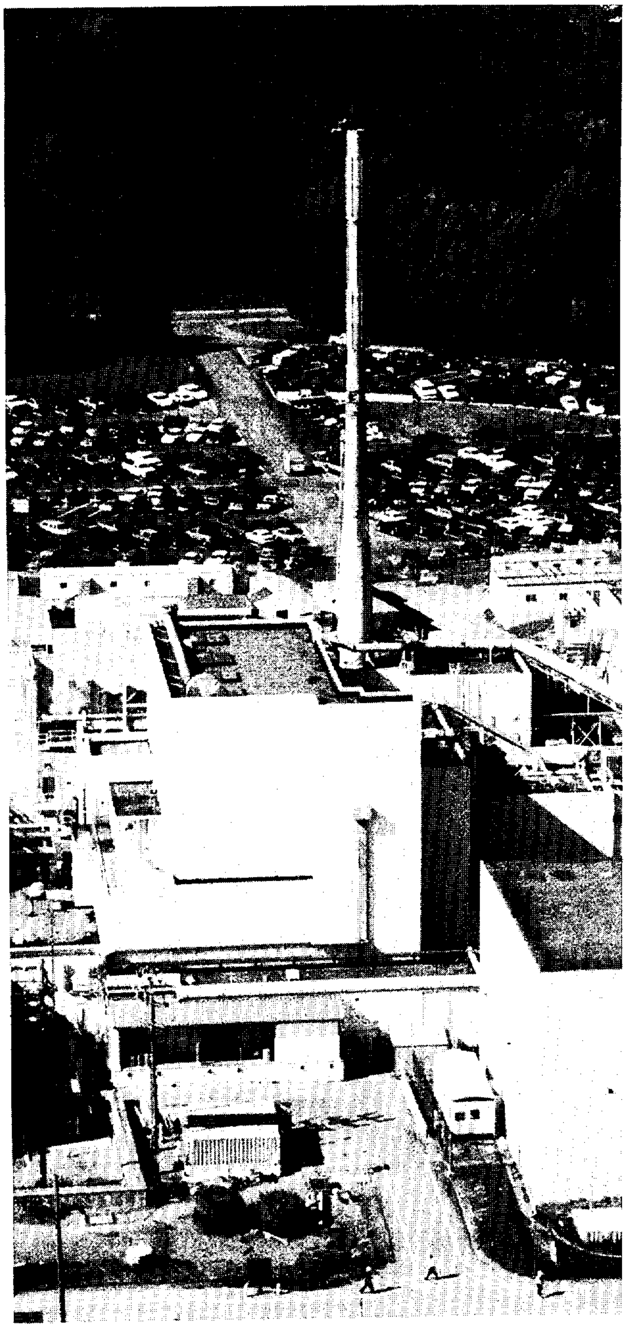
Airborne emissions of radionuclides are regulated by the EPA under the Clean Air Act and its implementing regulations. DOE facilities are subject to 40 CFR 61, Subpart H, National Emissions Standards for Hazardous Air Pollutants (NESHAP). The applicable standard for radionuclides is a maximum of 10 mrem (0.1 mSv) EDE to any member of the public in any year.

Releases of airborne radioactive materials from nominal 10-meter stacks and from the main 60-meter stack are modeled using the EPA-approved CAP88-PC computer code (U.S. Environmental Protection Agency March 1992). This air dispersion code estimates effective dose equivalents for the ingestion, inhalation, air immersion, and ground surface pathways. Site-specific data for radionuclide release rates in curies per year, wind data, and the current local population distribution are used as input parameters. Resulting output from the CAP88-PC code is then used to determine the total EDE to a maximally exposed individual and the collective dose to the population within an 80-kilometer (50-mi) radius of the WVDP.

As reported in Chapter 2, Environmental Monitoring, the main 60-meter stack and several shorter stacks were monitored for radioactive air emissions during 1998. The activity that was released to the atmosphere from these emission points is listed in Tables D-1 through D-11 and D-15. (See Appendix D, pp.D-3 through D-12 and D-16.) Appropriate information from these tables was used as input to the CAP88-PC code.

Wind data collected from the on-site meteorological tower during 1998 were used as input to the CAP88-PC code. Data collected at the 60-meter and 10-meter heights were used in combination with the main plant stack and ground-level effluent release data, respectively.

Maximum Dose to an Off-site Individual. Based on the airborne radioactivity released from the permitted point sources at the site during 1998, it was estimated that a person living in the vicinity of the WVDP could have received a



The Main Plant Ventilation Stack at the WVDP

total EDE of 0.034 mrem (0.00034 mSv). The computer model has established that this maximally exposed off-site individual is located 1.8 kilometers northwest of the site and is assumed to eat only locally produced foods. Approximately 99% of the dose is from iodine-129, emitted from the main stack.

The maximum total EDE of 0.034 mrem (0.00034 mSv) from the permitted stacks and vents is far below levels that could be measured at the exposed individual's residence. This dose is comparable to about one and one-half hours of natural background radiation received by an average member of the U.S. population and is well below the 10 mrem (0.1 mSv) NESHAP limit promulgated by the EPA and required by DOE Order 5400.5.

Collective Population Dose. The CAP88-PC version of AIRDOS-EPA was used to estimate the collective EDE to the population. The population data that were used for the 1998 assessment are from the most recent census projection, which was for 1995. In this five-year projection, 1.3 million people were estimated to reside within 80 kilometers (50 mi) of the WVDP. This population received an estimated 0.26 person-rem (0.0026 person-Sv) total EDE from radioactive airborne effluents released from the permitted WVDP point sources during 1998. The resulting average EDE per individual was 0.0002 mrem (0.000002 mSv).

Predicted Dose from Waterborne Releases

Currently there are no EPA standards establishing limits on the radiation dose to members of the public from liquid effluents except as applied in 40 CFR 141 and 40 CFR 143, Drinking Water Guidelines (U.S. Environmental Protection Agency 1984a; 1984b). The potable-water wells sampled for radionuclides are upgradient of the WVDP and therefore are not a potential source of exposure to radiation from Project activities. Since Cattaraugus Creek is not used as a drinking water supply, a comparison of the predicted concentrations and doses to the EPA drinking water limits established in 40 CFR 141 and 40 CFR 143 is not truly appropriate (although the values in creek samples are well below the EPA drinking water limits). The estimated radiation dose was compared to the applicable guidelines provided in DOE Order 5400.5. The EDE to the maximally exposed off-site individual and the collective EDE to the population due to routine waterborne releases and natural drainage are calculated using dose conversion factors as reported in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990).

Since the effluents eventually reach Cattaraugus Creek, which is not used directly as a source of drinking water, the most important individual exposure pathway is the consumption of fish by local sportsmen. It is assumed that a person may consume annually as much as 21 kilograms (46 lbs) of fish caught in the creek. Exposure to external radiation from shoreline or water contamination also is included in the model for estimating radiation dose. Population dose estimates assumed that radionuclides were further diluted in Lake Erie before reaching municipal drinking water supplies. The computer code LADTAP II (Simpson and McGill 1980) was used to calculate the dose conversion factors for routine waterborne releases and dispersion of these effluents. Input data included site-specific stream flow and dilution, drinking water usage, and stream usage factors. A detailed description of LADTAP II is given in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990).

Six planned batch releases of liquid radioactive effluents from lagoon 3 occurred during 1998. The radioactivity that was discharged in these effluents is listed in Appendix C, Table C-1 (p. C-3) and was used with the dose conversion factors to calculate the EDE to the maximally exposed off-site individual and the collective EDE to the population.

In addition to the batch releases from lagoon 3 (WNSP001), effluents from the sewage treatment facility (WNSP007) and the french drain (WNSP008) are routinely released. The activities measured from these release points were included in the EDE calculations. The measured radioactivity concentrations from the sewage treatment facility and french drain are presented in Appendix C, Tables C-5 and C-6 (p.C-7).

In addition to the above discharges there are two natural drainage channels originating on the Project premises with measurable amounts of radioactivity. These are drainages from the northeast swamp (WNSWAMP) and north swamp (WNSW74A). The measured radioactivity from these points is reported in Tables C-7 and C-8 (pp.C-8 and C-9). These release points are included in the EDE calculations for the maximally exposed off-site individual and the collective population.

Maximum Dose to an Off-site Individual. Based on the radioactivity in liquid effluents released from the WVDP (lagoon 3, sewage treatment plant, and french drain) during 1998, an off-site individual could have received a maximum EDE of 0.0081 mrem (0.000081 mSv). Approximately 73% of this dose would be from cesium-137 and 12% from strontium-90. This dose of 0.0081 mrem (0.000081 mSv) is negligible in comparison to the 295 mrem (2.95 mSv) that an average member of the U.S. population receives in one year from natural background radiation.

The maximum off-site individual EDE due to drainage from the north plateau (north swamp and northeast swamp) is 0.022 mrem (0.00022 mSv). (See Appendix C, Tables C-7 and C-8 [pp.C-8 and C-9].) The combined EDE to the maximally exposed individual from liquid effluents and drainage is 0.031 mrem (0.00031 mSv). This annual dose is negligible in comparison to the 295 mrem (2.95 mSv) that an average member of the U.S. population receives in one year from natural background radiation.

