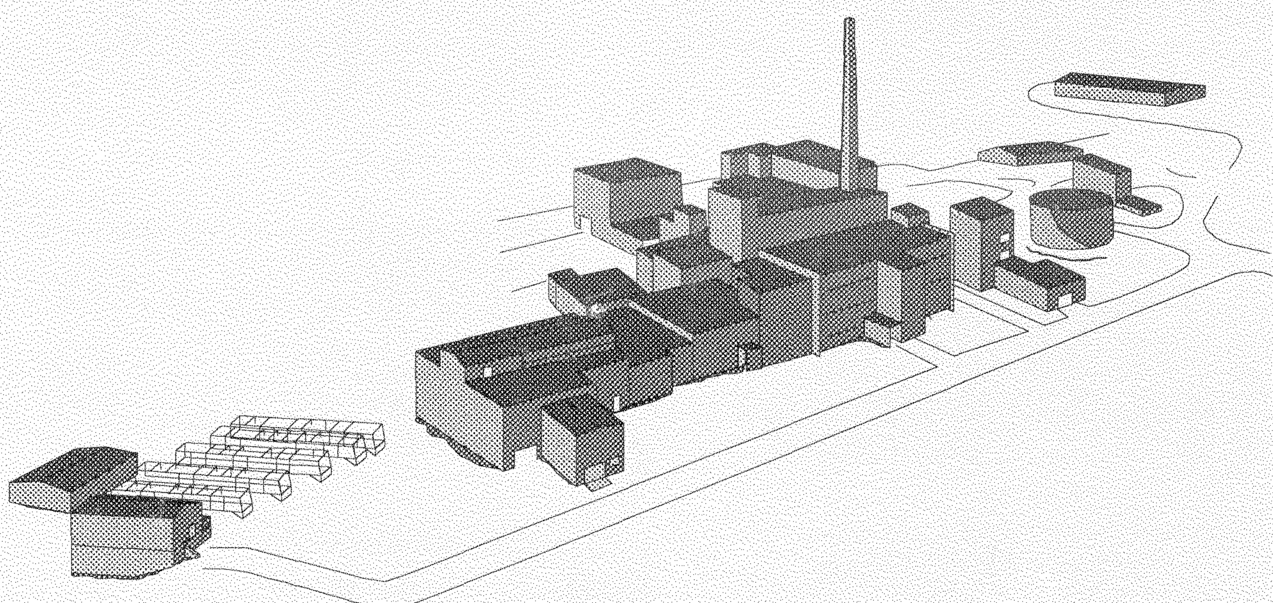
WEST VALLEY DEMONSTRATION PROJECT
SITE ENVIRONMENTAL REPORT
CALENDAR YEAR 1995



West Valley Nuclear Services Company, Inc.

and

Dames & Moore

Prepared for:
U.S. Department of Energy
Ohio Field Office
West Valley Area Office
Under contract DE-AC24-81NE44139

May 1996
P.O. Box 191
10282 Rock Springs Road
West Valley, New York 14171-0191

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Preface

Environmental monitoring at the West Valley Demonstration Project (WVDP) is conducted by the West Valley Nuclear Services Company, Inc. (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 1995 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 is a summary of the site environmental monitoring schedule. Appendix B lists the environmental permits and regulations pertaining to the West Valley Demonstration Project. Appendices C through F contain summaries of data obtained during 1995 and are intended for those interested in more detail than is provided in the main body of the report.

Requests for additional copies of the 1995 Site Environmental Report and questions regarding the report should be referred to the WVDP Community Relations Department, P.O. Box 191, 10282 Rock Springs Road, West Valley, New York 14171-0191 (Phone: 716-942-4610).

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Groundwater is routinely sampled for radiological and chemical parameters both inside the WVDP site security fence and outside the site to determine and document any effect of site activities on groundwater quality.

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.

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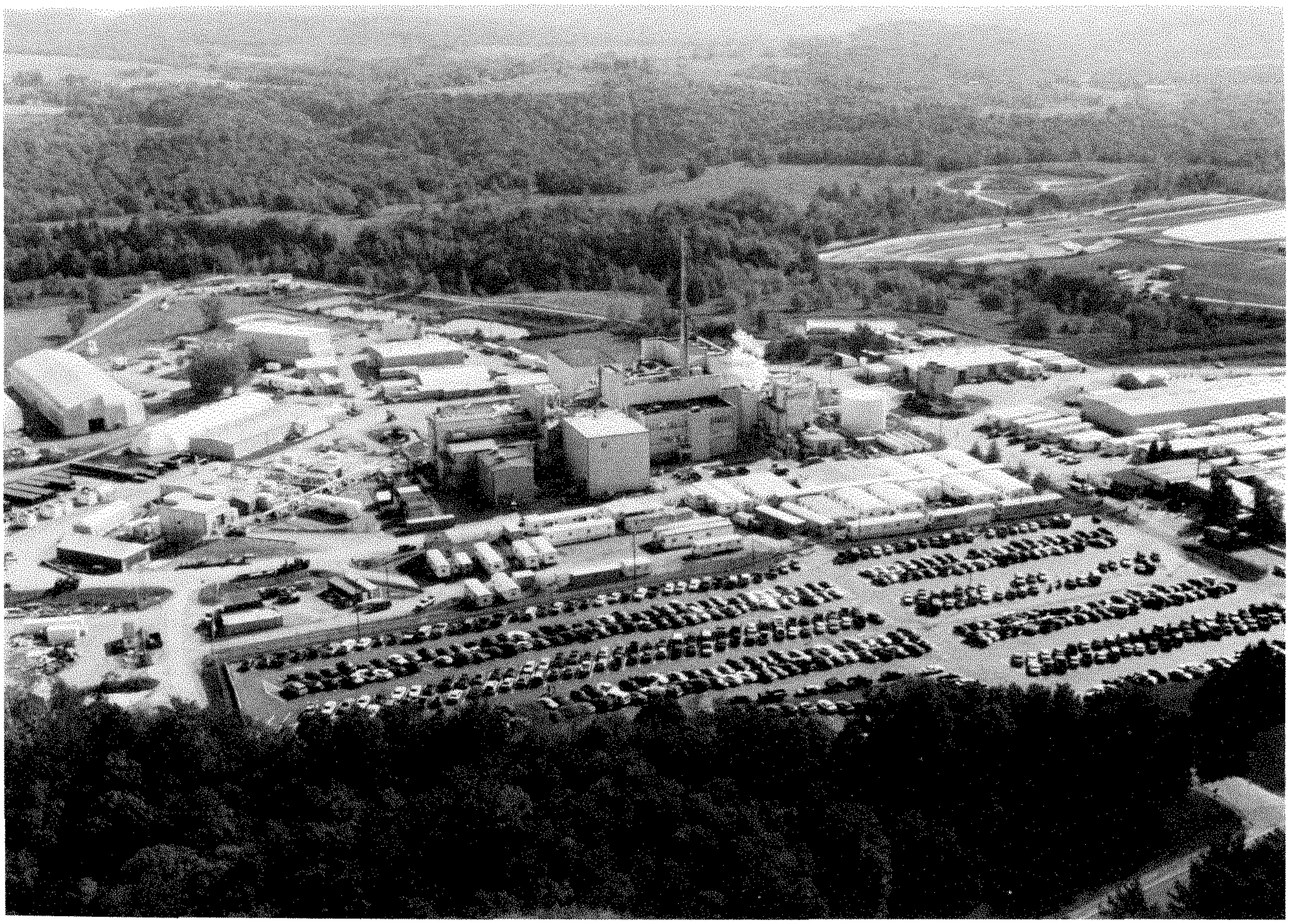


The West Valley Demonstration Project

EXECUTIVE SUMMARY

The West Valley Demonstration Project (the WVDP or Project) monitors the surrounding environment and effluent from on-site facilities to fulfill federal and state requirements. The results of this program show that during the course of activities at the WVDP, public health and safety and the environment are being protected.

This annual report summarizes the environmental monitoring data collected during calendar year 1995. On-site and off-site monitoring in 1995 confirmed that site activities were conducted well within state and federal regulatory radiological limits. (A description of regulatory issues is found in the *Environmental Compliance Summary: Calendar Year 1995* [p. xliii].) Although nonradiological monitoring carried out in 1995 identified several exceedances of the site's water effluent permit, none of these resulted in adverse effects upon public health or the environment.

The monitoring activities described in this report support the primary Project mission to solidify the high-level radioactive waste left at the site from the original nuclear fuel reprocessing activities.

During 1995 the major steps toward solidification of the high-level waste included combining two of the high-level waste streams in one underground storage tank and producing the first test canister of nonradioactive glass in the newly constructed vitrification facility. The final step, vitrification of the high-level waste residues, is currently scheduled to start in June 1996. More information is detailed in *Chapter 1, Environmental Monitoring Program Information* (pp. 1-6 through 1-8). A reader opinion survey questionnaire has been inserted in this report. If it is missing, please contact Community Relations at (716) 942-4610.

Compliance

The WVDP operates under U.S. Department of Energy (DOE) requirements for protection of the public and the environment from radiation. Limits on radioactivity concentrations and exposures to radiation are specified in DOE Orders. The Project did not approach any of the limits on radiation doses in 1995, including the emission standards promulgated by the U.S. Environmental Protection Agency (EPA) and incorporated in DOE Orders.

Nonradiological plant effluents are regulated by the New York State Department of Environmental Conservation (NYSDEC) and the EPA. Surface effluent water quality, regulated by NYSDEC, is tested for pH, biochemical oxygen demand (BOD-5), and other chemical constituents under a State Pollutant Discharge Elimination System (SPDES) permit, which identifies discharge water quality limits.

Although the site's SPDES permit limits were exceeded six times in 1995, none of the exceedances resulted in notices of violation being issued by NYSDEC. In no case did any exceedance result in any adverse effect on public health or the environment. (See the *Environmental Compliance Summary: Calendar Year 1995* [p. lii] for a more detailed description.)

Groundwater quality is regulated by NYSDEC and the EPA. Groundwater sampling and analyses confirm that on-site groundwater quality has been and continues to be affected both radiologically and nonradiologically by past facility operations. Evaluation of well sampling results for 1995 continues to better define these effects. Although radiological and nonradiological constituents are being detected in localized, on-site surface and groundwaters, these do not affect public health or the off-site environment.

In 1995 the WVDP continued the actions that were required by a Resource Conservation and Recovery Act (RCRA) 3008(h) Administrative Order on Consent. This agreement, entered into in 1992 between the EPA, NYSDEC, the DOE, and the New York State Energy Research and Development Authority (NYSERDA), specifies the measures that must be taken to provide information about hazardous wastes or constituents that may be potentially released to the environment from identified solid waste management units (SWMUs). As required by the Consent Order, a RCRA Facility Investigation (RFI) Work Plan (West Valley Nuclear Services Co., Inc. December 1993) was developed to be used in gathering this information. In 1994 all field work associated with this work plan was completed. In 1995 two draft SWMU assessments and seven draft RFI reports were submitted to the EPA and NYSDEC. The current focus of the RFI program is on finalizing these seven reports and drafting the two RFI reports that remain to be completed.

The WVDP continued to operate under and comply with a Federal and State Facility Compliance Agreement (FSFCA) that addresses radioactive mixed waste management issues. A draft site treatment plan also related to mixed waste management was developed and submitted to NYSDEC in 1994, as required by the Federal Facility Compliance Act (FFCAct). In March 1995 the WVDP submitted a proposed site treatment plan as the next required step.

In April 1995 the EPA removed the WVDP from the Federal Agency Hazardous Waste Compliance docket based on the determination (re: 60 CFR 18474) that the site of the WVDP is not federally owned. This action effectively resulted in the WVDP not being further considered at this time for placement on the National Priority List. (See the *Environmental Compliance Summary: Calendar Year 1995* [p. l].)

Waste minimization and pollution prevention initiatives continued to be aggressively pursued in 1995. The WVDP exceeded its 1995 waste-reduction goals: specifically, the generation of low-level radioactive waste was reduced by 55% and the generation of radioactive mixed waste by 80%. Hazardous waste generation was reduced by 37%.

Preparation of the draft environmental impact statement for Project completion by the DOE and closure or long-term management of facilities at the Western New York Nuclear Service Center (WNYNSC) by NYSERDA continued in 1995. Five alternatives are being evaluated for this statement, which is scheduled for public review and comment in 1996.

Effluent and Environmental Monitoring Program

In 1995 radiological and nonradiological site effluents and related on-site and off-site samples were measured and evaluated. Air and surface water samples were collected to monitor the two major pathways by which radioactive material could migrate off-site.

Testing of animal, soil, and vegetation samples from the area surrounding the Project provided additional data to calculate the risk of exposure to radioactivity through eating, drinking, or breathing. Control (background) samples were also taken to compare with on- or near-site samples.

Air Pathway Monitoring

Airborne particulate radioactivity was sampled continuously at six WNYNSC perimeter locations and four remote locations during 1995. (See *Chapter 2, Environmental Monitoring* [p. 2-14].) Sample filters were collected weekly; samples were analyzed weekly for gross alpha and gross beta radioactivity and quarterly for other specific nuclides. Airborne gross radioactivity around the site boundary was, in all cases, indistinguishable from background concentrations measured at the remote locations.

Direct monitoring of airborne effluents at the main plant stack and other permitted release points showed all discharges to be well below DOE and EPA effluent limitations.

Surface Water Pathway Monitoring

Automatic samplers collected surface water at six locations along site drainage channels. Samples were analyzed for gross alpha, gross beta, and gamma activity and for tritium and strontium-90. Analyses for carbon-14, iodine-129, uranium and plutonium radionuclides, and americium-241 are also program requirements at several collection points.

As a result of past site activities and continuing releases of treated liquids, gross radioactivity concentrations remained slightly higher in Buttermilk Creek downstream of the West Valley Project site than at the upstream background sample point. However, yearly average concentrations in water below the Project site in Cattaraugus Creek during 1995 were indistinguishable from background concentrations measured in Buttermilk Creek upstream of the Project facilities. All Cattaraugus Creek concentrations observed were well below DOE regulatory guidelines (derived concentration guides [DCGs]). Concentrations of cesium-137 and other gamma emitters, strontium-90 and other beta emitters, tritium, and uranium and plutonium radionuclides were below DOE DCGs at all off-site surface water sampling locations as well as at Frank's Creek downstream of the Project at the inner site security fence, which is more than 4.8 kilometers (3 mi) upstream of Cattaraugus Creek. (See *Chapter 2, Environmental Monitoring* [p. 2-7].)

The treated effluent from the low-level liquid waste treatment facility (LLWTF) contributes most of the activity released from the site in controlled liquid discharges. The 1995 annual average liquid effluent concentrations of radionuclides were below DOE release guidelines at the point of discharge.

One of the streams originating in a swampy area on the Project premises was found in late 1993 to have increasing gross beta radioactivity. Upon examination, a small seasonal groundwater seep was discovered that appeared to be a major contributor of strontium-90 to this drainage path. An investigation was initiated to characterize the source of this seep, its effect on surface water quality, and to provide information for mitigative action, if deemed necessary. Groundwater and soil beneath and downgradient of the process building were sampled between July 14, 1994 and October 19, 1994. During this investigation groundwater was collected from eighty locations, and soil samples were collected from four locations.