Collective Dose to the Population. As a result of radioactivity released in liquid effluents from the WVDP (lagoon 3, sewage treat-

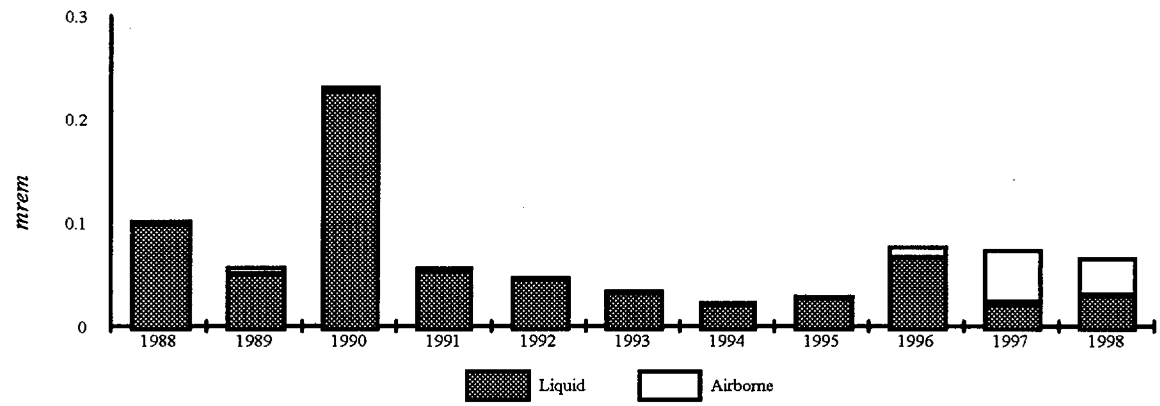


Figure 4-2. Effective Dose Equivalent from Liquid and Airborne Effluents to a Maximally Exposed Individual Residing near the WVDP

ment plant, and french drain) during 1998, the population living within 80 kilometers (50 mi) of the site received a collective EDE of 0.0077 person-rem (0.000077 person-Sv). The collective dose to the population from the north plateau drainage is 0.06 person-rem (0.0006 person-Sv).

This estimate is based on a population of 1.3 million living within the 80-kilometer radius. The resulting average EDE from lagoon 3, the sewage treatment plant, the french drain, and north plateau drainage (north swamp and northeast swamp) per individual is 5.2E-05 mrem (5.2E-07 mSv). This dose of 0.000052 mrem (0.00000052 mSv) is an inconsequential addition to the dose that an average person receives in one year from natural background radiation.

Predicted Dose from All Pathways

The potential dose to the public from both airborne and liquid effluents released from the Project during 1998 is the sum of the individual dose contributions. The calculated maximum EDE from all pathways to a nearby resident was 0.065 mrem (0.00065 mSv). This dose is approximately 0.07% of the 100 mrem (1 mSv) annual limit in DOE Order 5400.5.

The total collective EDE to the population within 80 kilometers (50 mi) of the site was 0.33 person-rem (0.0033 person-Sv), with an average EDE of 0.00025 mrem (0.0000025 mSv) per individual.

Table 4-2 (p. 4-7) summarizes the dose contributions from all pathways and compares the individual doses to the applicable standards.

Figure 4-2 (*above*) shows the calculated annual dose to the hypothetical maximally exposed individual over the last eleven years. The estimated dose for 1998 is slightly lower than the annual dose reported for 1997. The slight decrease in dose fraction from air emissions in 1998 is attributed to the decrease in iodine-129 emissions. The increased dose from the liquid pathway was the result of a 50% increase in strontium-90 released from the north plateau drainage. This increase is a result of the migration of the gross beta plume. (See Special Groundwater Monitoring in Chapter 3, p.3-15.)

Figure 4-3 (*facing page*) shows the collective dose to the population over the last eleven years. The upward trend, primarily from an increase in iodine-129 emissions from the main plant stack after the start of radioactive vitrification operations in June/July 1996, was not continued in 1998. These data confirm the continued inconsequential addition to the natural background radiation dose that the individuals and population around the WVDP receive from Project activities.

Unplanned Releases

There were no off-site unplanned releases (as defined by DOE Order 5400.1) of radioactive materials in air or liquid effluent identified or reported in 1998.

Risk Assessment

Estimates of cancer risk from ionizing radiation have been presented by the International Commission on Radiological Protection (1990), the National Council on Radiation Protection and Measurement (1987), and the National Research Council Committee on Biological Effects of Ionizing Radiation (1990). These reports estimate that the probability of fatal cancer induction to the public, averaged over all ages, ranges from 0.0001 to 0.0005 cancer fatalities/rem. The most recent risk coefficient of 0.0005 (International Commission on Radiological Protection 1991) was used to estimate risk to a maximally exposed off-site individual. The resulting risk to this hypothetical individual from airborne and waterborne releases was a 0.000000033 probability of a cancer fatality (1 chance in 31 million). This risk is well below the range of 0.000001 to 0.00001 per year considered acceptable by the International Commission on Radiological Protection Report 26 (1977) for any individual member of the public.

Summary

Predictive computer modeling of airborne and waterborne releases resulted in estimated hypothetical doses to the maximally exposed individual that were orders of magnitude below all applicable EPA standards and DOE Orders, which place limitations on the release of radioactive materials and dose to individual members of the public. The collective population dose also was assessed and found to be orders of magnitude below natural background radiation doses. Based on the dose assessment, the WVDP was found to be in compliance with all applicable effluent radiological guidelines and standards during 1998.

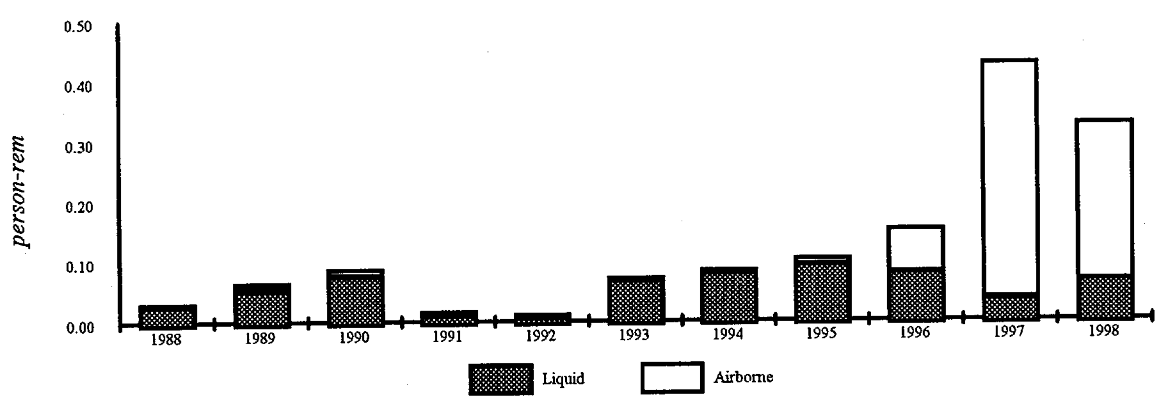


Figure 4-3. Collective Effective Dose Equivalent from Liquid and Airborne Effluents to the Population Residing within 80 Kilometers of the WVDP

CHAPTER 5
QUALITY ASSURANCE

The quality assurance (QA) program at the West Valley Demonstration Project (WVDP) provides for and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data.

Organizational Responsibilities

West Valley Nuclear Services Company (WVNS) is contractually obligated to implement a nuclear quality assurance program at the WVDP. Managers of programs, projects, and tasks are responsible for determining and documenting the applicability of quality assurance requirements to their activities and for implementing those requirements. For example, Environmental Laboratory management and staff are directly responsible for carrying out sampling and analytical activities in a manner consistent with good quality assurance practices and for following approved procedures.

Program Design

The quality assurance rule 10 CFR Part 830.120, Quality Assurance (U.S. Department of Energy [DOE] 1998), and DOE Order 414.1, Quality Assurance (U.S. Department of Energy 1998) provide the quality assurance program policies and requirements applicable to activities at the WVDP. The integrated quality assurance program applicable to environmental monitoring at the WVDP also incorporates requirements from Quality Assurance Program Requirements for Nuclear Facilities (American Society of Mechanical Engineers [ASME NQA-1] 1989) and Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (American National Standards Institute and American Society for Quality Control [ANSI/ASQC E4-1994] 1994).

The quality assurance program focuses upon assigning responsibilities and upon thorough planning, specification, control, and documentation of all aspects of an activity in order to ensure the quality of both radiological and nonradiological monitoring data. The quality assurance program includes requirements in the following areas:

√ *Responsibility*. Responsibilities involved in overseeing, managing, and conducting an activity must be clearly defined. Personnel who verify that the activity has been completed correctly must be independent of those who performed it.

√ *Planning*. An activity must be planned beforehand and the plan followed. All activities must be documented. Similarly, purchases of any equipment or items must be planned, specified precisely, and verified for correctness upon receipt.

√ *Control of design, procedures, items, and documents.* Any activity, equipment, or construction must be clearly described or defined and tested, and changes in the design must be tested and documented. Procedures must clearly state how activities will be conducted. Only approved procedures may be used. Equipment or particular items affecting the quality of environmental data must be identified, inspected, calibrated, and tested before use. Calibration status must be clearly indicated. Items that do not conform to requirements must be identified and separated from other items and the nonconformity documented.

√ *Documentation.* Records of all activities must be kept in order to verify what was done and by whom. Records must be clearly traceable to an item or activity.

√ *Corrective action.* If a problem should arise the cause of the problem must be identified, a corrective action planned, responsibility assigned, and the problem remedied.

√ *Audits.* Scheduled audits and assessments must be conducted to verify compliance with all aspects of the quality assurance program and determine its effectiveness.

Subcontractor laboratories providing analytical services for the environmental monitoring program are contractually required to maintain a quality assurance program consistent with WVDP requirements.

Procedures

Those activities that affect the quality of environmental monitoring data are conducted according to approved procedures that clearly describe how the activity should be performed and what precautions are to be taken in connection with the activity. Any person performing an activity that could affect the quality of environmental monitoring data is trained in that procedure and must demonstrate proficiency. New procedures are developed each time an activity is added to the monitoring program. Procedures are reviewed periodically and updated when necessary. Documents are controlled so that only current procedures are used.

Quality Control in the Field

Quality control (QC), an integral component of environmental monitoring quality assurance, is a way of verifying that samples are being collected and analyzed according to established quality assurance procedures. Quality control ensures that sample collection and analysis are consistent and repeatable and is a means of tracking down possible sources of error. For example, at the WVDP sample locations are clearly marked in the field to ensure that future samples are collected in the same locations; collection equipment in place in the field is routinely inspected, calibrated, and maintained; and automated sampling stations are kept locked to prevent tampering and to ensure sample integrity.