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

A final report describing the principal findings of the investigation, including potential sources and mitigative alternatives, was completed and submitted to NYSDEC in April 1995 in compliance with schedule provisions of the WVDP's SPDES permit. In November 1995, in an effort to mitigate the movement of strontium-90 contamination in site groundwater, the WVDP installed and began operating a groundwater pump-and-treat system. Recovered well water, after pretreatment, is directed either to the site's low-level waste treatment facility for additional treatment, or it is discharged to the environment through the monitored lagoon system. In 1995 approximately 935,000 liters (247,000 gal) were processed in this manner. The pump-and-treat system is currently being evaluated, along with other technologies, to determine if there are more effective methods for treating the groundwater. (See **Special Monitoring** in *Chapter 2* [p. 2-30] and **Interim Mitigative Measures Near the Leading Edge of the Gross Beta Plume on the North Plateau** in *Chapter 3, Groundwater Monitoring* [p. 3-24].)

Food Pathway Monitoring

Radioactivity that could pass through the food chain was measured by sampling milk, beef, hay, corn, apples, beans, fish, and venison. With two exceptions, no statistically significant differences in radionuclide concentrations between historical background (control) samples and near-site samples were measured in these media in 1995. However, these values still are within the historical range of background concentrations for other biological media. (See *Chapter 2*, **Radioactivity in the Food Chain** [p. 2-21] and *Chapter 4*, **Environmental Media Concentrations** [p. 4-9].)

Direct Environmental Radiation Monitoring

Direct environmental radiation was measured continuously during each calendar quarter in 1995 using thermoluminescent dosimeters (TLDs) placed at forty-three locations around the WNYNSC perimeter, along the site access road, at points around the Project site, and at various background locations. No real differences could be found between exposure rates measured at background stations and those at the WNYNSC perimeter locations. TLD measurements also were taken inside the restricted area boundary and reflect low-level radiation from nearby radioactive waste handling and storage facilities.

Nonradiological Monitoring

Nonradiological discharges from the site are regulated by NYSDEC; however, no special monitoring and reporting of nonradiological airborne effluents was required in 1995.

Nonradiological liquid discharges to an on-site stream from three permitted release points (outfalls) are monitored as required by the SPDES permit. Project effluents are monitored for biochemical oxygen demand, suspended solids, ammonia, iron, pH, oil and grease, and other water quality indicators. Although the SPDES permit limits were exceeded several times in 1995, as noted above, monitoring and observation downstream indicated that nonradiological liquid discharges had no observed effects on the off-site environment.

The WVDP continued to work with NYSDEC to complete storm water permitting requirements of the Clean Water Act by monitoring eleven outfalls in 1995. The storm water samples were analyzed for parameters identified in the current SPDES permit. The WVDP will submit a new storm water discharge permit application in 1996 that updates an original application filed in 1992.

Groundwater Monitoring

The WVDP is underlain by layers of unconsolidated sediments ranging from coarse gravels to fine clays. The ability of water to move through the sediments is largely related to the size of the soil particles in the sediments. The larger the soil particles, the easier it is for water to move through the sediments, making them more permeable to water. Groundwater monitoring focuses on the water-bearing layers of sediment with relatively higher permeabilities and groundwater velocities, which are thus potential pathways for contaminant migration.

The 1995 monitoring well network included both on-site wells for surveillance of SWMUs and off-site wells to monitor drinking water. The 1995 on-site groundwater monitoring network included ninety-one Project-related groundwater monitoring locations at the beginning of year. In May 1995 a report was issued that summarized a thorough review of the WVDP groundwater monitoring program. The review was conducted to evaluate and ensure that parameters of site-wide or SWMU-specific importance were being monitored and to eliminate redundancies in the program. A revised collection schedule was implemented for the third quarter of 1995, streamlining the program to fifty-six monitoring locations. Before implementation, NYSDEC approval was obtained under the condition that the program would continue to evolve to meet the needs of the 3008(h) Administrative Order on Consent.

Wells in the groundwater monitoring network provided upgradient and downgradient monitoring of the low-level liquid waste treatment facility lagoons, the high-level waste tank complex, the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA), and other SWMUs. Under the revised program for 1995 each well was sampled four times. The range of analyses performed was determined by technical regulatory guidelines and site-specific characterization needs. Although an additional twenty-one wells located around the New York State-licensed disposal area (SDA) are monitored separately by NYSERDA, data from those wells are also included in this report. (See *Appendix F* [pp. F-1 through F-11].)

Monitoring well data are grouped by hydrogeologic unit. Data from groundwater monitoring of the sand and gravel unit around the LLWTF lagoons indicate that radionuclides from past plant operations have affected groundwater quality.

Groundwater monitoring data from around the high-level waste tanks do not suggest any effect of the stored high-level radioactive waste on the groundwater. However, significant radiological differences between upgradient and downgradient wells do indicate that previous site activities have affected groundwater in this area. Most notable are elevated levels of gross beta in sand and gravel wells 408, 501, and 502, which are downgradient of the main process plant facilities.

Gross beta activity in 1995 at well 408 remained consistent with historical highs reached in 1994.

In all, there are eight wells on-site that exhibit elevated gross beta levels above a concentration of 1E-06 μCi/mL. This concentration corresponds to the DOE DCG for an annual average strontium-90 surface discharge and is presented for comparison only. Strontium-90 has been identified as the primary contributor to gross beta activity in groundwater on-site and therefore is used as the limiting beta-emitting radionuclide.

At other groundwater monitoring points, other measured parameters such as pH and conductivity have shown significant differences between upgradient and downgradient hydrogeologic unit locations. Downgradient sand and gravel well 103 continued to demonstrate high pH, sodium, and hydroxide ion levels in 1995 samples. This well is located in the vicinity of a spill of sodium hydroxide solution that occurred because of a transfer pipe failure in 1984.

Organic contaminants were identified in groundwater in the vicinity of three super solid waste management units (SSWMUs). Tributyl phosphate, detected at very low levels in the vicinity of the low-level waste treatment facility (SSWMU #1), is probably related to the use of this chemical in the NFS solvent extraction process. Radioactive contaminants have historically been present in the same area. Three chlorinated organic compounds have previously been detected at very low levels in the vicinity of the construction and demolition debris landfill (SSWMU #8) and near the high-level waste tank farm.

Tritium has been detected in wells in the near-surface weathered Lavery till in the vicinity of the SDA and the NDA. Elevated tritium has not been observed in the monitoring wells in the deeper Kent recessional sequence, supporting the expectation that the unweathered Lavery till would act as a barrier.

Ongoing environmental characterization and RCRA facility investigations are being used to assess the groundwater in greater detail.

A control and remediation effort within the NDA included installation in 1990 of a gravel-backfilled interceptor trench downgradient of soils known to be contaminated by tributyl phosphate and n-dodecane. As in previous years, no n-dodecane/tributyl phosphate was found.

In summary, the volume of on-site groundwaters having above-background levels of radioactivity that do flow to the surface is small in comparison to the natural stream flow with which it mixes. Consequently, levels of radioactivity, as seen in Cattaraugus Creek at the first point of public access, continue to be at or below background levels.

In addition to on-site monitoring, the potential effect of Project activities on off-site groundwater is monitored by annual sampling of designated private drinking water wells. Monitoring of these wells continues to demonstrate that the site has had no effect on residential drinking water supplies in the vicinity.

Radiological Dose Assessment

Potential radiation doses to the public from airborne and liquid effluent releases of radioactivity from the site during 1995 were estimated using computer models.

The EPA-approved computer program CAP88-PC (U.S. Environmental Protection Agency March 1992) was used to calculate potential radiation doses from airborne discharges from the permanent stacks. These potential doses are measured in millirems (mrem) or millisieverts (mSv) and express a combination of organ and tissue doses into a single "effective" whole body dose. (See **Units of Measurement** in *Chapter 4, Radiological Dose Assessment* [p. 4-2].) The highest annual effective dose equivalent (EDE) to a nearby resident was estimated to be 4.3E-04 mrem (4.3E-06 mSv), which is less than 0.005% of the 10 mrem EPA standard. The annual collective dose to all persons within an 80-kilometer (50-mi) radius was estimated to be 8.6E-03 person-rem (8.6E-05 person-Sv) effective dose equivalent.

The highest individual calculated EDE for liquid effluents was 2.8E-02 mrem (2.8E-04 mSv), with an annual EDE to the population within 80 kilometers (50 mi) estimated to be 9.4E-02 person-rem (9.4E-04 person-Sv).

The total calculated dose estimates from 1995 Project effluents result in a maximum EDE to an individual of 2.8E-02 mrem (2.8E-04 mSv), which is less than 0.03% of the 100 mrem DOE limit. Overall, the annual EDE from air and liquid discharges to people within an 80-kilometer (50-mi) radius of the site was calculated to be 1.0E-01 person-rem (1.0E-03 person-Sv). More detailed explanations of these dose calculations are found in *Chapter 4, Radiological Dose Assessment*, **Dose Assessment Methodology** (p. 4-4).

Statistical evaluations of biological media are made to determine if results should be used in dose assessments. Strontium-90 in a single on-site apple sample and annualized averages of strontium-90 in downstream fish showed levels above background. However, these values still are within the historical range of background concentrations for other biological media. (See *Chapter 4, Radiological Dose Assessment* [pp. 4-4 through 4-9].)

The potential calculated doses presented above should be considered in relation to the 100 mrem annual DOE limit for dose to an individual. From another perspective, a typical U.S. resident receives an average dose of about 300 mrem per year from natural background radiation. The dose assessment described in *Chapter 4, Radiological Dose Assessment* (pp. 4-4 through 4-9), predicts an insignificant effect on the public's health as a result of radiological releases from the WVDP.

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 annually 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.

Quality Assurance

The environmental monitoring quality assurance program includes provisions for evaluating and controlling data generated from both on-site and off-site measurements. Both on-site and off-site laboratories and their internal quality assurance programs are routinely reviewed by site personnel. In addition, commercial laboratories must satisfactorily perform blind analyses of standard or duplicate samples submitted by the WVDP Environmental Laboratory.

WVDP monitoring activities are subject to quality control checks from the time of sample collection through sample analysis and data reduction. Each analytical test of the samples analyzed in the on-site Environmental Laboratory is reviewed in detail. Specific quality checks include external review of sampling procedures, accurate calibrations using primary standard materials, participation in formal laboratory crosscheck programs (for example, with the EPA and the DOE), and assessments by independent organizations that include the New York State Department of Health (NYSDOH), the NRC, the DOE, and Westinghouse Electric Corporation.

Environmental sample sharing and co-location of measurement points with NYSDOH and the NRC continued in 1995, ensuring that selected samples and locations were routinely measured by two or more independent organizations.

Participation in crosscheck programs, coupled with other internal quality control procedures and external laboratory checks, verified the quality of data gathered in 1995. General program adequacy and specific issues of quality assurance were audited by the WVNS quality assurance department in 1995. Two concurrent self-assessments, conducted by a select team of environmental monitoring staff, identified areas needing improvement and tracked the actions taken. (See *Chapter 5, Quality Assurance* [p. 5-6].)

Project Assessment Activities

A number of important assessment activities were conducted at the WVDP in 1995 by external agencies. These included a routine annual inspection by NYSDEC for compliance with the Clean Air Act and Clean Water Act; inspections by the EPA and NYSDEC for compliance with RCRA; and an annual inspection of the WVDP drinking water supply system by the Cattaraugus County Health Department. None of these assessments resulted in any findings of noncompliance.

External overview activities in 1995 included an operational readiness review conducted by the DOE Office of Environmental Management and a monitoring visit by the NRC, which has helped to prepare the WVDP for radioactive operation of the vitrification facility. In addition to conducting employee interviews and field observations, the DOE team reviewed the results of WVDP internal assessment activities. The findings of the DOE assessment are currently being evaluated and corrective actions are being planned and carried out. None of the findings were directed at the environmental program.

The independent monitoring visit by the NRC in June 1995 examined all aspects of the WVDP's vitrification-related effluent monitoring program, the adequacy of quality assurance and quality control programs, and internal vitrification-readiness documentation. The NRC monitoring assessment report concluded that the WVDP has established viable programs for protecting public health and safety.

Overall, internal and external assessment activities carried out in 1995 continued to confirm the high quality of the environmental monitoring program at the WVDP and the Project's commitment to environmental compliance.

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 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), undertook construction and operation of 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 Western New York Nuclear Service Center 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, federal and state safety regulations, which were more rigorous than those previously in existence, 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 NFS 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 2.5 million liters (660,000 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., Inc. (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 such a period as may be 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 settled into two layers, a liquid supernatant and a precipitate sludge. Various subsystems were constructed that permitted the successful start-up in May 1988 of the integrated radwaste treatment system (IRTS). The system stripped 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 through 1-7] for a more detailed description.) In 1995, the two high-level waste streams were combined and the subsequent mixture washed a final time. The last ste[
vitrification of the remaining high-lev[
residues.

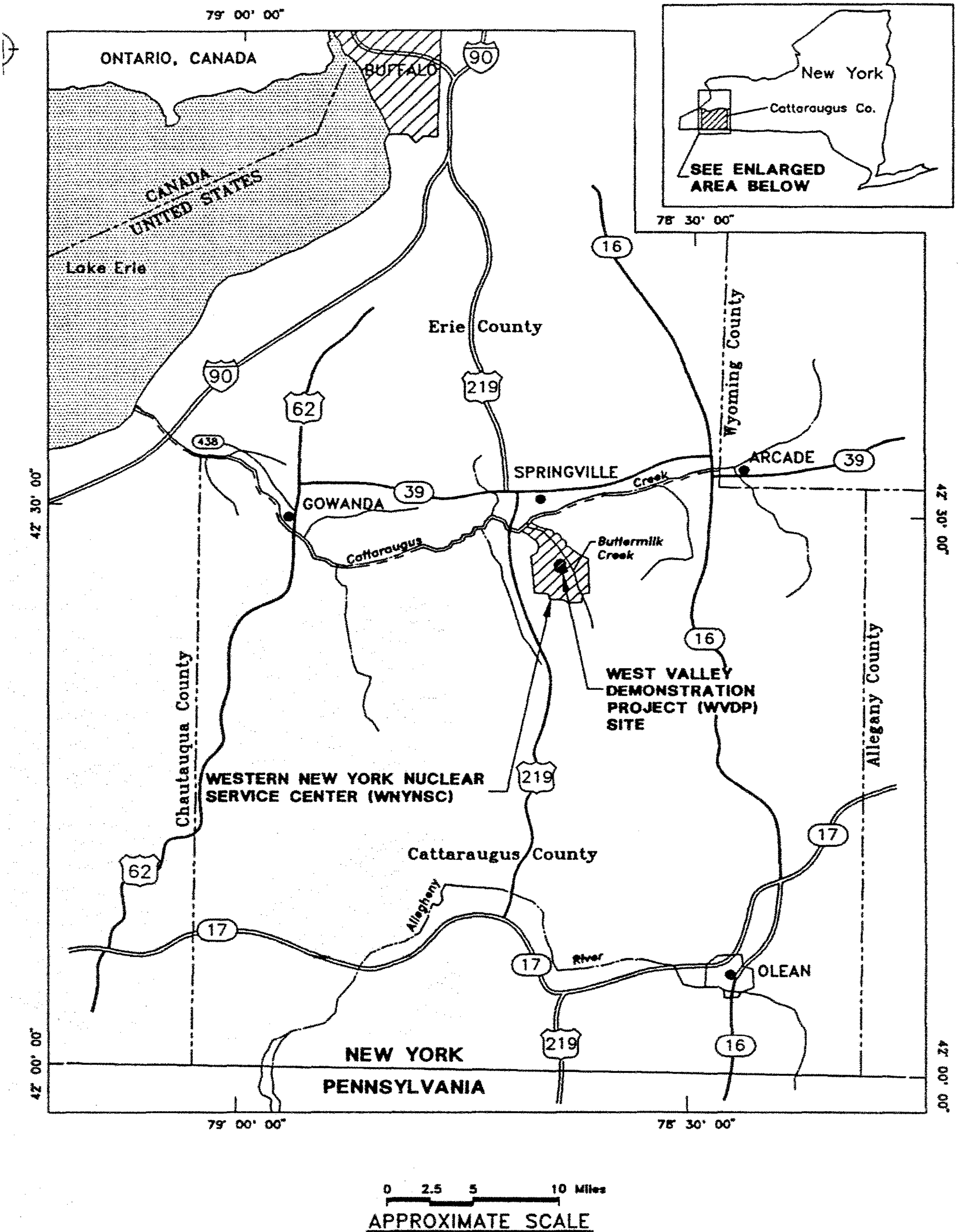
This annual environmental monitoring r
published to inform WVDP stakeholde[
environmental monitoring conditions. Th
presents a summary of the environment[
toring data gathered during the year in
characterize the performance of the V
environmental management, confirm con
with standards and regulations, and h
significant programs.

The geography, economy, climate, ecolc
geology of the region are principal fa[
assessing possible effects of site activitie
surrounding population and environment
an integral consideration in the design an
ture of the environmental monitoring prc

Location

The WVDP is located about 50 kilom[
mi) south of Buffalo, New York (Fig.
WVDP facilities occupy a security-fenced
about 80 hectares (200 acres) wit[
1,332-hectare (3,340-acre) Western Ne[
Nuclear Service Center. This fenced area is
to as the Project premises, or the restricted

The WVDP is situated on New York
Allegheny plateau at an average elevatio[
meters (1,300 ft). The communities c
Valley, Riceville, Ashford Hollow, and
lage of Springville are located within 8 kil[
(5 mi) of the plant. Several roads and a
pass through the WNYNSC, but the pub[
not have access to the WNYNSC. Ge[
hunting, fishing, and human habitation
WNYNSC are prohibited. (For purpose[
fining environmental monitoring [
collection locations, the land wit[
WNYNSC is considered to be "on-si[
NYSERDA-sponsored pilot program to



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

pilot program to control the deer population was initiated in 1994 and continued in 1995. Limited hunting permits were issued to local residents, and community response was 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 primarily 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. Waters from Lake Erie are 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 1995 totaled 87 centimeters (34 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.

A Young White-tailed Resident

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 thick sequence of glacial sediments. (See Figs. 3-2 and 3-3 [pp. 3-4 and 3-5] 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 Fig. 3-1 [p. 3-3] in *Chapter 3, Groundwater Monitoring*.)

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 vertically downward.

On the north plateau a relatively permeable alluvial sand and gravel layer overlies the 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 areal extent, the Lavery till-sand. The flow of groundwater within the till-sand appears to be very limited. Surface discharge points have not been observed, but gradients indicate flow to the southeast.

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.

Within the Lavery till on both the north and south plateaus are other localized permeable units capable of letting groundwater flow through. The uppermost few feet of shale bedrock has also demonstrated the ability to let significant quantities of groundwater flow through via fractures.

Information in this Report

Format and Content

Individual chapters in this report include information on compliance with regulations, general information about the monitoring program and significant activities in 1995, summaries of the results of radiological and nonradiological monitoring, and calculations of radiation doses to the population within 80 kilometers of the site. Where appropriate, graphs and tables are included to illustrate important trends and concepts. The bulk of the supporting data is furnished separately in the appendices following the text.

Appendix A (pp. A-i through A-55) summarizes the 1995 environmental monitoring program at both on-site 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 A* [pp. A-vi through A-ix].) *Appendix A* lists the kinds of samples taken, the frequency of collection, the parameters analyzed, the location of the sample points, and a brief rationale for the monitoring activities conducted at each location.

Appendix B (pp. B-1 through B-9) provides a list of those radiation protection standards most relevant to the operation of the WVDP as set by the DOE. It also lists federal and state regulations that affect the WVDP and environmental permits held by the site.

Appendix C (pp. C1-1 through C6-9) summarizes analytical data from air, surface water, off-site groundwater, sediment, soils, and biological samples (meat, milk, food crops, and fish) as well as direct radiation measurements and meteorological monitoring.

Appendix D (pp. D-1 through D-7) provides data from the comparison of results of analyses of identically prepared samples (crosscheck analyses) by both the WVDP and independent laboratories. Radiological concentrations in crosscheck samples of air, water, soil, milk, and vegetation are reported here. *Appendix D* also lists the comparisons of direct radiation measurements from thermoluminescent dosimeters (TLDs) monitored by the WVDP and measurements from dosimeters placed in the same locations by the U.S. Nuclear Regulatory Commission (NRC).

Appendix E (pp. E-1 through E-31) summarizes the data collected from on-site groundwater monitoring. The tables in *Appendix E* report concentrations at various locations for parameters such as gross alpha and gross beta, tritium, gamma-emitting radionuclides, organic compounds, and dissolved metals.

Appendix F (pp. F-1 through F-11) contains groundwater monitoring data for the New York State-licensed disposal area (SDA) provided by NYSERDA.

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 be familiar with (e.g., DOE, EPA, NRC, NYSDEC) 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 found at the end of this report.

Environmental Monitoring Program

The environmental monitoring program for the WVDP 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 will be provided.

Monitoring and Sampling

The environmental monitoring program consists of on-site effluent monitoring and on-site and off-site environmental surveillance in which samples are measured for both radiological and nonradiological constituents. (See the *Glossary* 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 potential effects on the environment from site activities. Sampling is the collection of media at scheduled times; sampling is slower than direct monitoring in indicating results because the samples collected must be analyzed in a laboratory to obtain data, but it allows much smaller quantities of radioactivity to be detected through the analysis.

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 and 5400.5 and DOE Regulatory Guide DOE/EH-0173T.

The West Valley Demonstration Project also 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 site drainage and specifies the sampling and analytical requirements for each outfall.

In addition, the site operates under state-issued air discharge permits for nonradiological plant effluents. Radiological air discharges must also be permitted by the Environmental Protection Agency (EPA) and comply with the National Emissions Standards for Hazardous Air Pollutants (NESHAP).

For more information about air and SPDES permits see the *Environmental Compliance Summary: Calendar Year 1995* (pp. il and li). Environmental permits are listed in *Appendix B* (pp. B-5 through B-9).

Exposure Pathways Monitored at the West Valley Demonstration Project

The major near-term pathways for potential movement of possible 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 as well as various water effluent points and surface water drainage locations. Samples of air, water, soils, and biota from the environment surrounding the site would indicate any radioactivity that might reach the public from site releases. Extensive groundwater monitoring addresses many long-term pathway concerns.

Water and Sediment Pathways

Process waters are collected in a series of on-site lagoons for treatment before being discharged. (The location of the lagoons is noted on Fig. 2-3 [p. 2-5] in *Chapter 2, Environmental Monitoring*.) Samples of this effluent and the effluent at three other discharge points are collected regularly or, in the case of lagoon 3, when the lagoon water is released. The samples are analyzed for radiological parameters, including gross alpha and gross beta, tritium, strontium-90, and gamma radionuclides, and for nonradiological parameters, including pH and conductivity. Additional analyses of composite samples determine metals content, solids, biochemical oxygen demand, nitrates, nitrites, ammonia, sulfate, organic chemicals, and specific isotopic radioactivity.

On-site groundwater and surface water samples are collected regularly and analyzed, at a minimum, for gross alpha and 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 radionuclides, pH, and conductivity.

Off-site surface waters, primarily from Cattaraugus Creek and Buttermilk Creek, are sampled both 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-1* [pp. C1-1 through C1-25] 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 and groundwater quality parameters and for nonradiological parameters such as volatiles, semivolatiles, and metals, as well as specific analytes of interest at particular monitoring locations. (See Table 3-2 [p. 3-15] and Table 3-3 [p. 3-20] in *Chapter 3, Groundwater Monitoring*.)

Air Pathways

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 nuclides.

Iodine-129 and tritium also are measured in effluent ventilation air. At two locations silica gel-filled columns are used to extract water vapor that is then distilled from the desiccant and analyzed for tritium. Five samplers contain activated charcoal adsorbent that is analyzed for iodine-129. The silica gel column distillates are analyzed weekly; 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-9 [p. A-55] in *Appendix A* for these four off-site air sampling locations.) Six samplers are located on the perimeter of the WNYNSC. (See Fig. 2-2 [p. 2-4] in *Chapter 2, Environmental Monitoring*.) These samples are analyzed for parameters similar to the effluent air samples. (See *Appendix C-2* [pp. C2-1 through C2-24] 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 occurred at Chernobyl. 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 determined by analyzing soil collected annually at each of the six perimeter and four off-site air samplers. (See *Appendix C-2* [p. C2-23] for fallout data summaries and *Appendix C-1* [pp. C1-23 through C1-25] for soil data summaries.)

Food Pathways

A potentially significant pathway of radioactivity to humans is through eating produce and domesticated farm animals raised near the WVDP and through 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 and its tributaries at various distances downstream from the WVDP. Venison is sampled from the deer herd ranging within the WNYNSC. Beef, milk, hay, and produce are collected at nearby farms and at selected locations well away from any possible WVDP influence. (See *Appendix C-3* [pp. C3-1 through C3-8] 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 situated around the site perimeter and access road and at background locations remote from the WVDP. The TLDs are retrieved quarterly and for the first three quarters of 1995 were processed on-site to obtain the integrated gamma exposure. A contract with an off-site service to prepare and process TLDs was placed in 1995. (See *Appendix D*, Table D-4 [p. D-7] for a comparison of on-site and subcontract results.)

Forty-three measurement points were used in 1995. (See *Appendix C-4* [pp. C4-1 through C4-5] for a summary of the direct radiation data.)

Meteorological Monitoring

Meteorological data are continuously gathered and recorded on-site. Wind speed and direction, barometric changes, temperature, and rainfall are all measured. Such data are valuable in evaluating long-term geohydrological trends and in developing airborne dispersion models. In the event of an emergency, immediate access to the most recent data is indispensable for predicting the path and concentration of any materials that become airborne. (See *Appendix C-6* [pp. C6-1 through C6-9] 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. Audits 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 D* [pp. D-1 through D-7] for a summary of crosscheck performance.) Outside laboratories contracted to perform analyses for the WVDP also are regularly subjected to performance audits.

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 planned actions for their implementation.

ENVIRONMENTAL COMPLIANCE SUMMARY

CALENDAR YEAR 1995

Introduction: Compliance Program

The primary mission of the West Valley Demonstration Project (WVDP) is to develop and demonstrate a safe method of solidifying high-level radioactive mixed waste. Vitrification, the selected method, converts radioactive and hazardous materials into a glass-like substance by incorporating the materials into the glass structure. The treatment process is regulated by various federal and state laws and regulations in order to 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 Order 5400.1 requires the preparation of this annual Site Environmental Report, which is intended to summarize environmental data gathered during the calendar year, describe significant programs, and confirm compliance with environmental regulations.

In September 1981, pursuant to the WVDP Act, the DOE and the U.S. Nuclear Regulatory Commission (NRC) entered into an agreement that established procedures for review and consultation by the NRC with respect to DOE activities at West Valley. The review and consultation is conducted informally and does not include formal or required procedures or actions by the NRC.

The major federal environmental laws 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. Regulations developed in accordance with 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 performing audits. The DOE issues Orders under the Atomic Energy Act (AEA) to regulate its own activities regarding radioactive materials.

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 exposure standards for such emissions to protect human health and the environment. The WVDP applies to NYSDEC and the EPA for permits that allow the site to release limited concentrations of radiological and nonradiological constituents through controlled and monitored discharges of water and air. These concentrations have been determined to be safe for humans and the environment. The permits describe the discharge points, list the limits on those pollutants likely to be present, and define the sampling and analysis schedule where required.

Inspections and audits are conducted routinely by the EPA, NYSDEC, the NRC, the New York State Department of Health (NYSDOH), and the Cattaraugus County Health Department. On-site and off-site radiological monitoring in 1995 confirmed that site activities were conducted well within state and federal regulatory limits. However, some nonradiological State Pollutant Discharge Elimination System (SPDES) permit limits were exceeded. (These exceedances are described in more detail in the section on the Clean Water Act.) No notices of violation were issued and efforts have been made to eliminate the potential for these exceedances to recur.

Management at the WVDP continued to provide strong support for environmental compliance issues. 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.

An operational readiness review (ORR) for radioactive operations was conducted by the DOE in November 1995. In preparation for the ORR, a comprehensive review of all site programs was performed. (See **Project Assessment Activities in 1995** [p. lviii].)

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 1995.

Compliance Status

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. Generators are responsible for ensuring the proper treatment, storage, and disposal of their wastes under RCRA.

Various federal agencies have specific responsibilities under RCRA. The EPA is 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 administer these regulations to NYSDEC. In May 1990 the state of New York was authorized by the EPA to administer a radioactive mixed waste management program. The U.S. Department of Transportation is responsible for issuing guidelines and regulations for the labeling, packaging, and spill-reporting provisions for hazardous wastes in transit.

Each facility that treats, stores (for more than 90 days), or disposes of hazardous waste at that facility must apply for a permit from the EPA (or state, if authorized). The permit defines the treatment processes to be used, the design capacity of these processes, the location of hazardous waste storage units, and the hazardous wastes to be handled. In 1984 the DOE notified the EPA of hazardous waste activities at the WVDP, identifying the WVDP as a generator of hazardous waste. In June 1990 the WVDP filed a RCRA Part A Permit Application with NYSDEC. Based on that submittal, 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. In September 1995 the WVDP amended the Application to incorporate the addition of a mixed waste storage area for high integrity containers, the addition of silver to the characterization of the THOREX waste stream (see *Chapter 1* [p.1-7]), and the deletion of two unused mixed waste storage tanks.

Hazardous Waste Management Program

To dispose of hazardous wastes generated from on-site activities, the WVDP uses permitted transportation services to ship RCRA-regulated wastes to treatment, storage, or disposal facilities (TSDFs). In 1995 the WVDP shipped approximately 49.8 metric tons (55 tons) of nonradioactive, hazardous waste off-site. Of this amount, 1.5 metric tons (1.7 tons) were recycled by the TSDFs.

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 generator of the waste within the NYSDEC statutory 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 were required to be filed in 1995.

Hazardous waste activities must be reported to NYSDEC every year through the submission of an annual hazardous waste report. This report lists the quantities of each waste type generated, the TSDFs used, and the type of treatment the wastes received.

In addition, a hazardous waste reduction plan must be filed every two years and updated annually. This plan, which documents the efforts to minimize the generation of hazardous waste, was first submitted to NYSDEC in 1990. The plan was most recently submitted in 1994 and revised in 1995.

Annual inspections to assess compliance with hazardous waste regulations were conducted by NYSDEC (March 16, 1995) and the EPA (July 20, 1995). No deficiencies were noted during the inspections.

Nonhazardous, Regulated Waste Management Program

The WVDP transported approximately 162.8 metric tons (179.6 tons) of nonradioactive, nonhazardous material off-site to TSDFs in 1995. Of this amount, 7.1 metric tons (7.9 tons) were recycled or reclaimed. The industrial waste materials included items such as concrete, asbestos debris, monitoring-well purge water, and neutralized acidic wastewaters. Some of the regulated materials recycled/reclaimed included lead acid batteries and nonhazardous oil. In 1995 the WVDP also shipped approximately 1,835 metric tons (2,023 tons) of sewage-treatment waste to permitted wastewater treatment facilities.