Samples are collected into certified pre-cleaned containers of an appropriate material and capacity and are labeled immediately with the pertinent information. Date, time, person doing the collecting, and special field sampling conditions are recorded and kept as part of the record for that sample.

Chain-of-custody protocols are followed to ensure that samples are controlled and tracked for traceability. If necessary, samples are preserved as soon as possible after collection.

In order to assess quality problems that might be introduced by the sampling process, duplicate field samples, field blank samples, and trip blank samples are collected. Background samples are collected for baseline environmental information.

Field Duplicates. Field duplicates are samples collected simultaneously for the same analyte at one location, after which they are treated as separate samples. If the sampling matrix is homogenous, field duplicates provide a means of assessing the precision of collection methods. Field duplicates are collected at a minimum rate of one per twenty analyses.

Field Blanks. A field blank is a sample of laboratory-distilled water that is put into a sample container at a field collection site and is processed from that point as a routine sample. Field blanks are used to detect contamination introduced by the sampling procedure. They are processed at a minimum rate of one per twenty analyses.

If the same collection equipment is used for more than one site, a special form of field blank known as an equipment blank may be collected by pouring laboratory-distilled water through cleaned collecting equipment and into a sample container. Equipment blanks are collected to detect any cross-contamination that may be passed from one sampling location to another by the equipment. Many wells and surface water collection stations have dedicated collecting equipment that remains at that location; equipment blanks are not necessary at these locations.

Trip Blanks. Trip blanks are prepared by pouring laboratory-distilled water into sample bottles in the laboratory. The bottles are then placed into sample coolers where they remain throughout the sampling event. Trip blanks are collected in order to detect any volatile organic contamination that may be introduced from handling during collection, storage, or shipping. Trip blanks are taken only when volatile organic samples are being collected.

Environmental Background Samples. To monitor each pathway for possible radiological contamination, samples of air, water, vegetation, meat, and milk are taken from locations remote from the site for comparison with samples from near-site locations. Samples that are clearly outside site influence show ambient radiological concentrations and serve as backgrounds or "controls," another form of field quality control sample. Background samples provide baseline information to compare with information from near-site or on-site samples so that any possible influence from the site can be determined.

Quality Control in the Laboratory

More than 11,000 samples were handled as part of site monitoring in 1998. Samples for routine radiological analysis were analyzed on-site, with the rest being sent to subcontract laboratories. Off-site laboratories must maintain a level of quality control as specified in contracts with WVNS. Subcontract laboratories are required to participate in all applicable crosscheck programs and to maintain all relevant certifications.

In order to monitor the accuracy and precision of data, laboratory quality control practices specific to each analytical method are clearly described in approved references or procedures. Examples of laboratory quality control activities at the WVDP include proper training of analysts, maintaining and calibrating measuring equipment and instrumentation, and processing samples in accordance with specific methods as a means of monitoring laboratory performance.

Analytical instruments and counting systems are calibrated at specified frequencies and logs of instrument calibration and maintenance are kept. Calibration methods for each instrument are specified in procedures or in manufacturers' directions. Standards traceable to the National Institute of Standards and Technology (NIST) are used to calibrate counting and test instrumentation.

Laboratory quality control samples consist of three general types: standards (including spikes), used to assess accuracy; blanks, to assess the possibility of contamination; and duplicates, to assess precision.

Standards. Laboratory standards are materials containing known concentrations of an analyte of interest such as a pH buffer or a plutonium-239 counting standard. Standards used at the WVDP for environmental monitoring activities are either NIST-traceable or reference materials from other nationally recognized sources. At a minimum, one reference standard is analyzed for every twenty sample analyses. The results of the analyses are plotted on control charts, which specify acceptable limits. If the results lie within these limits, then analysis of actual environmental samples may proceed and the results are deemed usable.

Spikes. Another form of standard analysis is a laboratory spike. In a laboratory spike, a known amount of analyte is added to a sample or blank before the sample is analyzed. The percent recovery of the analyte indicates how much of the analyte of interest is being detected in the analysis of actual samples; hence, a spike also is an assessment of the accuracy of the method. Spike recoveries are recorded on control charts with documented acceptance limits.

Blanks. Laboratory blanks are prepared from a matrix similar to that of the sample but known to contain none of the analyte of interest. For instance, distilled water, taken through the same preparatory procedure as a sample, may serve as a laboratory blank for both radiological and chemical analyses of water samples. A positive result for an analyte in a blank indicates that something is wrong with the analysis and that corrective action should be taken. In general, one laboratory blank is processed daily or with each batch of samples for a given analyte.

A special form of laboratory blank for radiological samples is an instrument background count, which is a count taken of a planchet or vial containing no sample. The count serves three purposes: to determine if contamination is present in the counting instrument; to determine if the instrument is responding in an acceptable manner; and to determine the background correction that should be applied when calculating radiological activity in certain samples.

Environmental samples containing little or no radioactivity must be measured with very sensitive instruments. For example, gross alpha and gross beta measurements must be made with a low-background proportional counter. An instrument background count is taken before each day's counting or with each batch of twenty samples. Background counts are recorded on control charts with defined acceptance limits. An unacceptable count requires corrective action before analyses can proceed.

Duplicates. Duplicates are analyzed to assess precision in the analytical process. Laboratory duplicates are created by splitting existing samples before analysis; each split is treated as a separate sample. If the analytical process is in control, results for each split should be within documented acceptance criteria.

Crosschecks. WVNS participates in formal radiological crosscheck programs conducted by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). The DOE requires all organizations performing effluent or environmental monitoring to participate in the semiannual Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP), which is designed to test the quality of environmental measurements being reported to the DOE by its contractors. WVNS also participates in crosscheck programs from the EPA's National Exposure Research Laboratory, Environmental Sciences Division (NERL-ESD).

An informal crosscheck, which compared results from WVDP environmental thermoluminescent dosimeters (TLDs) to results from NRC TLDs placed in the same locations, was discontinued in 1998. Another informal crosscheck program uses results from samples of air filters, water, milk, fish, vegetation, and sediments that have been split or separately collected and sent to NYSDOH for independent measurement. (Colocated samples are listed in Appendix B of this report.) Results from NYSDOH are compared with WVDP results as an independent verification of environmental monitoring program data.

Crosscheck samples for radiological analyses are analyzed by both the Environmental Laboratory on-site and by the subcontract laboratory. Results from radiological crosschecks are summarized in Appendix J, Tables J-1 through J-3 (pp.J-3 through J-8). A total of 162 radiological crosscheck analyses were performed by or for the WVDP and reported in 1998. One hundred fifty-five results (95.7%) were within control limits. Forty-one of the results were produced by the on-site Environmental Laboratory; 97.6% were within control limits.

Results of nonradiological EPA crosschecks are summarized in Appendix J, Table J-4 (p.J-9). Twenty-one parameters were analyzed by Ecology and Environment, Inc. and two by WVDP. Of the twenty-three results, seventeen (73.9%) were within control limits. Out-of-control results were followed up through formal corrective action processes.

By contract with WVNS, subcontract laboratories are required to perform satisfactorily on crosschecks, defined as 80% of results falling within control limits. Crosscheck results that fall outside control limits are addressed by formal corrective actions in order to determine any conditions that could adversely affect sample data and to ensure that actual sample results are reliable.

Personnel Training

Anyone performing environmental monitoring program activities is trained in the appropriate procedures and qualified accordingly before carrying out the activity as part of the site environmental monitoring program.

Record Keeping

Control of records is an integral part of the environmental monitoring program. Field data sheets, chain-of-custody forms, requests for analysis, sample-shipping documents, sample logs, bench logs, laboratory data sheets, equipment maintenance logs, calibration logs, training records, crosscheck performance records, data packages, and weather measurements, in addition to other records, are maintained as documentation of the environmental monitoring program. All records pertaining to the program are routinely reviewed and securely stored.

A Laboratory Information Management System (LIMS) is used to log samples, print labels, store and process data, track quality control samples, track samples, produce sampling and analytical worklists, and generate reports. Subcontract laboratories, where possible, provide data in electronic form for direct entry into the LIMS.

Chain-of-Custody Procedures

Chain-of-custody records begin with sample collection. Samples brought in from the field are transferred under signature from the sampler to the sample custodian and are logged at the sample receiving station, after which they are stored in a sample lockup before analysis or shipping.

Samples sent off-site for analysis are accompanied by an additional chain-of-custody/analytical request form. Subcontract laboratories are required by contract to maintain internal chain-of-custody records and to store the samples under secure conditions.

Audits and Appraisals

In 1998 the WVNS Quality Assurance and Environmental Affairs departments provided oversight by conducting audits, assessments, surveillances, and inspections. The areas examined were the environmental monitoring program, the State Pollutant Discharge Elimination System (SPDES) and drinking water monitoring programs, sampling on the north plateau, the activities and quality assurance programs of contract laboratories that analyze samples for the WVDP, the handling, shipping, and releasing of samples, the activities and quality assurance program of the on-site Environmental Laboratory, and the calibration of the meteorological tower.

Self-Assessments

Routine Self-assessments. Routine self-assessments of the environmental monitoring program were conducted in 1998. The primary topics addressed by the assessments were field sample documentation and collection, equipment maintenance and calibration, sample handling and preservation, sample storage and shipping, data management, and data reporting.

No findings were noted; one observation was reported. This deficiency was addressed through formal corrective action procedures. In addition, several comments regarding possible program improvements were noted and commendable practices were identified. Nothing was found during the course of these routine self-assessments that would compromise the data in this report or in the program in general.

Year-2000 Compliance Assessment. A special assessment was conducted in 1998 to determine if environmental monitoring program computer hardware and software were capable of handling data correctly when the year 2000 arrives. Several systems were examined, including the meteorological system, water samplers, air samplers, radiological instruments, emergency response equipment, laboratory and field instruments, laboratory and field support equipment, and data management and reporting systems.

Corrective actions were identified, and a schedule for completing the corrective actions, which includes purchasing new equipment and software, was developed so that all systems will be year-2000 compliant in 1999.