Radioactive Mixed Waste (RMW) Management Program

Radioactive mixed waste contains both a radioactive component, regulated under the AEA, and a hazardous component, regulated under RCRA. Both the EPA and NYSDEC oversee radioactive mixed waste management at the WVDP. Potential conflicts between AEA and RCRA requirements led the WVDP to initiate discussions with the EPA and NYSDEC. 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, Inc. (WVNS), the primary contractor for the DOE at the WVDP. The FSFCA addresses the requirements for managing the hazardous component of the radioactive mixed waste such as compliance with the Land Disposal Restrictions of RCRA for radioactive mixed waste, specifies particular storage requirements for radioactive mixed waste, and requires the characterization of historical wastes stored at the WVDP. The characterization of historical wastes continued during 1995.

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 regulatory agencies requiring the treatment of the inventories according to the approved plans.

DOE facilities developed site treatment plans in three steps: conceptual, draft, and proposed. The WVDP's conceptual plan was submitted to NYSDEC in October 1993 and the draft plan in August 1994. The WVDP submitted the proposed site treatment plan to NYSDEC in March 1995. The proposed plan is comprised of two volumes: the Background Volume and the Plan Volume. The Background Volume provides information on each radioactive mixed waste stream as well as information on the preferred treatment method for the waste. The Plan Volume contains proposed schedules for treating the radioactive mixed waste to meet the Land Disposal Restrictions requirements of RCRA. Each submittal to NYSDEC underwent a public comment period during which input was solicited from WVDP stakeholders.

Upon approval of the proposed plan by NYSDEC, the DOE and NYSDEC will enter into a consent order requiring compliance with the Plan Volume of the treatment plan. Since March 1995, the DOE has been negotiating the terms of the consent order with NYSDEC. The DOE expects that the consent order will be executed in May 1996.

RCRA Facility Investigation (RFI) Program

The DOE and NYSERDA entered into a 3008(h) Administrative Order on Consent under RCRA with NYSDEC and the EPA in March 1992. The Consent Order requires NYSERDA and the DOE West Valley Area Office to conduct RCRA facility investigations at solid waste management units (SWMUs) 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 identified in the Consent Order, twenty-five SWMUs were grouped into twelve super solid waste management units (SSWMUs) to facilitate investigative efforts under the RCRA facility investigation (RFI) program.

In general, the purpose of an RFI is to collect and evaluate information to determine which of the following actions are appropriate for each SWMU or SSWMU: no further action; a corrective measures study; or additional investigations to support one of these other actions. The RFI addresses RCRA-regulated hazardous wastes or hazardous constituents. To define and assess the environmental settings, unit and waste characteristics, and the potential sources and extent of nonradiological contamination, the WVDP has reviewed existing information, collected and analyzed more than two hundred surface soil, subsurface soil, and sediment samples, and collected and reviewed groundwater data.

Of the twelve SSWMUs, two have been identified to date as requiring no further action: #10, the integrated radwaste treatment system drum cell, and #12, the hazardous waste storage lockers. The remaining ten were assessed as part of the RFI program to determine the appropriate actions to be taken. Seven draft SSWMU assessment reports were submitted to the EPA and NYSDEC for review in 1995. The remaining draft SSWMU assessment reports will be submitted in 1996, with the last report being submitted to the EPA and NYSDEC by May 1996.

In May 1994 sixteen rooms previously used during nuclear fuel reprocessing operations were evaluated under the RFI program, as required by the Consent Order. In December 1994 the EPA and NYSDEC reviewed the evaluation and issued a determination of "no further action" for eight of the rooms. Additional information on the remaining eight rooms was requested and submitted to the EPA and NYSDEC.

A discussion of the NRC-licensed disposal area (NDA) interceptor trench and pretreatment system, as required under the NDA Interim Measures Work Plan, is found under **Special Monitoring** (p. 2-30) in *Chapter 2, Environmental Monitoring*.

Waste Minimization and Pollution Prevention

The WVDP has initiated a long-term program to minimize the generation of low-level radioactive waste, radioactive mixed waste, hazardous waste, industrial waste, and sanitary waste as directed by Executive Order 12856, Federal Compliance with Right-to-Know and Pollution Prevention Requirements. 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 hazardous waste by 50% by December 1, 1999. (This waste reduction determination does not include vitrification-related wastes: baseline information for these wastes was not available in 1993.) The generation of industrial and sanitary waste will be reduced by 30% by the same date. Toward that end, the WVDP set the following cumulative waste-reduction goals for 1995: an 18% reduction in the generation of low-level radioactive waste, radioactive mixed waste, and hazardous waste; a 14% reduction in industrial waste; and a 6% reduction in sanitary waste.

The WVDP met or exceeded the 1995 reduction goals for all six waste categories. Low-level radioactive waste generation was reduced by 55%, radioactive mixed waste generation by 80%, and hazardous waste generation by 37%. Industrial waste generation was reduced by 16% and sanitary waste generation by 25%.

Specific accomplishments in waste minimization and pollution prevention during 1995 included the following:

- The WVDP instituted a sitewide paper recycling program in March 1993. In 1995, 242 metric tons (267 tons) of paper were recycled, 75.7% more than in 1994.
- 82.1 metric tons (90.5 tons) of carbon steel, stainless steel, and copper were recycled.
- 1.5 metric tons (1.7 tons) of hazardous waste were recycled.
- 7.1 metric tons (7.8 tons) of nonhazardous, regulated waste were recycled in 1995.

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, codified at Title 40 Code of Federal Regulations (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. Facilities with tanks in service on December 22, 1988, were allowed a grace period for installing the upgrades.

New York State also regulates underground storage tanks through two programs, petroleum bulk storage (6 NYCRR Parts 612 - 614) and chemical bulk storage (6 NYCRR Parts 595 - 599). The 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.

The WVDP does store petroleum products in three regulated, 2,000-gallon underground tanks. Two of the tanks contain unleaded gasoline. The third tank contains low-sulfur diesel fuel. Procedural controls in conjunction with metered delivery provide overfill protection and spill prevention. The tank fill ports are color-coded as required. Leak detection requirements are met through daily tank-gauging, inventory records, and monthly reconciliations of the product added, product removed, and the current contents. Annual tank tightness and integrity testing was conducted on November 1, 1995.

A fourth regulated tank, a 550-gallon underground storage tank, is used to store diesel fuel for the standby power plant for the supernatant treatment ventilation blower system. This tank, a double-walled tank with an interstitial leak-detection system (see *Glossary*), is filled by a metered delivery system and is monitored through daily gauging and monthly reconciliations. The tank's fill port is also color-coded in accordance with American Petroleum Institute standards.

In accordance with 40 CFR Part 280.21, these underground tanks must be upgraded to meet the requirements for new or substantially modified underground storage tanks (e.g., corrosion protection, interior lining) by December 22, 1998, or be permanently closed.

Registration for all regulated underground tanks is renewed with NYSDEC as required.

New York State-regulated Aboveground Storage Tanks

The state of New York regulates aboveground petroleum storage under 6 NYCRR Parts 612, 613, and 614. Aboveground hazardous 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 internal inspections. Furthermore, petroleum tank fill ports must be color-coded and chemical tanks labeled to indicate the product stored.

One petroleum and four chemical bulk storage aboveground tanks were permanently closed in 1995. Registration for all regulated aboveground tanks is renewed with NYSDEC as required. At the end of 1995, seven aboveground petroleum tanks and fifteen aboveground chemical storage tanks were registered. Three of the petroleum tanks contain No. 2 fuel oil; the remainder contain diesel fuel. Twelve 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.

The Quality Assurance department inspects the aboveground petroleum tanks on a monthly basis. In December 1995 an inspection of all aboveground, hazardous substance storage tanks was conducted to fulfill the new requirements for annual inspection (6 NYCRR Part 598.7 (c)). No violations were noted during the inspection.

Closed Nonradioactive Construction Debris Disposal Facility

Ongoing maintenance required for the construction and demolition debris landfill, closed under New York State regulation 6 NYCRR 360, is discussed under **Special Monitoring** (p. 2-33) in *Chapter 2, Environmental Monitoring*.

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 the medical wastes generated. Medical wastes are autoclaved by the disposal firm to remove the associated hazard and then disposed. Approximately 32 kilograms (70 lbs) of medical waste were disposed in 1995.

Clean Air Act (CAA)

The Clean Air Act establishes a framework for the EPA to regulate air emissions from both stationary and mobile sources. NYSDEC is currently adopting regulations to implement the CAA requirements. In New York State, permits for stationary sources emitting regulated pollutants, including hazardous air pollutants, are issued by either the EPA or NYSDEC. Sources requiring permits are those that emit a regulated pollutant, which is above a predetermined threshold, from a particular source through a stack, duct, vent, or other similar opening. Under the CAA, this type of air emission is considered a point source. Non-point sources of emissions, such as lagoons and soil piles, do not require specific permits from the EPA or NYSDEC. Emissions from these sources are, however, quantified for reporting purposes to both the EPA and NYSDEC.

Emissions of radionuclides from the WVDP are regulated by the EPA under the National Emission Standards for Hazardous Air Pollutants (NESHAP [40 CFR Part 61]). Currently, the WVDP has permits for six radionuclide sources. In May 1995 the WVDP received interim approvals from the EPA to operate two additional sources: 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. The WVDP reports the radionuclide emissions from its non-permitted and permitted sources to the EPA annually in accordance with NESHAP requirements. Calculations to demonstrate compliance with NESHAP radioactive emissions standards showed 1995 doses to be less than 0.01% of the 10 millirem standard.

Nonradiological sources of air emissions are regulated by NYSDEC. The WVDP has thirty permits-to-construct (PCs) and certificates-to-operate (COs) nonradiological point sources. In 1995 four PCs were converted to COs for the cold chemical facility and the vitrification facility HVAC system. These COs expire in 1999. Eight COs were renewed in 1995; the renewals expire in 1999. The vitrification facility off-gas system PC was extended in 1995 to allow for the completion of construction and start-up testing. An application to convert the PC to a CO will be requested from NYSDEC after completion of a nitrous oxide stack test, which will be performed to verify emissions and the accuracy of the monitoring system. The testing is scheduled for completion during the second quarter of 1996.

The air permits in effect at the WVDP in 1995 are listed in *Appendix B,* Table B-3 (p. B-5 through B-9).

NYSDEC conducted its annual inspection of air emission sources at the WVDP on October 3, 1995. No violations were noted during the inspection. The EPA did not inspect the radionuclide sources in 1995.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act authorizes the EPA to prioritize and regulate the cleanup of certain inactive hazardous waste disposal sites. In addition, the EPA regulates the response to hazardous substance spills and releases under this authority. The EPA collects data and prioritizes sites according to their potential to cause adverse human health or environmental effects. The sites with the highest priority are placed on the National Priority List.

On February 5, 1993, the WVDP was added to the EPA's Federal Agency Hazardous Waste Compliance docket as established under CERCLA. As required under CERCLA Section 120(c), a preliminary assessment of the WVDP was conducted in accordance with criteria established in the National Contingency Plan. On October 3, 1993, the preliminary assessment was submitted to the EPA for review. On April 11, 1995 the EPA deleted the WVDP from the Federal Agency Hazardous Waste Compliance docket based on the determination that the site of the WVDP is not federally owned (60 FR 18474). No further activity pursuant to CERCLA Section 120 is anticipated. Site activities continue to be conducted in accordance with the WVDP Act and the RCRA corrective action process.

Emergency Planning and Community Right-to-Know Act (EPCRA)

The Emergency Planning and Community Right-to-Know Act is a statute 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 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 and 303), extremely hazardous substance (EHS) release notification (Section 304), material safety data sheet (MSDS)/chemical inventory (Sections 311 and 312), and toxic release inventory (TRI) reporting (Section 313).

The WVDP complied with these provisions in 1995 as follows and as summarized in the EPCRA compliance table.

- In May 1995 a WVDP representative attended the annual meeting of the Cattaraugus County Local Emergency Planning Committee (Sections 302 - 303). Meetings held by Cattaraugus and Erie County Emergency Management Services were attended as well.

- In 1995 the WVDP complied with all necessary EPCRA reporting requirements. There were no releases that triggered any release notifications (Section 304). As such, no release notifications were required.

- Under Section 311 the WVDP reviews information on reportable chemicals on a quarterly basis. If a new hazardous chemical, which has not been previously reported, is stored on-site in an amount exceeding the threshold planning quantity, an MSDS and an updated hazardous chemical list is submitted to the local emergency response groups. This supplemental reporting ensures that the public and the emergency responders have current information about the chemicals on-site. All reports were submitted on time.

- Under Section 312, the WVDP submits annual reports to state and local emergency response organizations and fire departments that specify the quantity, location, and hazard associated with chemicals stored on-site. In 1995 sixteen reportable chemicals above regulatory threshold planning quantities were stored on-site.

- Under Section 313, the WVDP submitted a toxic release inventory report to the EPA in 1995 for sulfuric acid use and release during calendar year 1994.

1995 EPCRA Compliance Table

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.

Clean Water Act (CWA)

The Clean Water Act of 1972, as amended, authorizes the EPA to regulate discharges to waters of the United States, including lakes and streams, through the National Pollutant Discharge Elimination System permit program. The EPA has delegated this authority to the state of New York, which issues State Pollutant Discharge Elimination System (SPDES) permits.

Section 404 of the CWA contains regulations for the development of areas in and adjacent to the waters of the United States. U.S. Supreme Court interpretations of Section 404 have resulted in the regulatory definition of waters of the United States to include wetlands. In addition, New York State has promulgated regulations at 6 NYCRR Parts 662 through 665 for the protection of freshwater wetlands. Section 404 provides stringent controls for dredging activity and the disposal 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.

SPDES-permitted Outfalls

Point source effluent discharges to surface waters at the WVDP are permitted through the New York SPDES program. The WVDP has three SPDES-permitted outfalls, all of which discharge to Erdman Brook.

- Outfall 001 (WNSP001) receives the treated liquid discharge from the low-level waste treatment facility (LLWTF). The treated wastewater is held in lagoon 3, sampled and analyzed, and periodically released upon notifying NYSDEC.

  In 1995 treated wastewater from the LLWTF was discharged in five batches that totaled 39 million liters (10.3 million gal) for the year. The annual average concentration of radioactivity at the point of release was 43% of the DOE's derived concentration guides (DCGs). (See also *Chapter 1* [p. 1-8].) None of the individual releases exceeded the DCGs. (See Table B-1 [p. B-3] in *Appendix B*.)

- Outfall 007 (WNSP007) receives the effluent discharge from the site sanitary and industrial wastewater treatment plant, which includes wastewater from sewage and various nonradioactive industrial and potable water treatment systems. The average daily flow in 1995 was 70,000 liters (18,500 gal).

- Outfall 008 (WNSP008) receives 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 in 1995 was 8,200 liters (2,200 gal).

The site's SPDES permit, reissued February 1, 1994, includes additional chemical monitoring requirements and, in some cases, applies more stringent effluent limitations. A new calculation method that accounts for naturally occurring variations in iron in discharges from the site also was instituted. In addition, a method for augmenting the discharge at outfall 001 with raw (untreated) reservoir water was approved by NYSDEC as a means of ensuring that stream water quality standards for total dissolved solids are met.

A Schedule of Compliance in the permit itemizes a number of major compliance actions and required completion dates for each item. In accordance with the Schedule, the following actions were completed in 1995: the installation of equipment to monitor flow in Frank's Creek and an investigation and report on the source and extent of groundwater contamination from the north plateau and alternative methods for preventing further migration of the contamination. (See **Current Issues and Actions** [p. lvi].) In June 1995 the SPDES permit was modified to include chemical additives for the closed-loop cooling system and steam condensate. No additions to the Schedule of Compliance were required as a result of this modification.

The SPDES permit limits were exceeded six times in 1995 at outfall 007:

- The daily maximum limit of 0.1 mg/L for nitrite, measured as nitrogen, was exceeded in January and March at outfall 007. On January 13, 1995, the nitrite level was 0.89 mg/L. On March 3 and 8, 1995, the nitrite level was 11.6 mg/L and 2.5 mg/L, respectively. These increases were attributed to temperature fluctuations in the treatment system wastewater: decreases in temperature facilitate the conversion of chloramines to nitrogen trichloride and inhibit completion of the process that converts ammonia to nitrite and then nitrate. Efforts are currently under way to maintain the liquid levels in the outdoor, influent flow equalization basin as low as possible during winter months and to make other operational modifications to minimize the effect of temperature changes on treatment system performance.

- The five-day biochemical oxygen demand (BOD-5) daily maximum limit of 10.0 mg/L was exceeded at outfall 007 twice in February. On February 2, the BOD-5 level was 21.9 mg/L, and on February 8 the level was 178.0 mg/L. The daily average limit of 5.0 mg/L for BOD-5 was also exceeded: the daily average limit for February was 59.6 mg/L. These exceptions were attributed to bulking in the clarifier, which upsets the normal process of settling and compaction of sludge in the clarifier. There are predominantly two types of bacteria that affect the sludge: filamentous and floc-forming. The bulking is caused by an overgrowth of filamentous bacteria and/or inhibited growth of floc-forming bacteria. High sucrose water may have contributed to the excessive growth of the filamentous bacteria. The growth of floc-forming bacteria can be inhibited by low dissolved oxygen levels, a low food-to-microorganism ratio, and/or a nutrient deficiency in the wastewater. To offset this condition high sucrose water as an influent source wastestream was eliminated; the frequency for back-washing the effluent polishing filter was increased from once to twice per day; and air delivery to the aeration tanks was adjusted to increase dissolved oxygen levels in the sewage.

- On August 10, a pH of 8.7 standard units was recorded for outfall 007, which exceeded the upper limit of 8.5. Operational test data for grab samples of the effluent from the last treatment stage (i.e., dechlorination chamber) for the wastewater treatment facility indicated that the pH was 8.10 on August 9 and 11, 1995. In addition, a process control sample was taken on August 10, which indicated that the pH was less than 8.0 and within the normal operating range of the system for that month.

Given these results, the exceedance was attributed to a faulty reading or error in transcription of the reading.

No notices of violation were issued as a result of any permit exceedances. Although these exceedances did not result in any significant effect on the environment, the WVDP is continuing to work closely with NYSDEC to prevent their recurrence.

On March 28, 1995, NYSDEC conducted its annual inspection of the SPDES outfalls, waste water treatment facilities, and data management system at the WVDP. At the request of the inspector, a tour was given of the SPDES outfalls, the sanitary and wastewater treatment facility, and the north plateau. No violations were noted during the inspection.

Wetlands

In 1993, a wetlands investigation was conducted under Section 404 of the CWA, which identified forty-five wetland units on a 550-acre area that includes the 200-acre WVDP site and adjacent parcels north, south, and east of the site. A report documenting the wetlands investigation and delineation was submitted to the U.S. Army Corps of Engineers and NYSDEC in June 1994.

NYSDEC reviewed the report and inspected the site, determining that a group of eight contiguous wetlands met the criteria for regulation as a single unit. The grouped wetlands will be included on the next proposed amendment to the official New York State Freshwater Wetlands Map for Cattaraugus County. Any work conducted within a mapped wetland or within 100 feet of a mapped wetland requires NYSDEC approval. The WVDP notifies the U.S. Army Corps of Engineers and NYSDEC of proposed actions that have the potential to affect these wetlands and that are not specifically exempted from regulation or notification. No notifications were required in 1995.

Petroleum and Chemical Product Spill Reporting

The WVDP has a Spill Notification and Reporting Policy to ensure that all spills are properly managed, documented, and remediated in accordance with applicable regulations. The policy identifies the departmental responsibilities for spill management and illustrates the proper spill control and clean-up 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 do not go unnoticed.

Under an agreement with NYSDEC, the WVDP reports on-site spills of petroleum products of 10 gallons or less onto an impervious surface (such as blacktop) in a monthly log. Spills greater than 10 gallons that do not affect ground- or surface water or enter a drainage system must be reported to NYSDEC within twenty-four hours and entered in the monthly log. Spills of any amount that travel to waters of the state (i.e., groundwater, surface water, drainage systems) must be reported immediately to the NYSDEC spill hotline and entered in the monthly log. The WVDP also reports spills of hazardous substances in accordance with reporting requirements under CERCLA, EPCRA, the CAA, RCRA, and New York's Hazardous Waste Management Program.

Petroleum and chemical-product spills were entered in the monthly log throughout the year. However, under the reporting protocol, no spills required immediate notification of NYSDEC. All spills were cleaned up in a timely fashion in accordance with the WVDP Spill Notification and Reporting Policy, and the collected materials were characterized for shipment to a TSDF. None of the spills resulted in any adverse environmental impact.

Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act 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. The drinking water quality program in the state of New York is administered by NYSDOH through county health departments.

The WVDP obtains its drinking water from surface water reservoirs on the Western New York Nuclear Service Center (WNYNSC) site and is considered a nontransient, noncommunity public water supplier. The Project'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 (organic and inorganic) to monitor water quality. The results of these analyses are reported to the Cattaraugus County Health Department. In turn, the Cattaraugus County Health Department also independently collects a monthly sample of WVDP drinking water to determine bacterial and residual chlorine content. The microbiological samples analyzed in 1995 produced satisfactory results and the free chlorine residual measurements in the distribution system were positive on all occasions, indicating proper disinfection. In 1993, 1994, and 1995, the WVDP sampled and tested for lead and copper in the site's drinking water in accordance with EPA and NYSDOH regulations. The analytical results to date show lead levels to be above the action level of 15 μg/L at several locations in the distribution system. NYSDOH regulations require an evaluation of potential water treatment actions and the preparation of a Corrosion Control Plan. In March 1994 the WVDP submitted its plan to the Cattaraugus County Health Department. The Corrosion Control Plan was reviewed by the Cattaraugus County Health Department and NYSDOH. Based on the review, NYSDOH recommended that the WVDP adjust the pH to control lead levels in the water distribution system. The WVDP is currently implementing a program to reduce the level of those metals in the treated water.

Employees at the WVDP are made aware of the elevated lead levels through a public education program. Though not required, notices have been posted at locations where elevated lead levels have been measured advising employees not to consume water from that location.

Other than the lead action-level exceedance noted above, monitoring results in 1995 indicate that the Project's drinking water meets NYSDOH drinking water quality standards.

The Cattaraugus County Health Department conducted its annual inspection of the WVDP water supply system on November 7, 1995. No detrimental findings or notices of violation were issued.

There were several changes in the 1995 site drinking water program:

- A new water clarifier was installed and the temporary clarifier dismantled.
- Plans to install a new potable water storage tank were approved. The installation is scheduled for 1996.
- In August 1995, after conducting a synthetic organic chemicals analysis and two watershed inspections, the Cattaraugus County Health Department determined that the WVDP water supply was not vulnerable to synthetic organic chemicals contamination. As a result, the WVDP is not required to conduct any additional synthetic organic chemical sampling.

Toxic Substances Control Act (TSCA)

The Toxic Substances Control Act of 1976 regulates the manufacture, processing, distribution, and use of chemicals, including polychlorinated biphenyls (PCBs). In 1995 the WVDP continued to manage radioactively contaminated PCB wastes as radioactive mixed wastes because PCBs are a listed hazardous waste in New York State. These wastes originated from a dismantled hydraulic power unit inside the former reprocessing facility and from two radiologically contaminated capacitors that contained PCB fluids. To comply with TSCA, the WVDP maintains an annual document log that details PCB use and storage on-site and any changes in storage or disposal status.

National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969, as amended, establishes a national policy for the protection of the environment (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 to fulfill these goals. The CEQ regulations for implementing NEPA are promulgated at 40 CFR Parts 1500 - 1508.

Since 1990 the DOE has been revising its NEPA-compliance procedures and guidelines. On May 26, 1992, the CEQ approved DOE's procedures, which are promulgated at 10 CFR Part 1021. During 1995 the WVDP participated in the DOE's initiative to revise DOE NEPA procedures. On January 20, 1996, the DOE published it proposed amendments to 10 CFR Part 1021 in the Federal Register for a 45-day public comment period. After incorporating public comments, the DOE plans to publish the final rule in June 1996. Until that time, the WVDP continues to follow the existing DOE NEPA procedures (10 CFR Part 1021).

NEPA requires that all federal agencies that propose actions having 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). If a proposed action will have an insignificant effect on the environment, it is excluded from further environmental review under a categorical exclusion. If a proposed action will have the potential to affect the environment, then it requires an environmental assessment. If the results of the assessment indicate that the action will have no significant effect, then a finding of no significant impact is issued. A proposed action that has the potential to significantly affect the environment requires an environmental impact statement.

Both environmental assessments and environmental impact statements are made available to the public. NEPA requires that the public be notified and given the opportunity to review and comment on environmental impact statements. In 1993 the Secretary of Energy established guidelines that provide the public the opportunity to review and comment on environmental assessments.

1995 NEPA Activities

Eight proposed actions were reviewed under the DOE NEPA-implementing regulations in 1995. The proposed actions included activities such as routine site maintenance, trailer removal, and upgrades to on-site petroleum storage tanks. All eight of the proposed actions were categorically excluded.

In 1994 the WVDP prepared two environmental assessments. The first assessment evaluated the construction and operation of a contaminated soil consolidation area to provide temporary storage of low-level radiologically contaminated soil that has been excavated at the WVDP. On July 10, 1995, the DOE approved this environmental assessment and issued a finding of no significant impact for the proposed action.

The second environmental assessment evaluated a proposal for off-site, commercial treatment of Class A low-level radioactive waste and low-level radioactive mixed waste generated by the WVDP. The proposed action involves shipping the waste from the WVDP to a commercial facility for volume-reduction and then shipping the volume-reduced waste back to the WVDP. The action was proposed to make full use of existing storage facilities at the WVDP and to minimize the construction of new waste storage. On November 29, 1995, after responding to public comments on the proposed action, the DOE approved the environmental assessment and issued a finding of no significant impact.

Preparation of the draft environmental impact statement for completion of the WVDP and closure or long-term management of the facilities at the WNYNSC continued in 1995. Five alternatives are being evaluated for the statement. The draft environmental impact statement was submitted for public review and comment on March 22, 1996.

In June 1993 the Federal Court for the District of Idaho ruled that the DOE was required to prepare an environmental impact statement for spent nuclear fuel management. In June 1995 the DOE issued a record of decision for DOE/EIS-0203, Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, which announced the department-wide decision to regionalize spent nuclear fuel management by fuel type for DOE-owned spent nuclear fuel from 1995 until the year 2035. Regionalized management will result in shipment of the fuel assemblies that remain at the WVDP to the Idaho National Engineering Laboratory (INEL) for long-term storage.

To fulfill all the requirements established by the court, however, the DOE and the Attorney General of Idaho had to reach a settlement agreement. The settlement agreement that was reached on October 16, 1995 establishes terms and conditions for the receipt of spent nuclear fuel at INEL. These conditions apply to DOE actions at INEL and elsewhere in the DOE complex. Provided that the terms and conditions are met by DOE and found acceptable by the state of Idaho, the West Valley fuel assemblies could be shipped to INEL as early as January 1, 2001.

Summary of Permits

The environmental permits in effect at the WVDP in 1995 are listed in *Appendix B*, Table B-3 (p. B-5 through B-9).

Current Issues and Actions

RCRA Facility Investigation

Identifying and evaluating SWMUs at the WVDP to ensure compliance with the requirements of the RCRA 3008(h) Administrative Order on Consent continued in 1995. Two draft SWMU assessments and seven draft RFI reports were submitted to the EPA and NYSDEC. The current focus of the RFI program is on finalizing these reports and submitting the two RFI draft reports that remain.

Clean Water Act

SPDES Permit

The SPDES permit includes a Schedule of Compliance, which itemizes a number of major compliance actions and each required completion date. In accordance with the Schedule, equipment to augment and monitor flow in Frank's Creek was installed and an investigation into the source and extent of contamination in the north plateau and the identification of potential contaminant control methods was conducted. In June 1995 the SPDES permit was modified to include chemical additives for the closed-loop cooling system and steam condensate. No additions to the Schedule of Compliance were required as a result of this modification.

Flow Augmentation

During the summer of 1995 a flow measurement device (Parshall flume) was installed in Frank's Creek to measure flow and maintain compliance with a new permit limit for total dissolved solids in the stream. Approval to install these devices was received from NYSDEC and the U.S. Army Corps of Engineers in November 1994. The approval, a permit under the Nationwide Permit Program for the development of areas adjacent to waters of the United States (33 CFR Part 330), was received from the Corps. Flow augmentation was not required in 1995 because the measured level of total dissolved solids was below the limit specified in the SPDES permit.

Groundwater Investigation

Increased levels of gross beta radioactivity in water seeping from a localized area of wet ground northeast of the process building were identified in December 1993. Strontium-90 was identified as the primary radionuclide responsible for the elevated gross beta levels.

In 1994 an investigation was conducted to determine the nature and extent of the groundwater contamination and to identify potential sources. The primary source of the contamination was traced to an area in the southwest corner of the process building where acid recovery operations had been conducted in the past as part of nuclear fuel reprocessing. In April 1995 a report was prepared to document the investigation and this information was reported to NYSDEC.

In November 1995 the WVDP installed a groundwater pump-and-treat system to mitigate the movement of strontium-90 contamination in the groundwater. Two 15-foot-deep recovery wells, installed near the leading edge of the groundwater plume, collect contaminated groundwater from the underlying sand and gravel. The treatment system uses an ion-exchange column to remove the strontium-90 from the groundwater. The system is operated in conjunction with the WVDP low-level waste treatment facility. After the groundwater is treated, it is discharged to lagoons 2, 4, or 5 at the low-level waste treatment facility. Approximately 935,000 liters (247,000 gallons) were processed through the system in 1995.

The pump-and-treat system is currently being evaluated along with other technologies to determine if there are more effective methods for treating the groundwater.

Storm Water Discharge Permit

In 1992 the WVDP submitted an application for an individual permit for storm water discharges associated with industrial activity. The application included characteristic analytical results from sampling conducted at three locations in 1991. These monitoring locations comprised all storm water discharged from the WVDP but also included base flow for the receiving water at the sample points. NYSDEC requested that the sampling points be moved to locations with no base flow to differentiate the quality of the storm water discharges from the receiving water. In response to the request, thirty-three on-site monitoring points were identified in 1994. Clean Water Act regulations allow petitioning to group identical discharges for monitoring and reporting. NYSDEC accepted the WVDP's petition to group several of the discharge points.

As such, eleven storm water outfalls were monitored in 1995. Two samples were collected from each outfall, a first-flush sample collected within roughly the first half-hour of the storm event and a flow-weighted composite collected during the first three hours of the storm event. The storm water samples were analyzed for parameters identified in the existing SPDES permit. In 1996 the WVDP will submit a new storm water discharge permit application that identifies these outfalls.