Lessons Learned Program

Information from audits, appraisals, and self-assessments that may be important to WVDP organizations other than the originating department may be shared through the WVDP Lessons Learned Program. The WVDP maintains this system in order to identify, document, disseminate, and use this information to improve the safety, efficiency, and effectiveness of all WVNS operations.

Data Management and Data Validation

Information on environmental monitoring program samples is maintained and tracked in the LIMS and includes date and time of collection, chain-of-custody transfer, shipping information, analytical results, and final validation status.

All software used to generate data is subjected to verification and validation before use. All analytical data produced in the Environmental Laboratory at the bench level are reviewed and signed off by a qualified person other than the one who performed the analysis. A similar in-house review is contractually required from subcontractor laboratories.

Analytical data from both on- and off-site laboratories are formally validated by the data validation group. As part of the validation procedure, quality control samples analyzed in conjunction with a batch of samples are checked for acceptability. After validation is complete and transcription between hard copy and the LIMS is verified, the sample result is formally approved and released for use in reports.

Data Assessment and Reporting

Radiological and nonradiological data from the environmental monitoring program are evaluated in order to assess the effect, if any, of the site on the environment and the public. Data from each sampling location are compared to applicable standards or background measurements.

- Radiological concentrations in liquid effluent releases or air emissions are compared to DOE derived concentration guides (DCGs) for release of water or air to an unrestricted environment. DCGs for specific radionuclides are listed in Table K-1 (p.K-3).

- Calculated doses from air emissions are compared to National Emissions Standards for Hazardous Air Pollutants (NESHAP) limits.

- Nonradiological releases from liquid effluents covered by the SPDES permit are compared to the limits specified in the permit (listed in Table G-1 [pp.G-3 and G-4]).

- Near-site radiological results are compared to results from background locations far from the site.

- Results from surface waters downgradient of the site are compared to results from upgradient locations.

Standard statistical methods are used to compare the data. Where possible, the underlying distribution of the data set is assessed before determining the appropriate statistical tests to be used. Once the data have been evaluated reports are prepared. Calculations summarizing the data, e.g., summing the total curies released from an effluent point, averaging the annual concentration of a radionuclide at a monitoring point, or pooling confidence intervals from a series of measurements, are made in accordance with formally approved procedures. Final data are reported as described elsewhere in this report. (See Data Reporting [p.1-4] and the section on Scientific Notation at the back of this report.)

Before each technical report is issued the document, including the data, is comprehensively reviewed by one or more persons who are knowledgeable in the necessary technical aspects of the field of work.

Summary

The multiple levels of scrutiny built into generating, validating, evaluating, and reporting data from the environmental monitoring program ensure that reliable data are reported. The quality assurance elements described in this chapter ensure that environmental monitoring data are consistent, precise, and accurate. The effectiveness of the monitoring program is evidenced by continuing favorable quality assurance assessments.

Appendix A

Maps

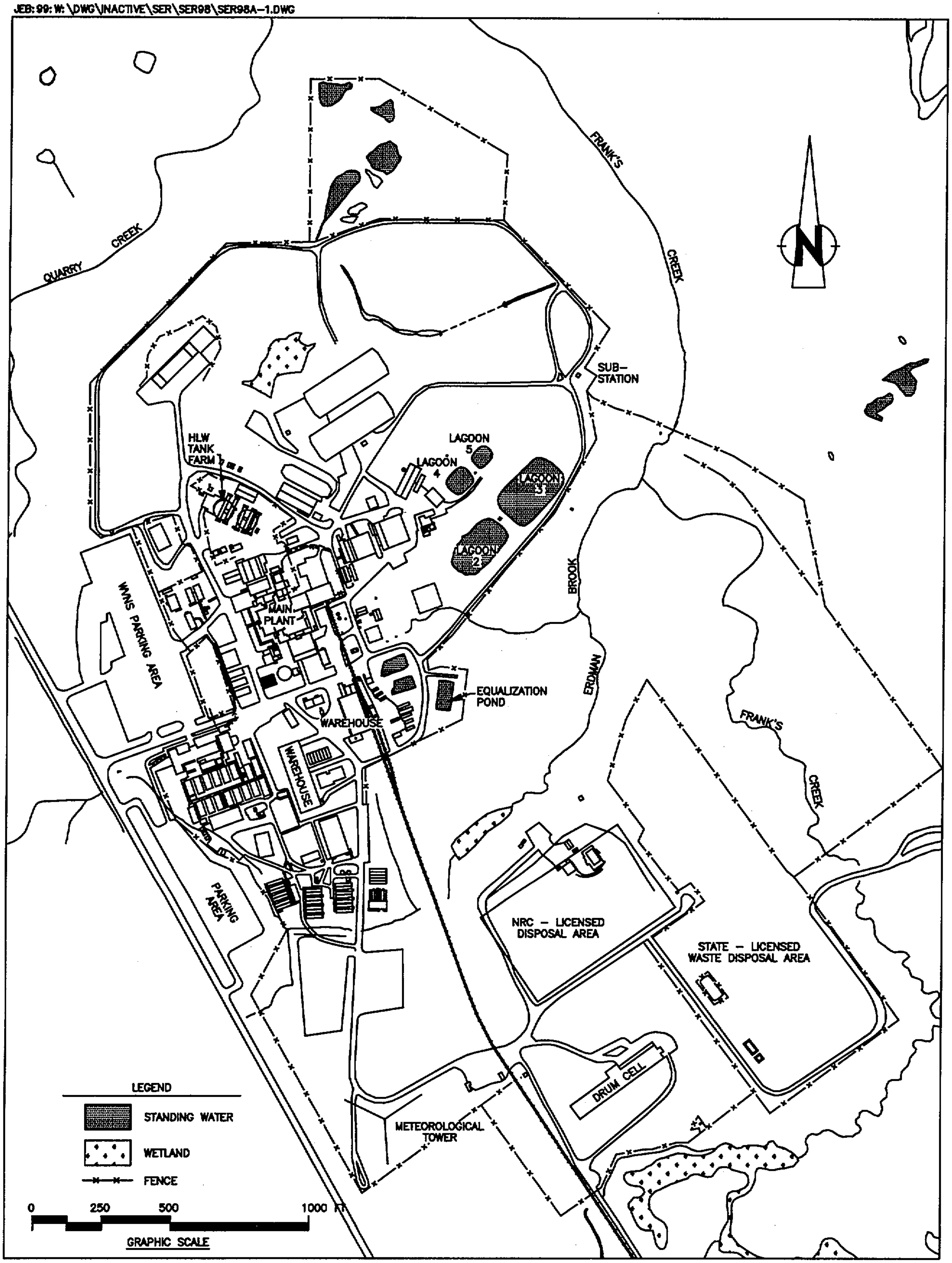


Figure A-1. Project Base Map.

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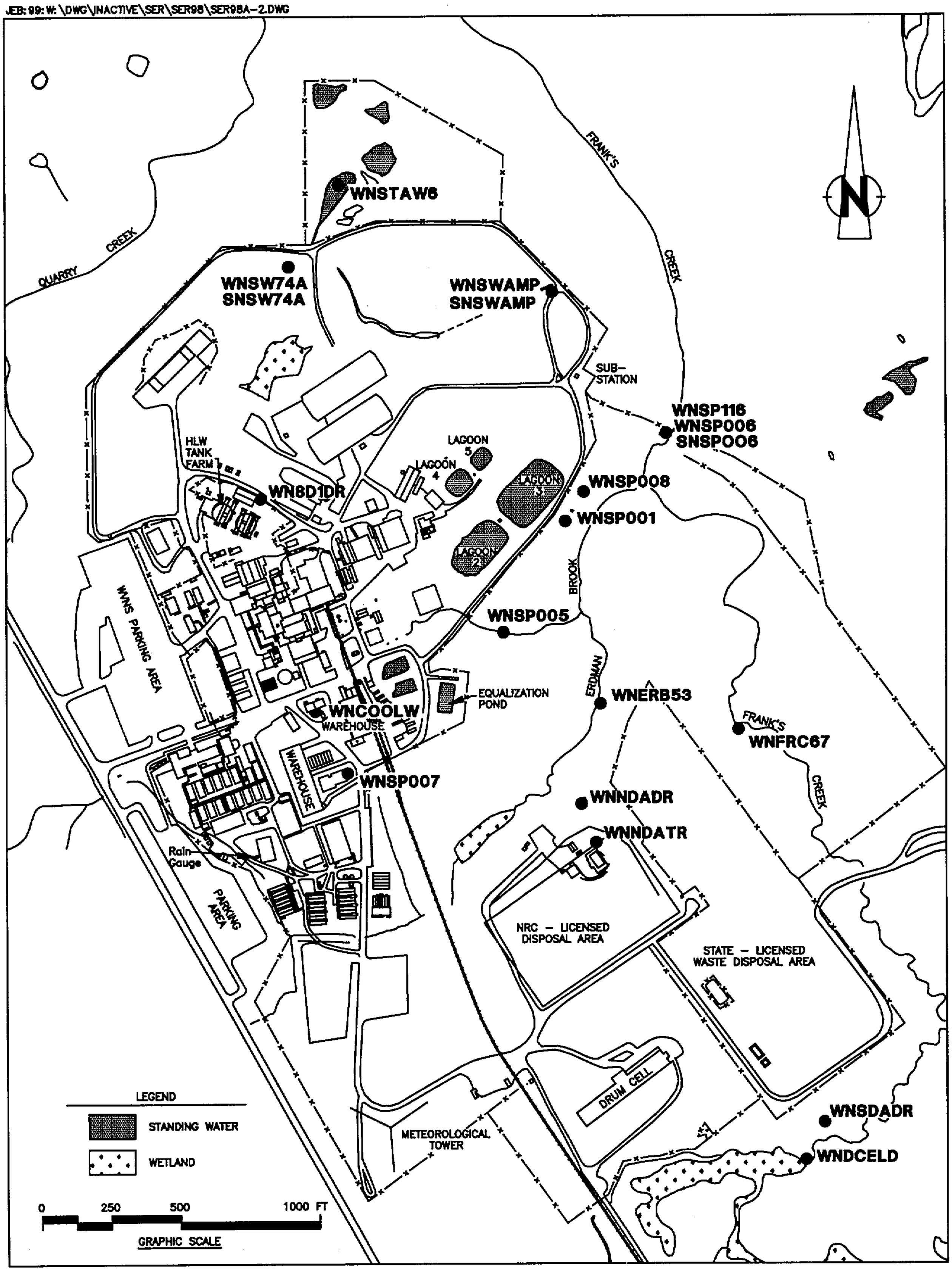

Figure A-2. On-site Surface Water and Soil/Sediment Sampling Locations.