Project Assessment Activities in 1995

As the primary contractor for the DOE at the WVDP, WVNS conducted more than eighty-nine reviews of environmentally related activities in 1995. These included four assessments, seventy-one surveillances, and fourteen line management self-assessments. (See p. 4 of the *Glossary*.) In addition, seven reviews were conducted by organizations external to the WVDP such as the NRC, NYSDEC, and the EPA. Overall results of the reviews reflect continuing, well-managed environmental programs at the WVDP. Significant external environmental overview activities in 1995 included an operational readiness review by the U.S. Department of Energy, Office of Environmental Management (DOE-EM); a radiological monitoring visit by the NRC; a routine annual inspection by NYSDEC for compliance with the Clean Air Act; inspections by the EPA and NYSDEC for compliance with RCRA; an inspection by NYSDEC for compliance with SPDES requirements; and an annual inspection of the WVDP potable water supply system by the Cattaraugus County Health Department. These appraisals and inspections did not identify any environmental program findings (see p. 3 of the *Glossary*) and further demonstrated the WVDP's commitment to protection of the environment.

1995 U.S. Department of Energy Operational Readiness Review

Before initiating radioactive operations WVNS conducted line management self-assessments and an operational readiness review in accordance with DOE Order 5480.31, Startup and Restart of Nuclear Facilities. Between February and September 1995, WVNS completed seven line management self-assessments, which included twenty-six separate lines of inquiry for environmental planning, permitting, notification, and monitoring as well as for the personnel and procedures associated with fulfilling these requirements. The seven assessments focused on hazardous chemical use, melter start-up, tank farm isolation, off-gas system verification, analytical and process chemistry laboratory readiness, and integrated operations. No environmental program findings were identified.

On September 30, 1995, WVNS declared readiness for nonradioactive operations to demonstrate remote operations of the vitrification system (i.e., integrated cold operations). During October, in parallel with the integrated run, WVNS completed its own operational readiness review. On October 31, 1995, WVNS declared readiness to transfer radioactive waste from the tank farm to the vitrification facility, contingent upon closure of findings and open items identified in the assessments and operational readiness review.

From November 1 through 17, 1995, seventeen representatives of DOE-EM conducted an operational readiness review to determine if West Valley was ready to conduct radioactive operations. In addition to conducting employee interviews and field observations, the DOE team reviewed the WVNS line-management self-assessments, the WVNS operational readiness review, and other documentation. Eight observations and twenty-three findings were identified. WVNS and the West Valley Area Office are currently evaluating the causes for the findings and preparing corrective action plans for submission to DOE-EM. None of the observations or findings pertained to environmental programs.

1995 U.S. Nuclear Regulatory Commission Monitoring Visit

From June 19 through 23, 1995, the NRC visited the WVDP to review programs for vitrification facility operations. The NRC examined the major liquid and gaseous release points from the WVDP site, the airborne treatment systems and sampling/monitoring capability of the major airborne release pathways associated with the vitrification process, the WVNS effluent sampling and analytical procedures and calibration techniques, representative liquid effluent sampling stations, results of the 1993 and 1994 environmental monitoring program, laboratory operations and quality assurance/quality control programs, and the WVNS line management self-assessments and operational readiness review for radioactive operations. As a result of the visit, the NRC monitor concluded that WVNS has established viable programs for protecting public health and safety. The monitor also made five technical recommendations for enhancing these programs.

Follow-up to the 1994 U.S. Department of Energy Audit

In April 1994 the DOE Idaho Operations Office conducted a comprehensive environmental, safety, health, and quality assurance functional appraisal.

The audit team evaluated environmental programs, construction safety, fire protection, nuclear safety, emergency preparedness, conduct of operations, radiological controls, industrial hygiene, firearms safety, and transportation programs. Performance-based criteria were used to assess the overall effectiveness of the evaluated programs. The appraisal identified eleven findings, twenty-three observations, and four concerns. No deficiencies were found that represented conditions or actions posing a significant threat to public health or the environment.

WVNS responded to the audit items in an action plan, which was submitted to the DOE on September 9, 1994. All items not resolved in the action plan are tracked through closure in the WVNS open items tracking system. Currently, one audit item, unrelated to environmental programs, remains open.

Follow-up to the U.S. Department of Energy 1991 and 1992 Environmental Audits

In December 1992 the WVDP received the final report by the DOE Headquarters Office of Environmental Audit on the 1992 environmental audit. The WVDP completed its final action plan and resubmitted it to DOE Headquarters in February 1993. All of the identified action items were resolved. Both the 1991 and 1992 audits have been formally closed.

ENVIRONMENTAL MONITORING PROGRAM INFORMATION

Introduction

The high-level radioactive waste (HLW) presently stored at the West Valley Demonstration Project (the WVDP or Project) is the by-product 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 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 p. 4 of the *Glossary*.) The nuclei continue to 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.

Radiation is the energy released as atomic nuclei decay. By emitting energy the nucleus moves towards a less energetic, more stable state. The energy that is released takes three main forms: alpha particles, beta particles, and gamma rays.

α *Alpha Particles*

An alpha particle 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. 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 uranium-232. At the WVDP, uranium-232 can be detected in liquid waste streams as a result of a thorium-based nuclear fuels reprocessing campaign conducted by NFS.

β *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, is an example of a beta-emitting radionuclide. Strontium-90 is found in the decontaminated supernatant.

γ *Gamma Rays*

Gamma rays are high-energy "packets" of electromagnetic radiation called photons 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 only be effectively reduced 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 Ra-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 3.7E-02 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 amount of energy necessary to lift a mosquito about 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

Potential Effects of Radiation

The biological effects of radiation can be either somatic or genetic. Somatic effects are restricted to the person 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 others. These changes may produce genetic effects and may show up in future generations. Radiation-produced genetic defects and mutations in 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 300 mrem (3 mSv), comes from natural sources. The rest comes from medical procedures, consumer products, and other manmade sources. *(See Chapter 4, Radiological Dose Assessment, p. 4-3.)*

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.

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.

evaluating potential exposure through the major pathways.

The on-site and off-site monitoring program at the WVDP includes measuring the concentration of solids containing 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.

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 a previously 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.

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 pathways are the two major means by which radioactive material can move off-site.

The geology of the site (kinds and structures of rock and soil), the hydrology (location and flow of surface and underground water), and meteorological characteristics of the site (wind speed, patterns, and direction) are all considered in

More detailed measurements are also made for specific radionuclides. Strontium-90 and cesium-137 are measured because they are normally present in WVDP waste streams. 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 A* [p. A-1 through A-46] for a schedule of samples and radionuclides measured and *Appendix B*, Table B-1 [p. B-3] for related Department of Energy protection standards, i.e., derived concentration guides [DCGs] and half-lives of radionuclides measured in WVDP samples.)

Data Reporting

Because no two samples are exactly the same, statistical methods are used to decide how a particular concentration compares with concentrations from similar samples. The term *confidence level* is used to describe the range of concentrations above and below the test result within which the "true" value can be expected to lie, at a specified degree of statistical certainty. The WVDP environmental monitoring program uses the 95% confidence level.

The uncertainty range is the expected range of values that account for random nuclear decay and small measurement process variations. The uncertainty range around a concentration 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). Within this range a result will be "true" 95% of the time. For example, a value recorded as 5.30±3.6E-09 μCi/mL means that 95% of the time the "true" value for this sample will be found between 1.7E-09 μCi/mL and 8.9E-09 μCi/mL.

If the uncertainty range is greater than the value itself (e.g., 5.30±6.5E-09 μCi/mL), the result is below the detection limit. The values listed in tables of radioactivity measurements in the appendices include both the value and uncertainty regardless of the detection limit value. If the uncertainty range is greater than the value itself, measurements of radiological parameters may be represented by a "less than" ("<"). Chemical data are expressed by the detection limit prefaced by a "<" if that analyte was not measurable. (See also **Data Reporting** [p. 5-7] in *Chapter 5, Quality Assurance*.)

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.

1995 Changes in the Environmental Monitoring Program

Changes in the 1995 environmental monitoring program enhanced the environmental sampling and surveillance network in order to support current activities and to prepare for future activities.

Changes included placing a weir at sampling point WNSP006 to allow direct measurement of flow; replacing the background air sampler, originally located at Dunkirk, with a new sampler located at Nashville in the town of Hanover; and installing an additional air monitoring sampler and back-up sampler for the vitrification heating, ventilation, and air conditioning exhaust system. These air samplers are providing baseline data during nonradioactive, pre-operational assessment of the vitrification facility.

A major update in 1995 was the entry into the Laboratory Information Management System (LIMS) of pre-set screening levels for the various parameters measured. The screening levels are based upon a statistical evaluation of historical results, regulatory limits or guides, or analytical method detection limits. Newly entered environmental data are electronically compared with the pre-set levels, thus allowing sampling results to be immediately evaluated for changes from previous levels.

Another major change occurred in the groundwater sampling program. With the program for the expanded characterization of groundwater completed in 1994, the number of monitoring points could be reduced and the parameters measured could be tailored more specifically to each active monitoring point.

Appendix A (pp. A-i through A-55) summarizes the program changes and lists the sample points and parameters measured in 1995.

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.

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 B-1, Appendix B, p. B-3.)

DOE Orders require that the hypothetical dose to the public from facility effluents be estimated using specific computer codes. (See Chapter 4, Radiological Dose Assessment [p. 4-4].) 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 is in compliance with the DOE guideline.

Although the DOE provides DCGs for airborne radionuclides, the more stringent U.S. EPA NESHAP standards apply to Project airborne effluents.

As a convenient reference point, comparisons with DCGs are made throughout this report for both air and water samples.

Pretreatment of the supernatant began in 1988. A four-part process, 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. This 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 salts 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. The resulting mixture was washed and the wash water was processed. The IRTS processing of the combined wash waters was completed in May 1995. Tank 8D-4 contained THOREX high-level radioactive waste. This waste was produced by a single reprocessing campaign of a special fuel containing thorium that had been conducted by the previous facility operators from November 1968 to January 1969. 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 will be blended with the washed sludge before being transferred to the vitrification facility for blending with the glass-formers. In 1995 approximately 91% of the spent zeolite was transferred to high-level waste tank 8D-2 in preparation for vitrification.

Vitrification Accomplishments

Several major milestones have been reached in completing the Project's vitrification facility. Non-radioactive 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. In addition, the cold chemical building was completed, as was the sludge mobilization system that will transfer high-level waste to the melter. This system was fully tested in 1994. A number of additional major systems components also were installed in 1994: the canister turntable, which positions the vessels 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.

1995 Activities at the WVDP

Vitrification

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.

Solidification into glass is scheduled to begin in 1996. The high-level waste mixture of washed sludge and spent zeolite from the ion-exchange process will be combined with glass-forming chemicals, fed to a ceramic melter, heated to approximately 2,000°F, and poured into stainless steel canisters. Approximately 300 stainless steel canisters, 10 feet long by 2 feet in diameter, will be filled with a uniform, high-level waste glass that will be suitable for eventual shipment to a federal repository.

Environmental Management

Aqueous Radioactive Waste

Water containing radioactive material from site process operations is collected and treated in the low-level liquid 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 1995, 39 million liters (10.3 million gal) of water were treated in the LLWTF and released through the lagoon 3 weir.

The discharge waters contained an estimated 22 millicuries of gross alpha plus gross beta radioactivity. Comparable releases during the previous ten years averaged about 44 millicuries per year. The 1995 release was about 50% of this average. (See **Radiological Monitoring,** *Low-level Waste Treatment Facility Sampling Location* in *Chapter 2, Environmental Monitoring* [p. 2-7].)

Approximately 1.4 curies of tritium were released in WVDP liquid effluents in 1995. This is 79% of the ten-year average of 1.77 curies.

Non-Aqueous Radioactive Waste

In 1995, 2,939 liters (776 gal) of low-level radioactive waste oil was sent to Diversified Scientific Services, Inc. in Oak Ridge, Tennessee for processing.

Solid Radioactive Waste

Low-level radioactive waste at the WVDP, stored in aboveground facilities, consists of various materials generated through site maintenance and cleanup activities. Metal piping and tanks are cut up and packaged in a special size-reduction facility, and dry compressible materials such as paper and plastic are compacted to reduce waste volume. For more details see the *Environmental Compliance Summary: Calendar Year 1995* (p. xliv).

Airborne Radioactive Emissions

Air used to ventilate the facilities where radioactive material cleanup processes are operated is passed through filtration devices before being emitted to the atmosphere.

Ventilated air from the various points in the IRTS process (high-level waste sludge treatment, main plant and liquid waste treatment system, cement solidification system, and the LLWTF) and from other waste management activities centered in the main plant building is sampled continuously during operation. In addition to monitors that alarm if 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 emissions in 1995, primarily from the main plant ventilation, contained an estimated 0.3 millicuries of gross alpha plus gross beta radioactivity. This compares to less than 0.04 millicuries of combined gross alpha and beta activity in 1994 and 0.03 millicuries in 1993 and reflects an increase in current processing operations. (See *Chapter 2, Environmental Monitoring* [p. 2-15], for more detail.)

Approximately 0.036 curies of tritium (as hydrogen tritium oxide [HTO]) were released in facility air emissions in 1995. This compares with 0.032 curies in 1994 and 0.031 curies in 1993.

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. Industrial waste and sanitary waste reduction goals were added in 1994. By using source reduction, recycling, and other techniques, waste in all of these categories has been greatly reduced. In 1995, the fifth year of the program, reductions in all categories exceeded the 1995 reduction goals by as much as 80%. (For more details see the *Environmental Compliance Summary: Calendar Year 1995* [p. xlvii].)

Pollution Prevention Awareness Program

The WVDP's pollution prevention awareness program is a significant part of the Project's overall waste minimization program. The program includes hazard communication training and new-employee orientation that provides information about the WVDP's Industrial Hygiene and Safety Manual, environmental pollution control procedures, and the Hazardous Waste Management Plan.

The WVDP's goal is to make all employees aware of the importance of pollution prevention both at work and at home.

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. (See the *Environmental Compliance Summary: Calendar Year 1995* [p. lv] for a discussion of specific NEPA activities in 1995.)

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 will describe the potential environmental effects associated with Project completion and various site closure alternatives. Preparation of the draft environmental impact statement was nearly completed by the end of 1995.

Self-Assessments

Self-assessments continued to be conducted in 1995 to review the management and effectiveness of the WVDP environmental protection and monitoring programs. Results of these self-assessments are evaluated and corrective actions 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. (For more details see the *Environmental Compliance Summary: Calendar Year 1995* [p. lviii].)

Occupational Safety and Environmental Training

The occupational safety of personnel who are involved in industrial operations is protected by standards promulgated under the Occupational Safety and Health Act (OSHA). 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 v environment for employees.

29 CFR 1910.120, Hazardous Waste Op(and Emergency Response, requires that em at treatment, storage, and disposal faciliti(may be exposed to health and safety hazards hazardous waste operations, receive training priate to their job function and responsibiliti WVDP Environmental, Health, and Safety t matrix identifies the specific training requi for affected employees.

The WVDP provides the standard twent hour hazardous waste operations and eme response training. (Emergency response t includes controlling contamination to grou ter and spill response measures.) Tr programs also contain information on wast mization and pollution prevention. Besid standard training, employees working in logical areas receive additional traini subjects such as understanding radiation a diation warning signs, dosimetry, and resp protection. In addition, specific qualif standards for specific job functions at the s required and maintained. These program evolved into a comprehensive curricul knowledge and skills necessary to maint health and safety of employees and ens continued environmental compliance WVDP.