JEB: 99: W:\DWG\INACTIVE\SER\SER98\SER98A-3.DWG

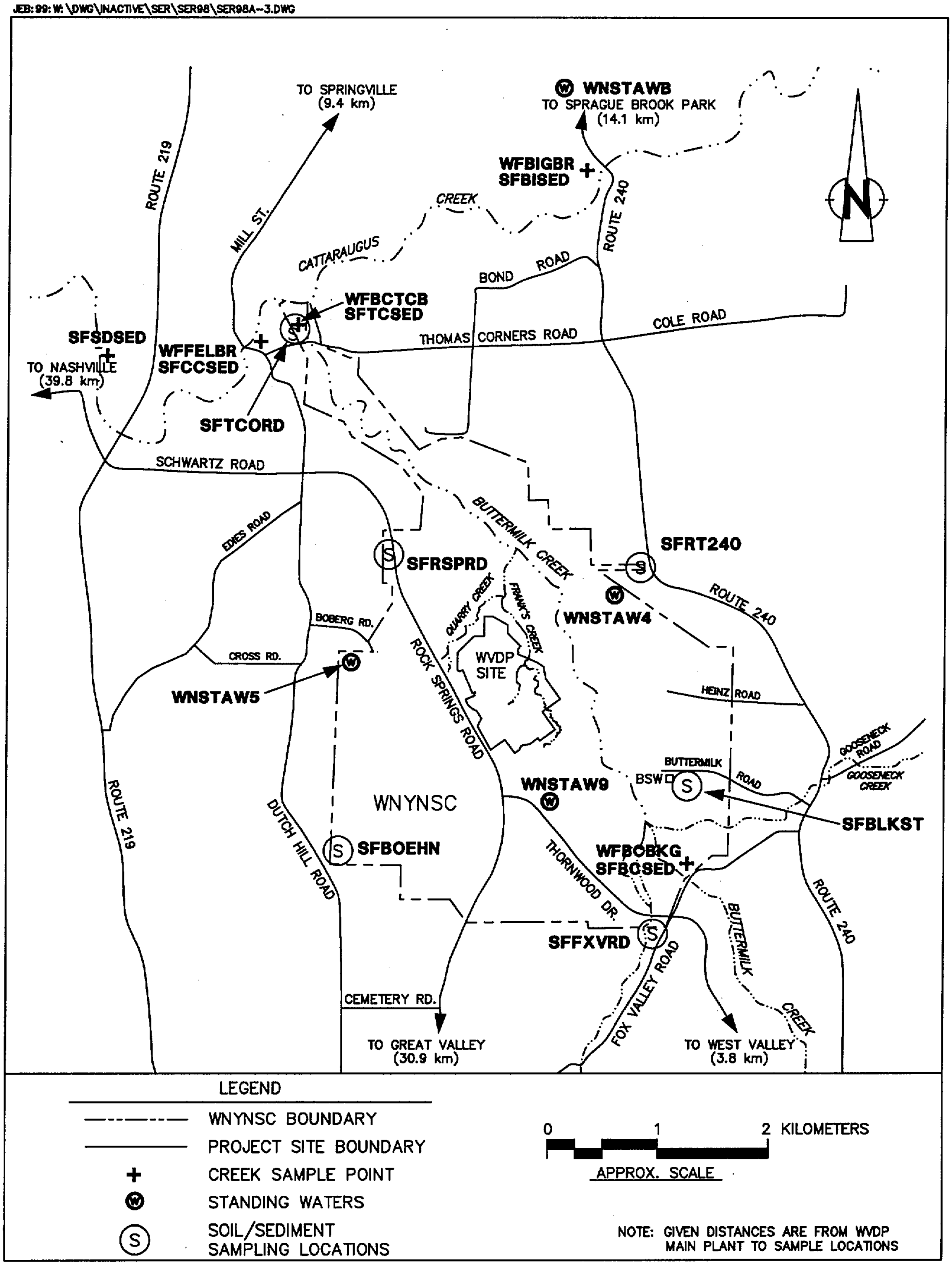

Figure A-3. Off-site Surface Water and Soil/Sediment Sampling Locations.

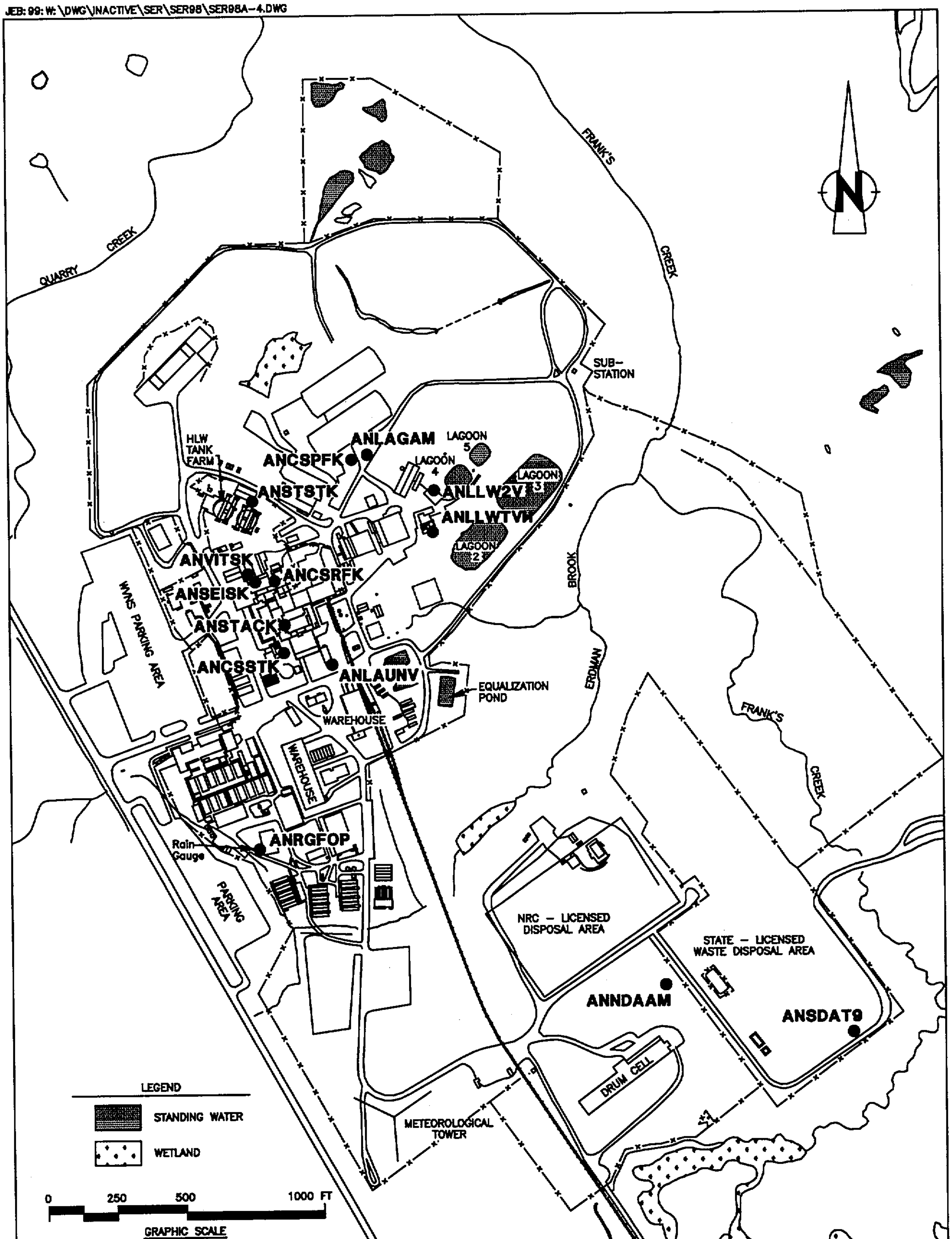

Figure A–4. On–site Air Monitoring and Sampling Points.