The WVDP maintains a hazardous materi sponse team that is trained to respond to s hazardous materials. This team maintains i ficiency through classroom instructio scheduled training drills.

Any person working at the WVDP that picture badge receives general employee tr covering health and safety, emergency res and environmental compliance issues.

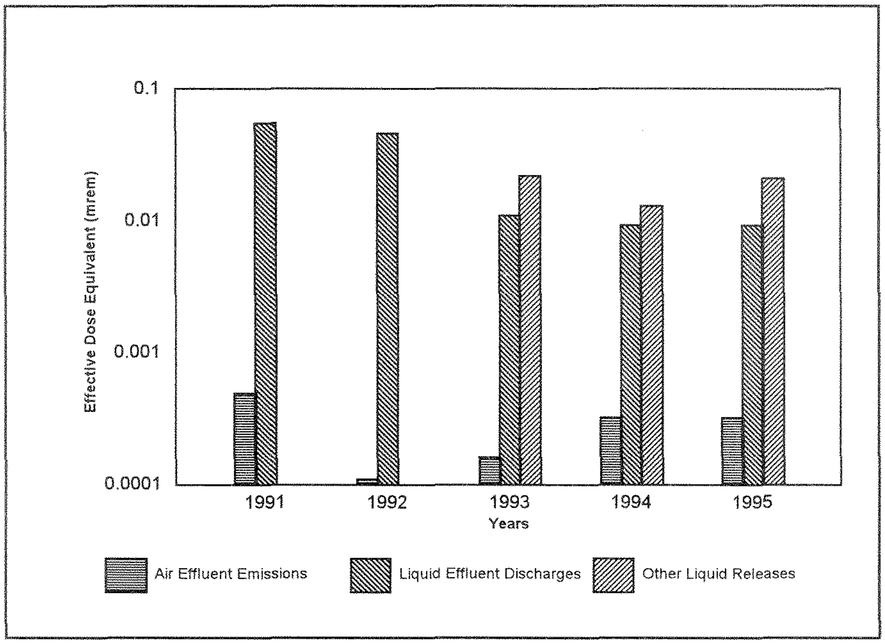


Figure 1-1. Annual Effective Dose Equivalent to the Maximally Exposed Individual

All visitors to the WVDP also receive a site-specific briefing on safety and emergency procedures before being admitted to the site.

Performance Measures

Performance measures can be used to evaluate effectiveness, efficiency, quality, timeliness, productivity, safety, or other areas that reflect achievements related to an organization's or process' goals. Performance measures 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 LLWTF, the identification of spills and releases, the reduction in the generation of wastes, and the potential radiological dose received by the maximally exposed off-site individual.

Radiation Doses to the Maximally Exposed Off-Site Individual

Some of the most important 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 provides an indicator of well-managed radiological operations. The effective dose for air emissions, water effluent, and the total effective dose for 1991 through 1995 are graphed in Figure 1-1. Note that these values are well below the DOE standard of 100 mrem. These consistently low results indicate that radiological activities at the site are well-controlled.

SPDES Permit Exceedances

Effective operation of the LLWTF 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. The goal of LLWTF operations is to operate the LLWTF such that effluent monitoring results are consistently within the permit requirements. A graph of the number of exceedances occurring in each calendar year from 1991 through 1995 is shown in Figure 1-2 (p. 1-12).

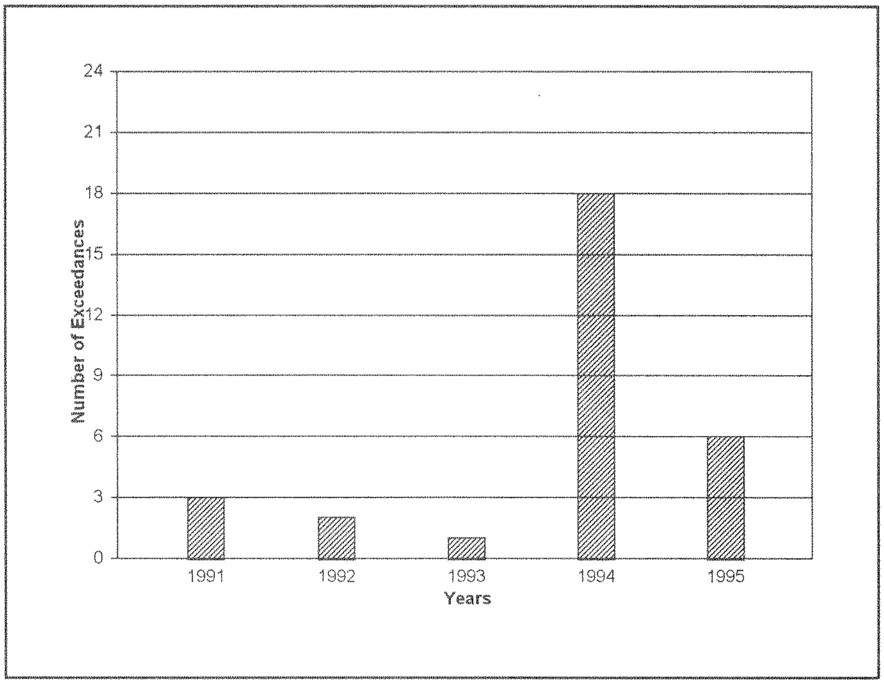


Figure 1-2. SPDES Permit Exceedances by Year

Exceedances do occur periodically. Although they are not always related to operating deficiencies, they still can indicate the need to institute changes. For example, of the eighteen exceedances that occurred in 1994, seven were related to the pH of the outfall 001 effluent and occurred over a five-day span. Similarly, five of the 1994 exceedances were related to five-day biochemical oxygen demand at the 007 outfall in the month of April. Both of these problems were successfully addressed through operational changes and the installation of additional or alternate process equipment. All exceedances are evaluated to determine their cause and to identify potential means of correcting operating problems or treatment techniques.

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 (rubbish) 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 for calendar years 1991 through 1995. Not all waste streams have been tracked over this period. Note that the low-level radioactive waste figures from 1993 through 1995 include the vol-

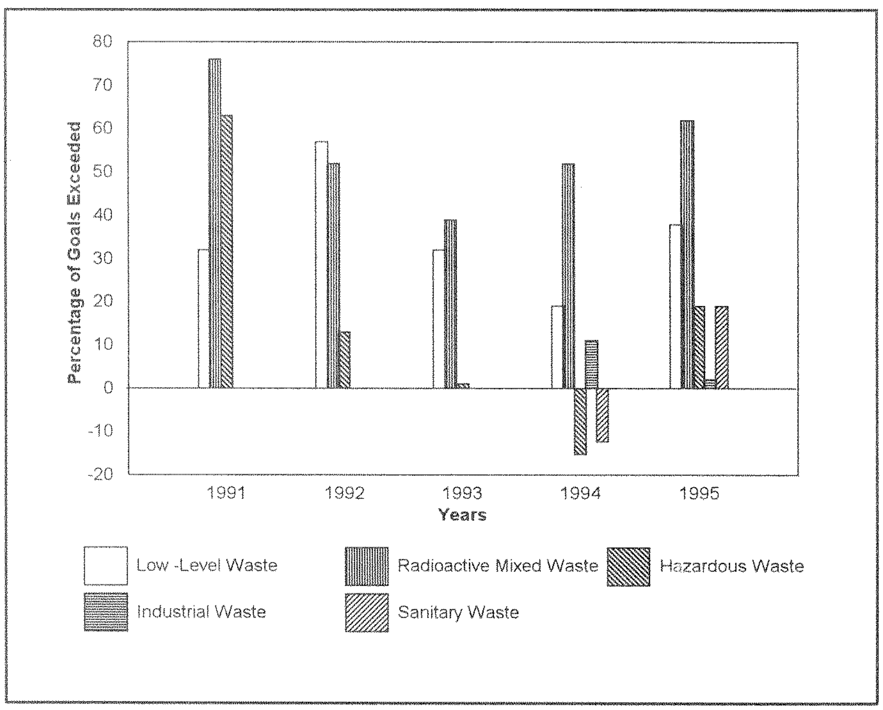


Figure 1-3. Waste Reduction Percentage Exceeding Goals

ume of drummed waste produced in the cement solidification system. The hazardous waste quantity for 1994 also includes 1,891 kilograms (about 4,170 lbs) of waste produced in relation to preparation for vitrification.

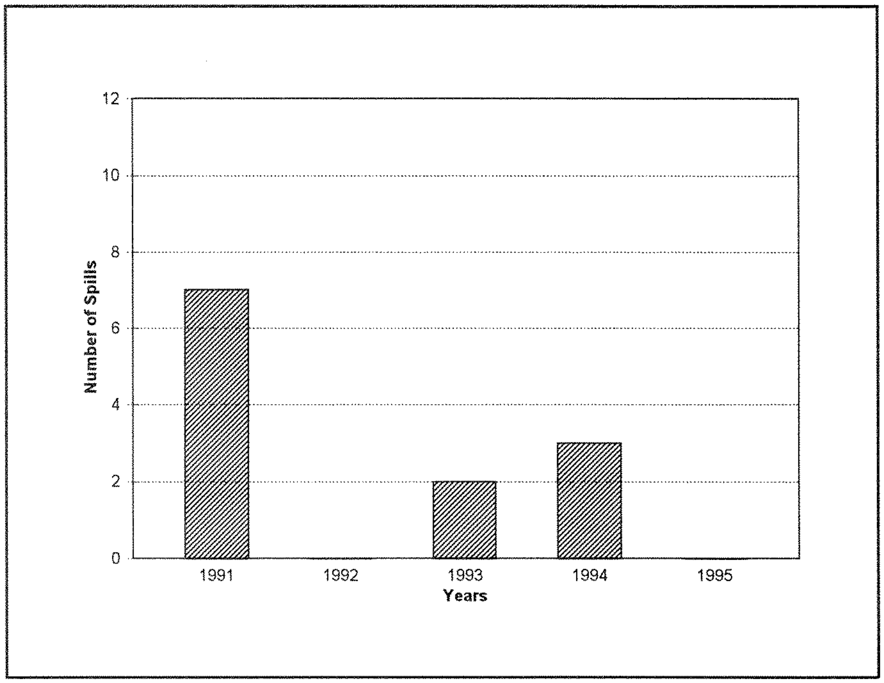


Figure 1-4. Number of Immediately Reportable Spills and Releases

Spills and Releases

Prevention is the best means of protection against oil and chemical 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. This first-line reporting helps to ensure that spills will be properly documented and mitigated in accordance with applicable regulations.

Chemical spills greater than the applicable reportable quantity must be reported immediately to NYSDEC and the National Response Center and other agencies as required. Petroleum spills greater than 10 gallons must be reported within two hours to NYSDEC. Spills of any amount that travel to waters of the state (i.e., groundwater, surface water, drainage systems) must be reported immediately to the NYSDEC spill hotline and entered in the monthly log. There were no reportable spills in 1995. (See Fig. 1-4 for a bar graph of immediately reportable spills from 1991 to 1995.)

ENVIRONMENTAL MONITORING

Pathway Monitoring

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

Sediments are sampled upstream and downstream of the West Valley Demonstration Project (WVDP). The food pathway is monitored by collecting samples of beef, hay, milk, and produce at both near-site and remote locations, samples of fish upstream and downstream of the site, and venison samples from the on-site deer herd and from background locations. Direct radiation on-site, at the perimeter of the site, and at background locations is also monitored to provide additional data.

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

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 annually through ventilation systems and liquid discharges and makes a negligible contribution to the radiation dose to the surrounding population through a variety of exposure pathways. (See Chapter 4, Table 4-2.)

Air and Water Pathways

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

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

Both air and water samples are collected at site perimeter locations where the highest concentrations of transported radionuclides might be expected. Samples are also collected at remote locations to provide background concentration data.

Sampling Codes

The complete environmental monitoring schedule is detailed in *Appendix A* (pp. A-i through A-55). This schedule provides information on monitoring and reporting requirements and the types and extent of sampling and monitoring at each location. An explanation of the codes that identify the sample medium and the specific sampling or monitoring location is also found in *Appendix A* (p. A-iii). For example, a sample location code such as AFGRVAL indicates an air sample (A), off-site (F), at the Great Valley (GRVAL) sampling station.

These codes are used throughout this report for ease of reference and to be consistent with the data reported in the appendices.

Air Sampler Location and Operation

Air samplers are located at points remote from the WVDP, at the perimeter of the site, and on the site itself. Figure 2-1 shows the locations of the on-site air effluent monitors and samplers; Figure 2-2 (p. 2-4) and Figure A-9 in *Appendix A* (p. A-55) show the location of the perimeter and remote air samplers.

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

Water Sampler Location and Operation

Automatic samplers collect surface water at points along drainage channels within the WNYNSC that are most likely to show any radioactivity released from the site and at a background station upstream of the site. (Grab samples are collected at several other surface water locations both on- and off-site.) Figure 2-3 (p. 2-5) shows the location of the on-site surface water monitoring points. (On-site automatic samplers operate at locations WNSP006, WNNDADR, WNSW74A, and WNSWAMP.) Figure 2-4 (p. 2-6) shows the location of the off-site automatic surface water monitoring points. (Off-site locations are WFBCTCB, WFFELBR, and the background location, WFBCBKG.)

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

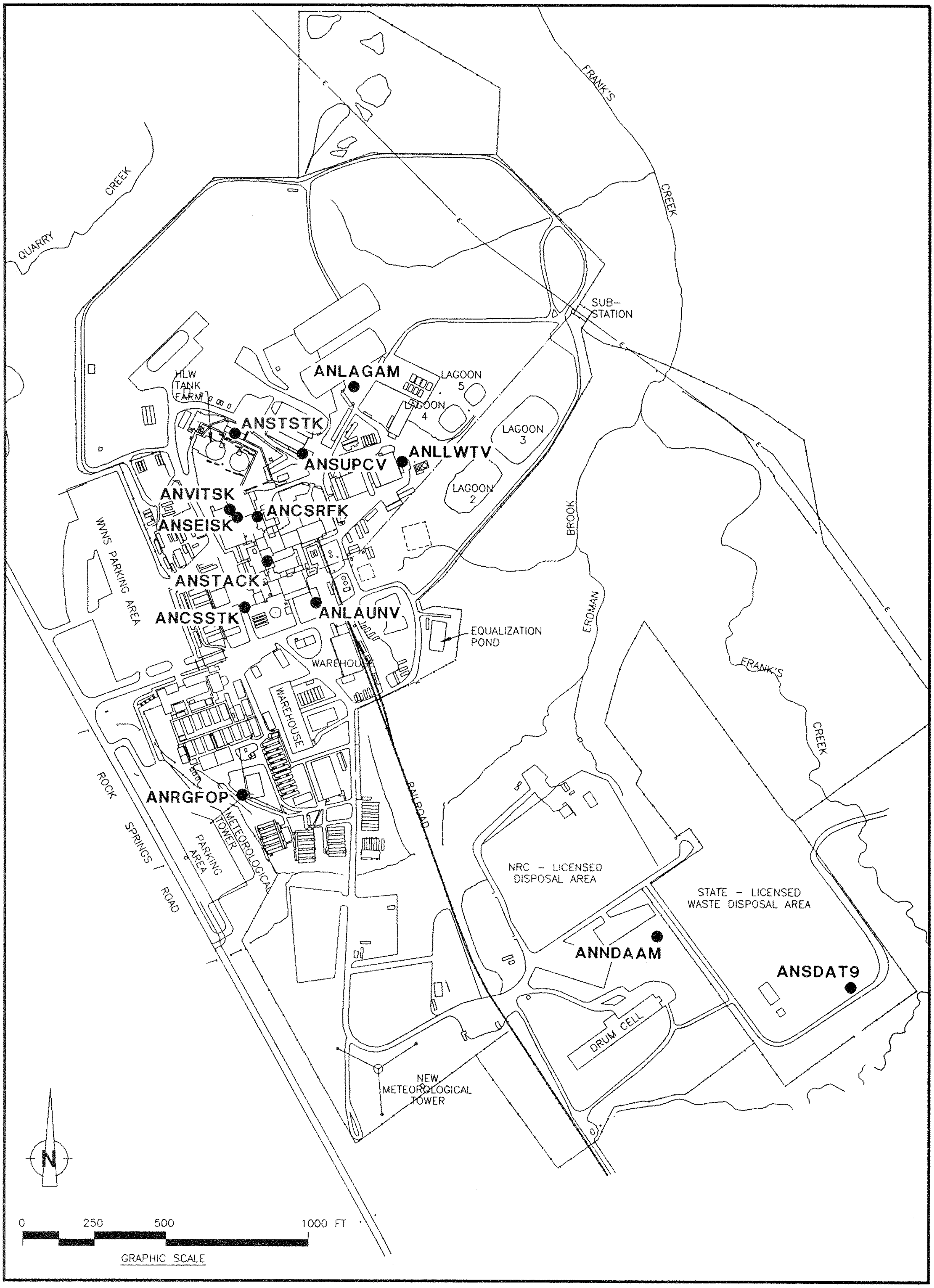


Figure 2-1. On-site Air Monitoring and Sampling Points.