JEB: 99: W:\DWG\INACTIVE\SER\SER98\SER98A-5.DWG

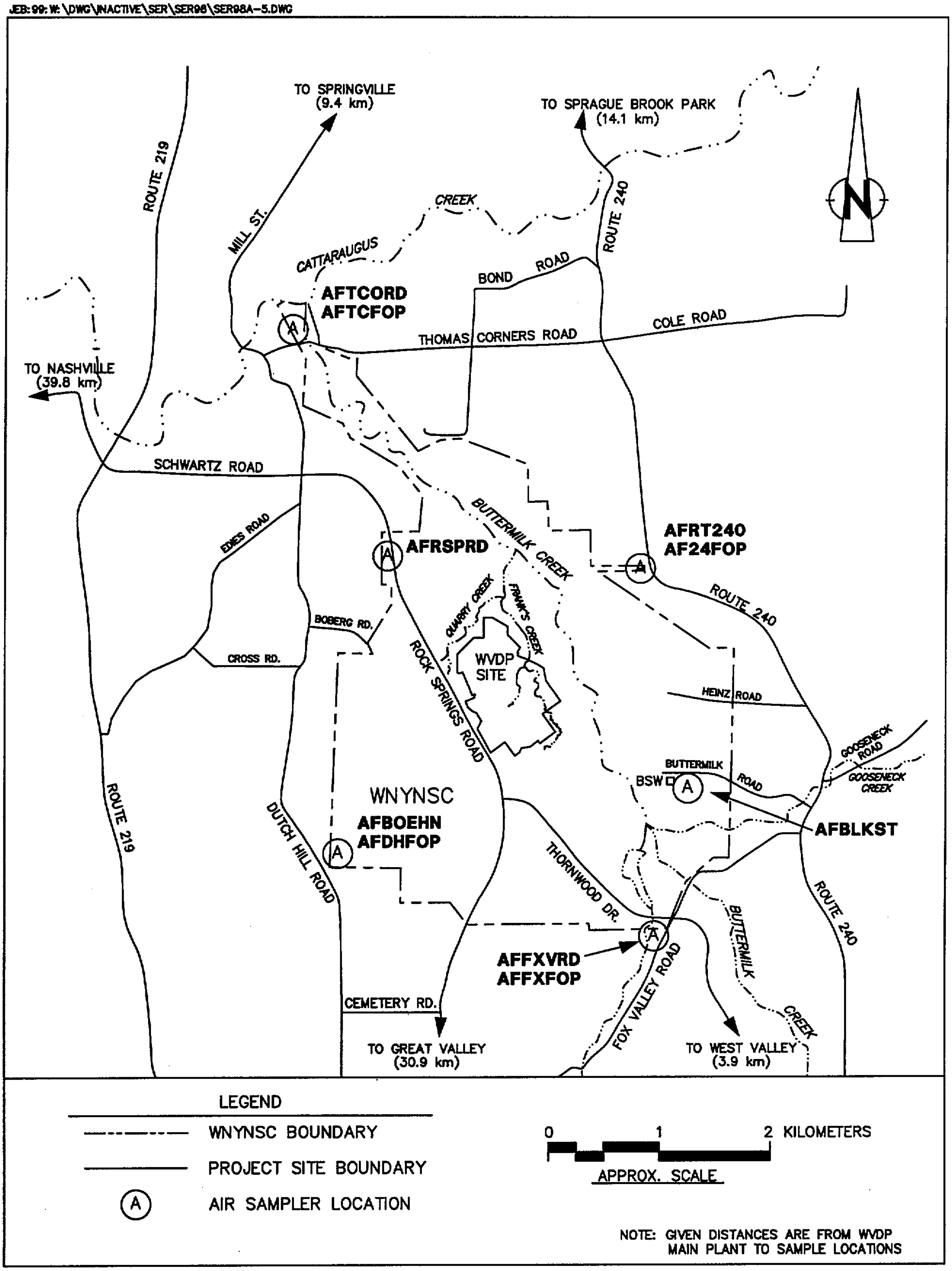

Figure A-5. Off-site Air and Fallout Sampling Points.

JEB: 99: W:\DWG\INACTIVE\SER\SER98\SR98A-6.DWG

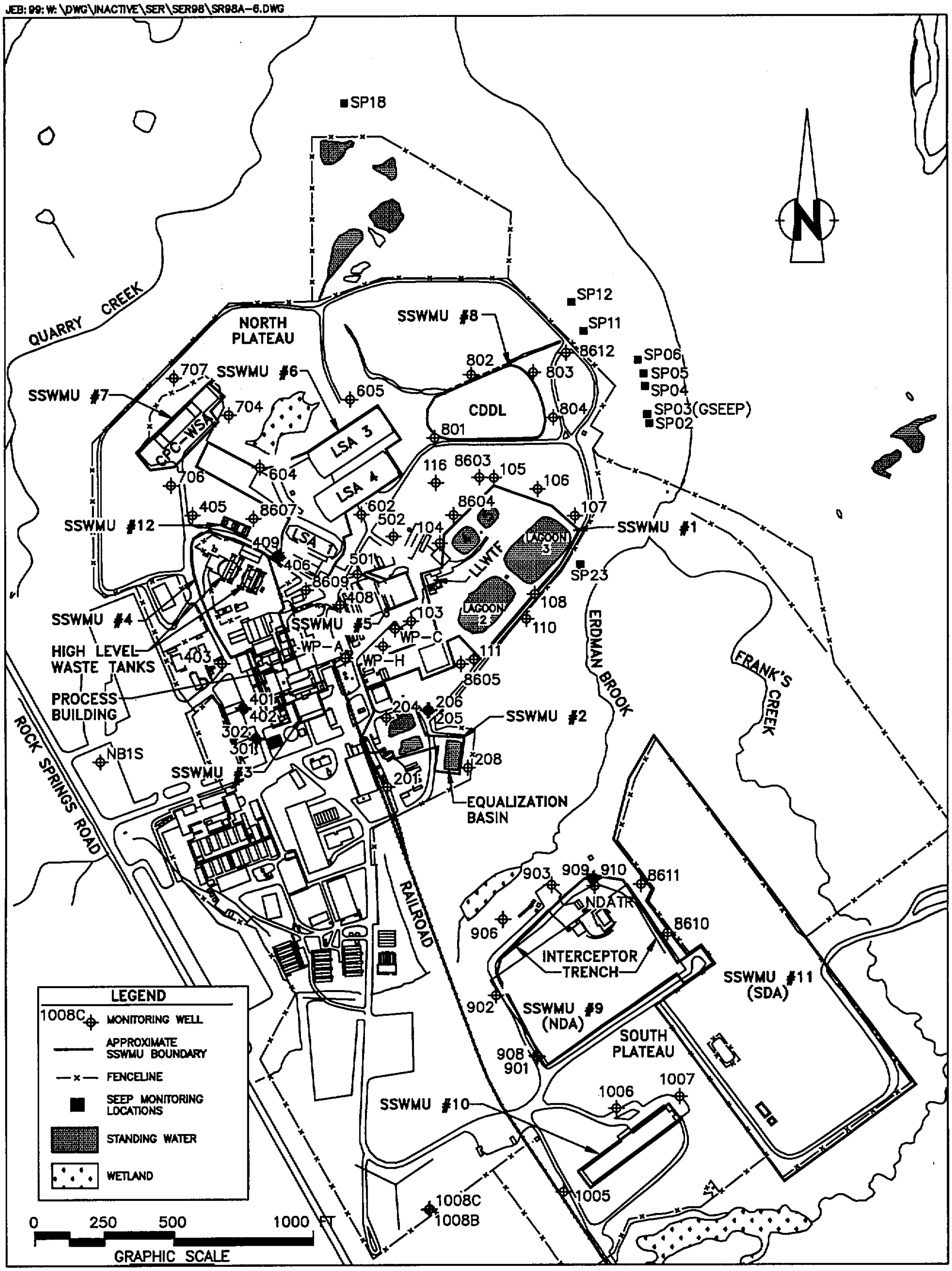

Figure A-6. WVDP Groundwater Monitoring Program Locations Sampled in 1998.

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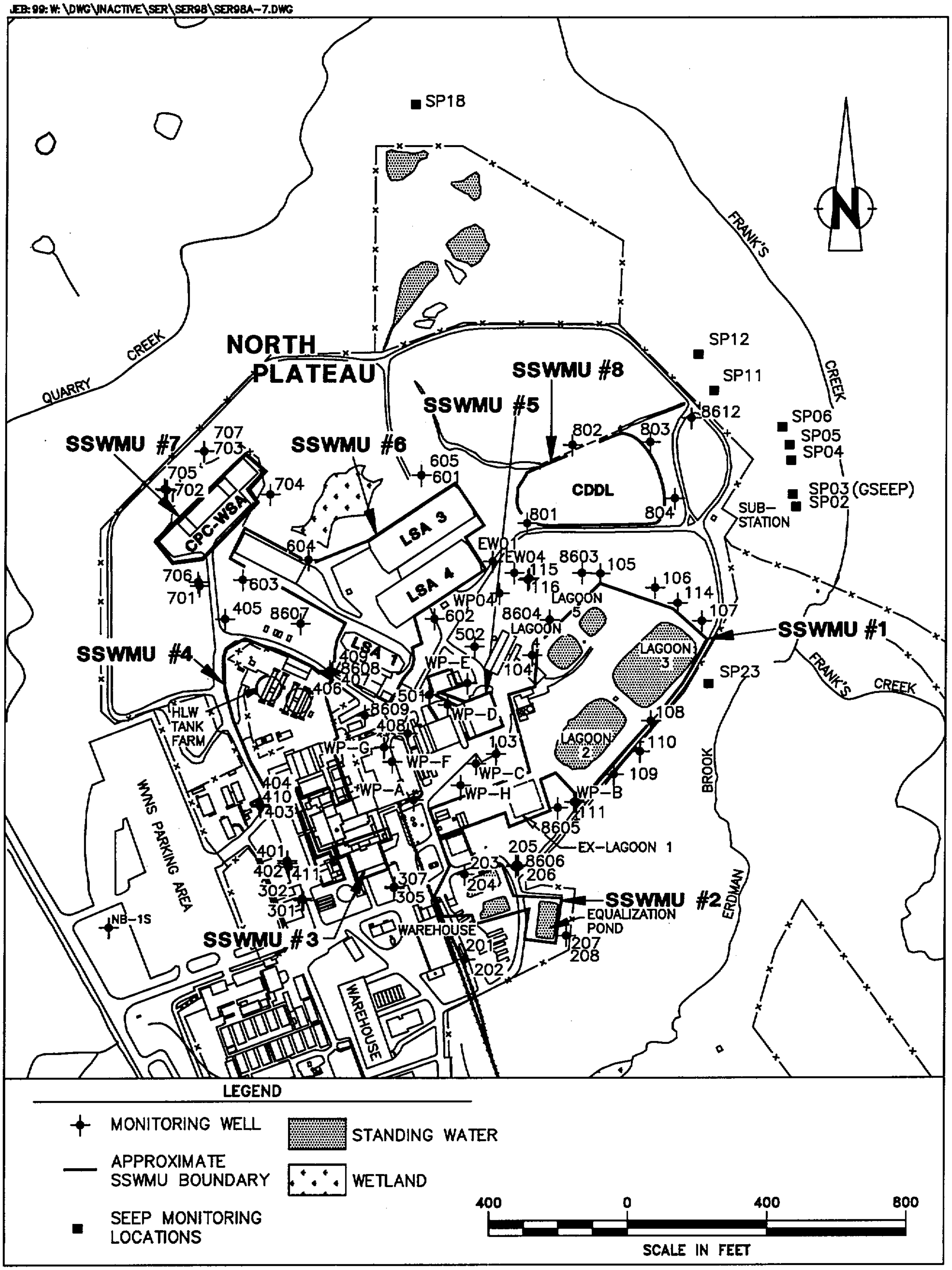

Figure A-7. North Plateau On-Site Groundwater Monitoring Network
(Includes wells used for water level measurements).

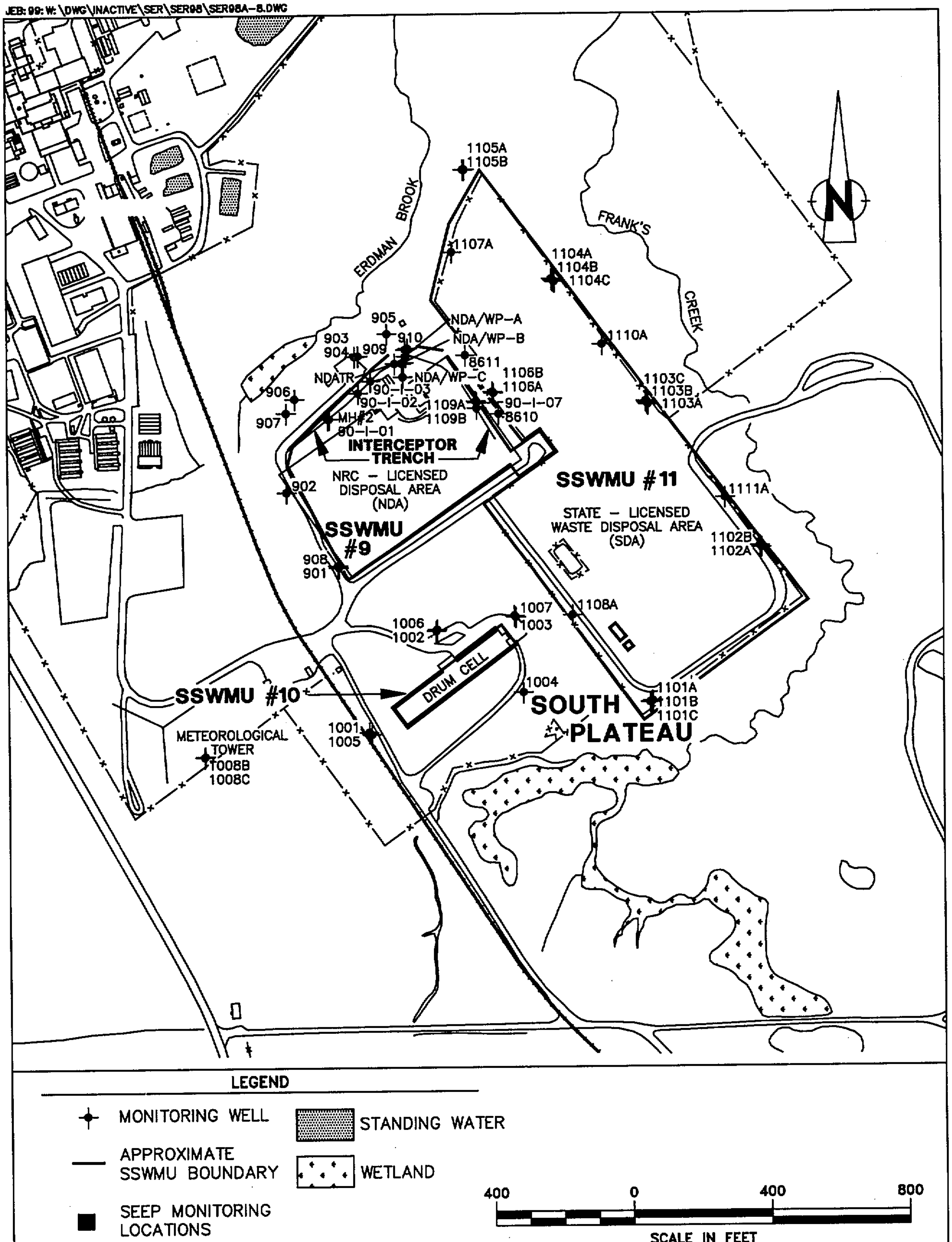

Figure A-8. South Plateau On-Site Groundwater Monitoring Network (Includes wells used for water level measurements).

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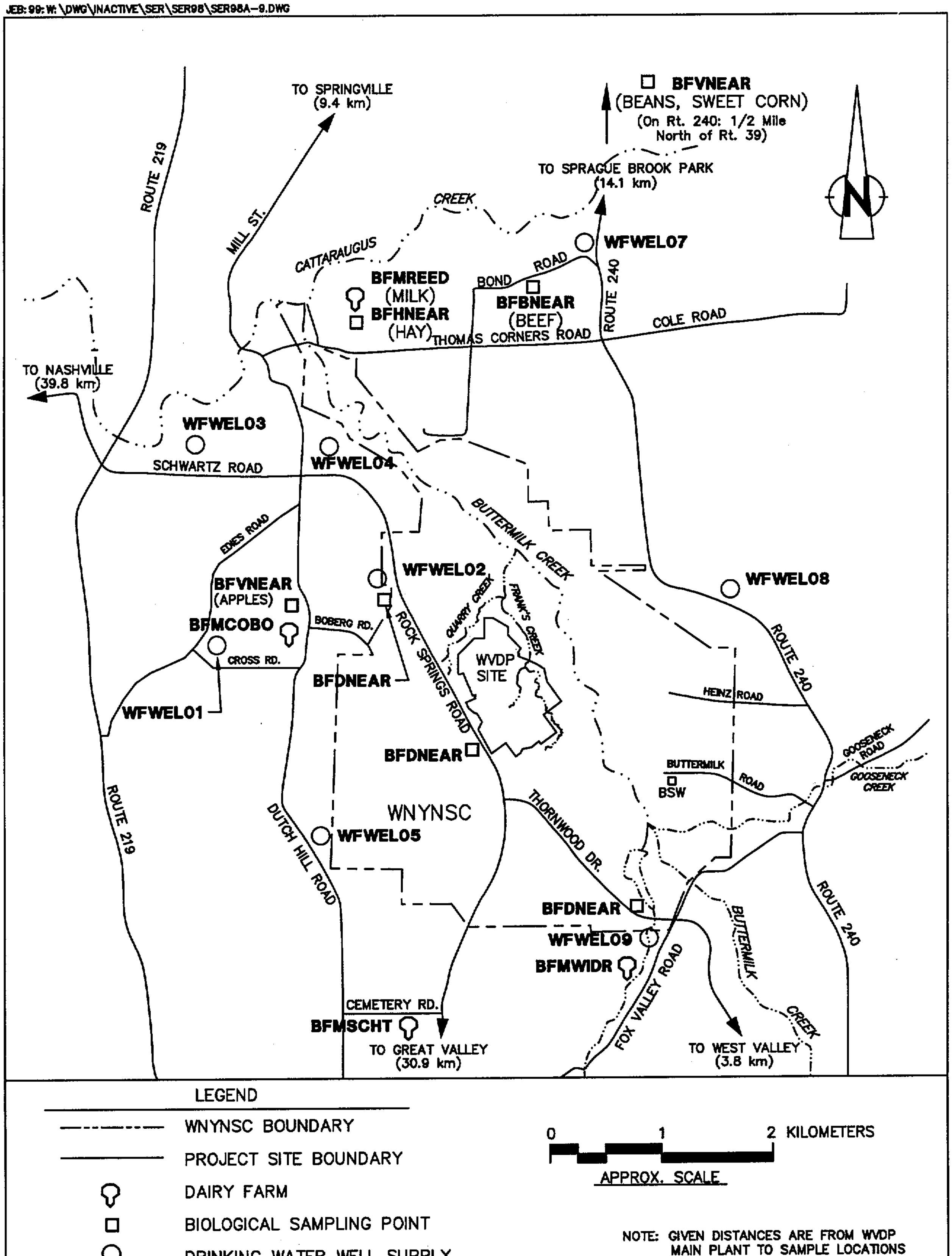

Figure A-9. Near-site Drinking Water and Biological Sample Points.

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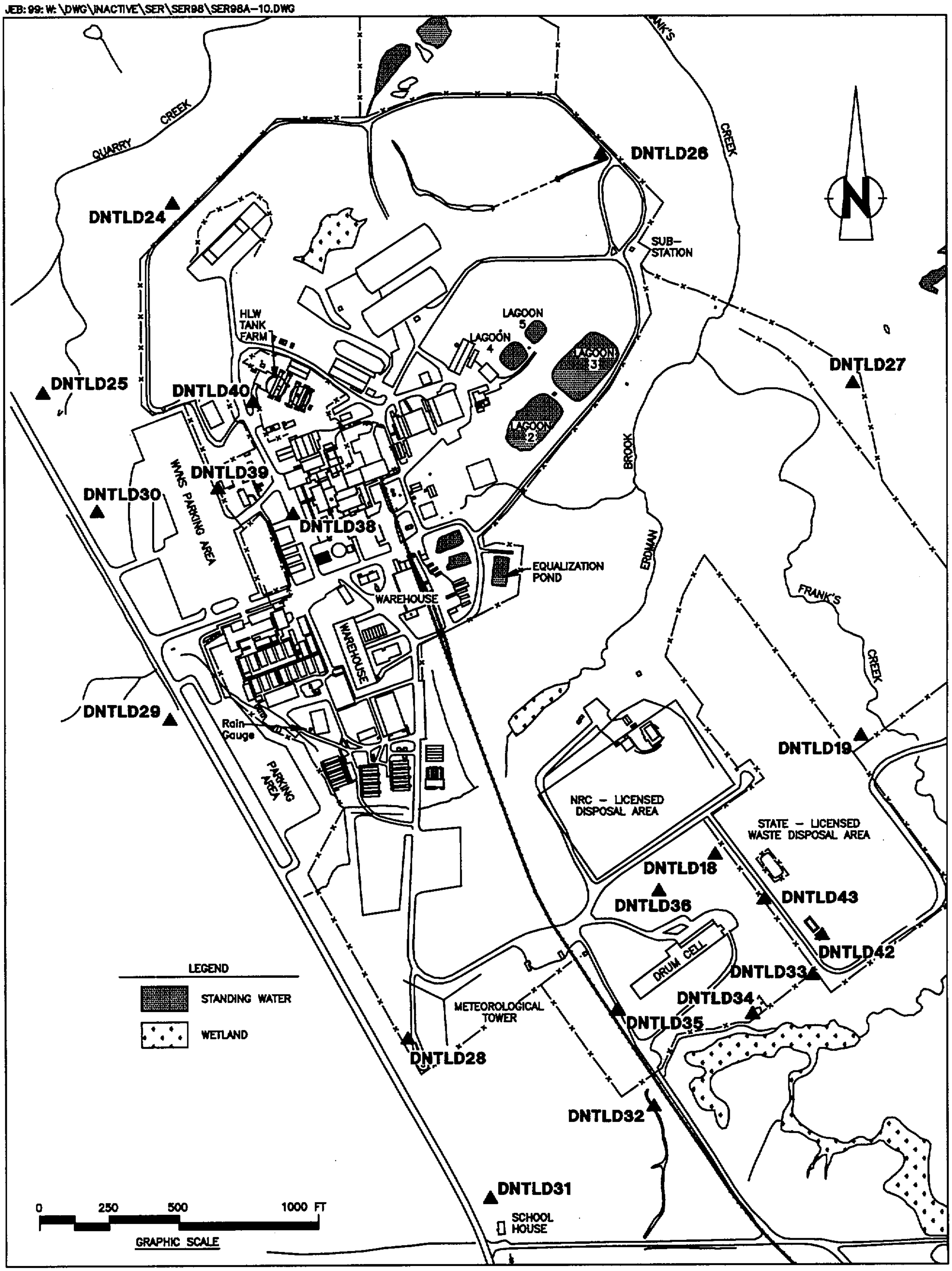


Figure A-10. Location of On-site Thermoluminescent Dosimeters (TLDs).

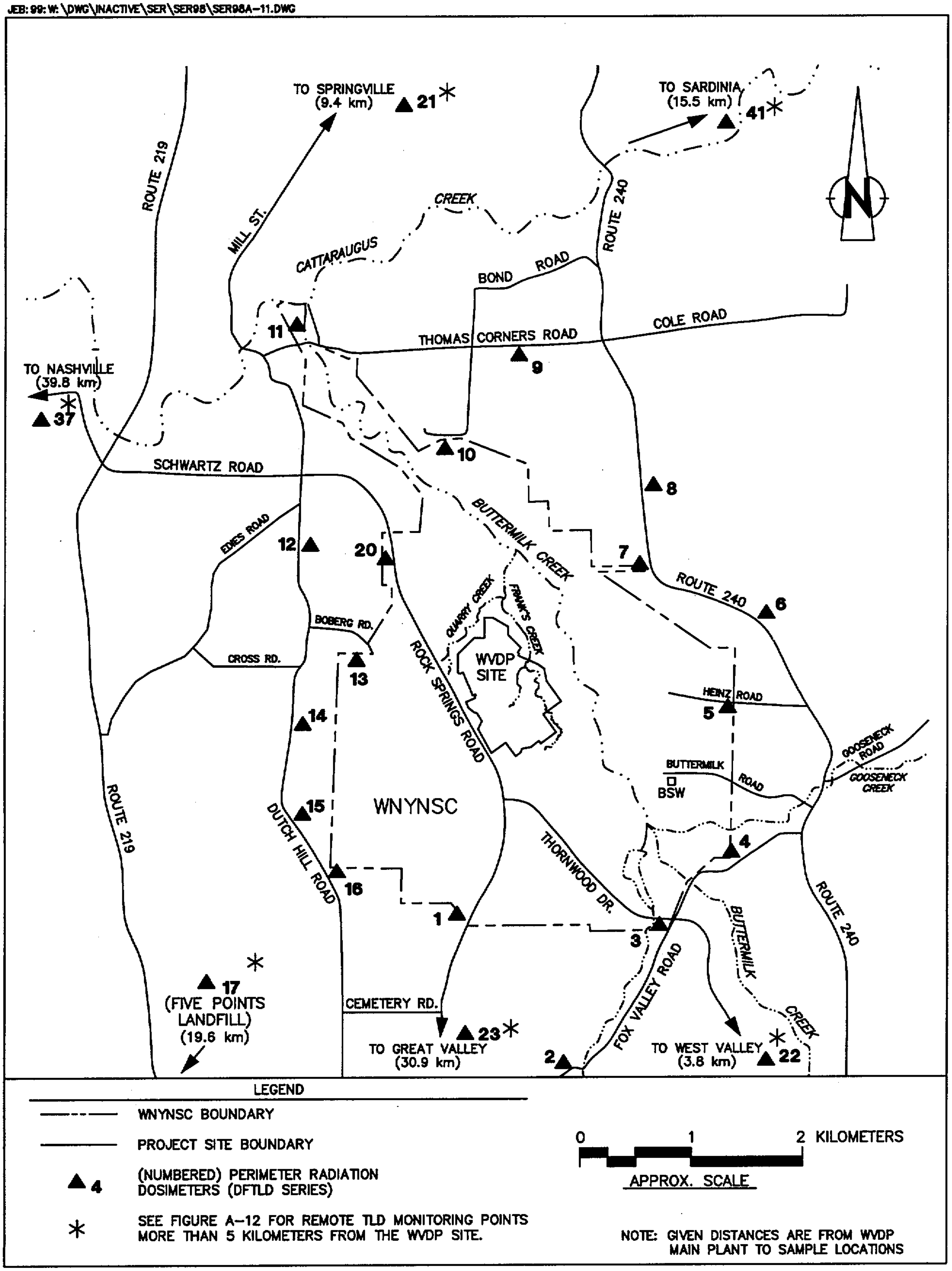
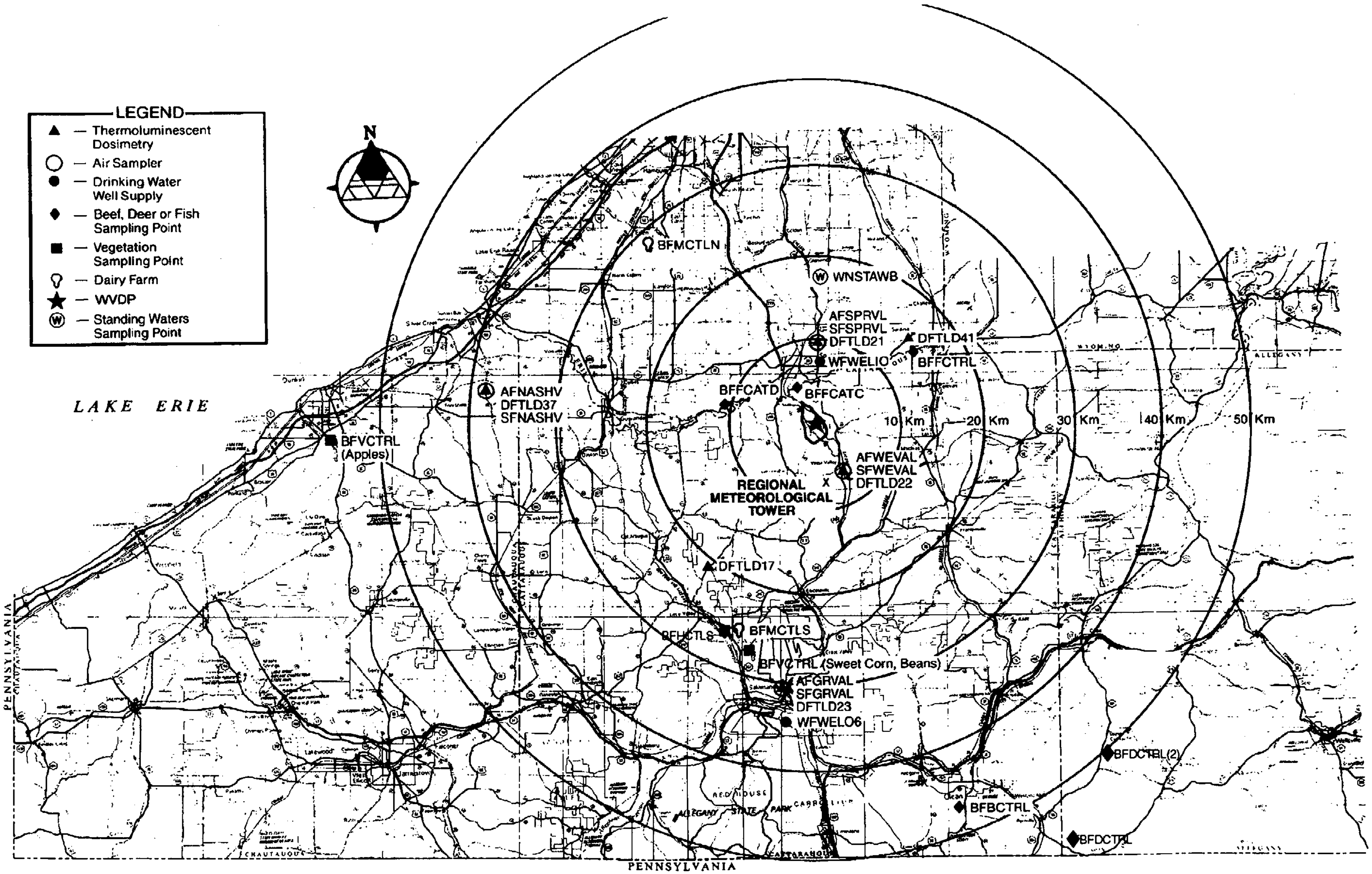


Figure A-11. Location of Off-site Thermoluminescent Dosimeters (TLDs).



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

Figure A-12. Environmental Sample Points more than 5 Kilometers from the WVDP Site.