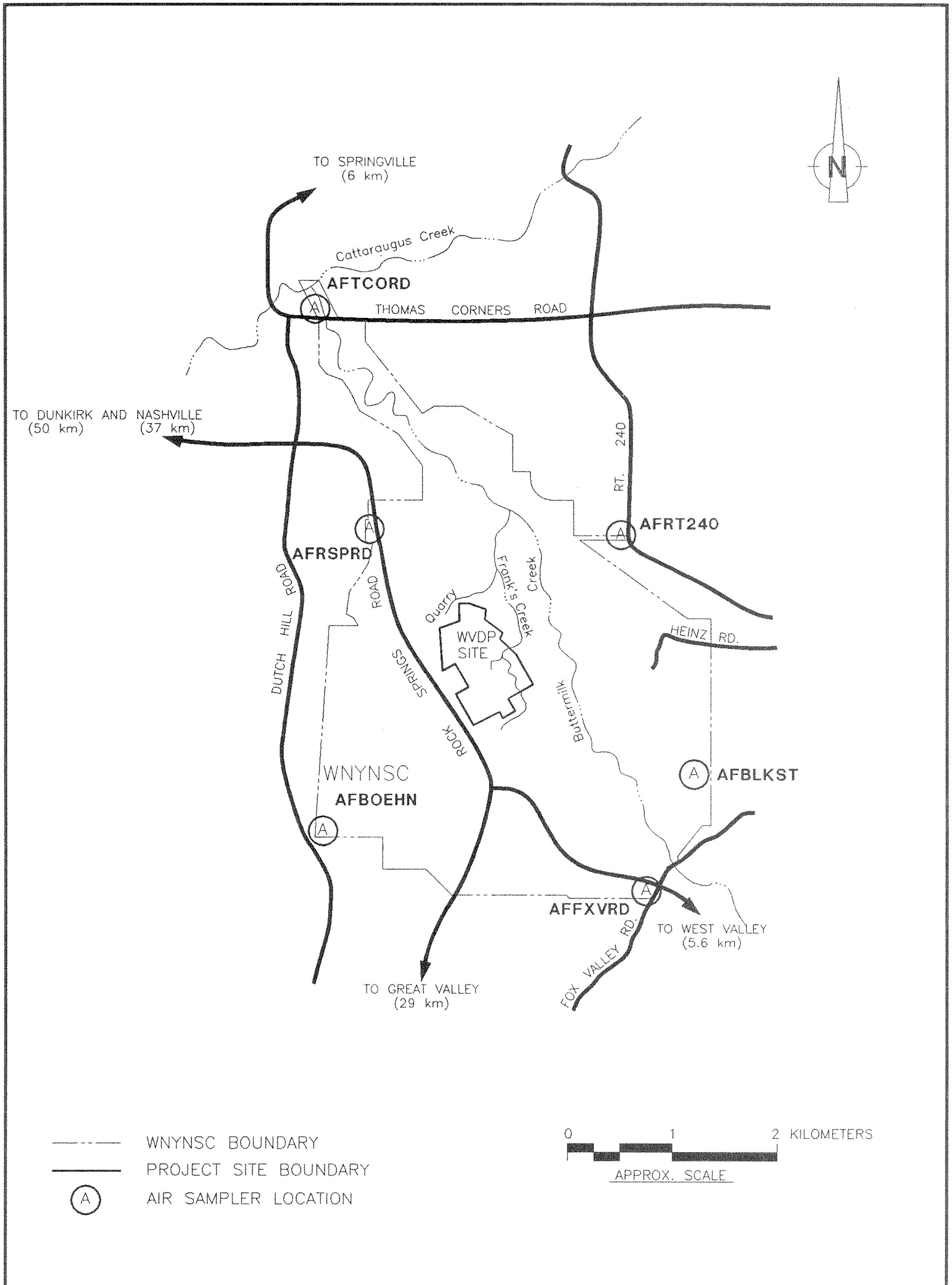


Figure 2-2. Location of Perimeter Air Samplers.

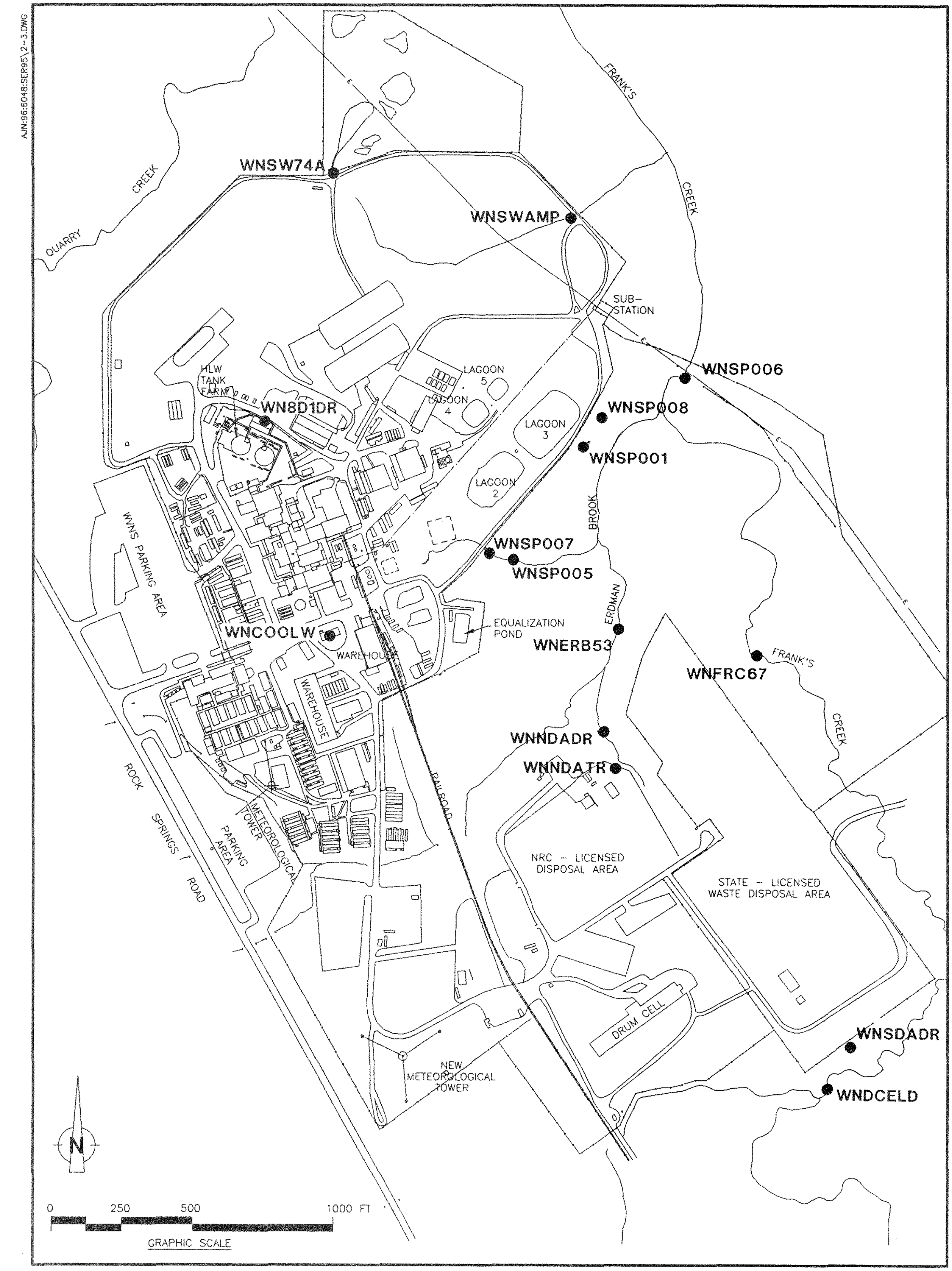


Figure 2-3. Sampling Locations for On-site Surface Water.

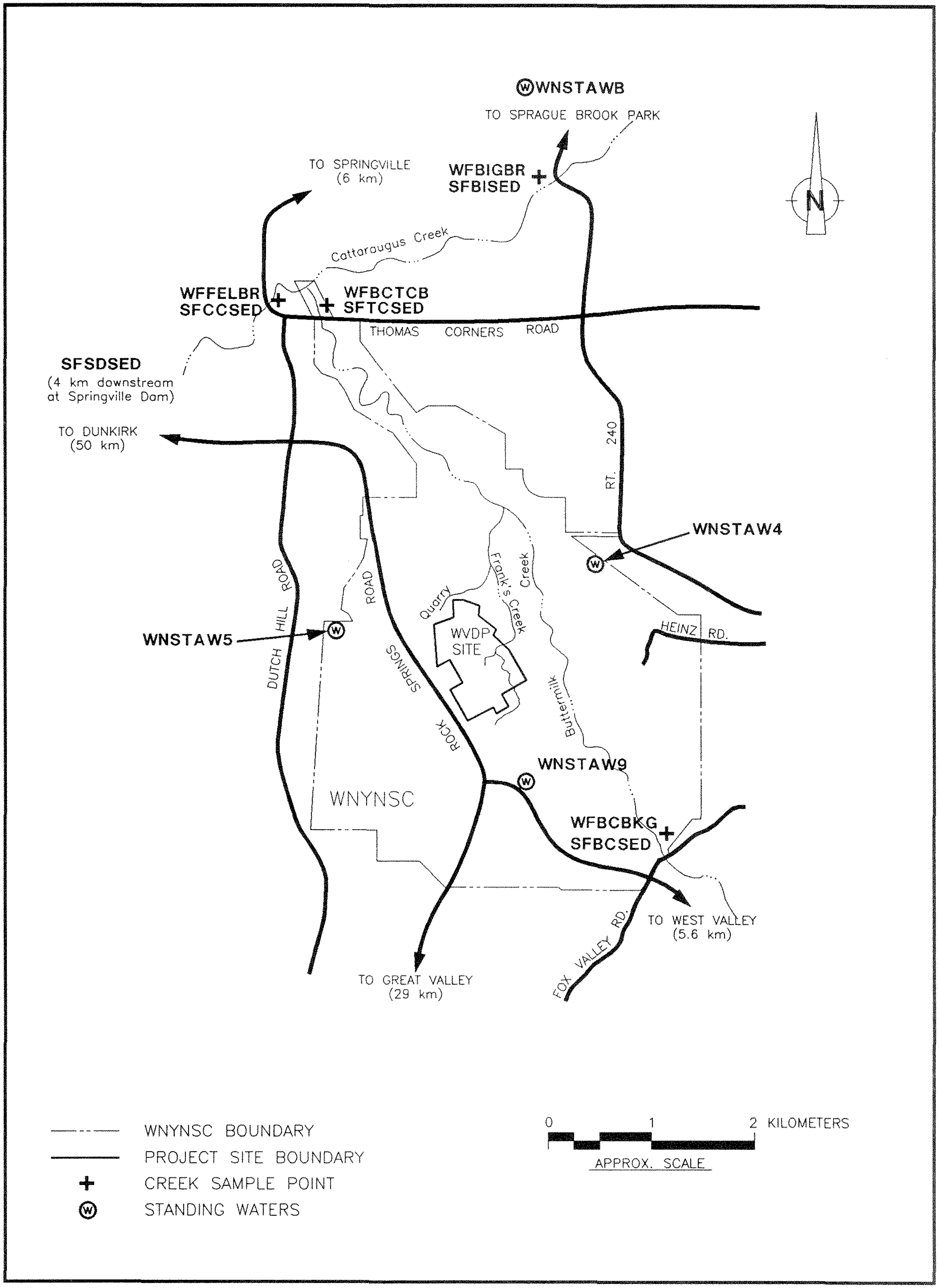


Figure 2-4. Location of Off-site Surface Water and Sediment Samples.

Radiological Monitoring

Surface Water and Sediment Monitoring

On-site Surface Water Sampling

A map of on-site surface water sampling locations is found on Figure 2-3 (p. 2-5).

Low-level Waste Treatment Facility Sampling Location

The largest single source of radioactivity released to surface waters from the Project is the discharge from the low-level waste treatment facility through the lagoon 3 weir (WNSP001 on Fig. 2-3 [p. 2-5]) into Erdman Brook, a tributary of Frank's Creek. There were five batch releases totaling about 38.8 million liters (10.3 million gal) in 1995. In addition to composite samples collected near the beginning and end of each discharge, a total of fifty-two effluent grab samples, one for each day of discharge, were collected and analyzed.

The total amounts of radioactivity from specific radionuclides in the lagoon 3 effluent are listed in *Appendix C-1*, Table C-1.1 (p. C1-3). The observed annual average concentration of each radionuclide released is divided by its corresponding Department of Energy derived concentration guide (DCG) in order to determine what percentage of the DCG was released. (DOE standards and DCGs for radionuclides of interest at the WVDP are found in *Appendix B* [p. B-3].) As a DOE policy, the sum of the percentages calculated for all radionuclides released must not exceed 100%. In 1995 the annual average isotopic concentrations from the lagoon 3 effluent discharge weir combined to be less than 43% of the DCGs, compared to about 44% in 1994. (See Table C-1.2 [p. C1-4].)

In the course of preparing existing facilities to support vitrification, cleaning water was processed in the low-level waste treatment facility (LLWTF). Variations in waste stream constituents noted within the last few years could have contributed to a shift in final liquid effluent isotopic ratios. Possibly related to these waste stream transients, higher concentrations of strontium-90 and uranium-232 have been observed in the lagoon 3 effluent from 1993 through 1995. Improved LLWTF operation has reduced cesium-137 concentrations in the final effluent since 1992.

Frank's Creek Sampling Location

A water sampling station (WNSP006) is located on Frank's Creek where Project site drainage leaves the security-fenced area, more than 4.0 kilometers (2.5 mi.) from the nearest public access point. (See Fig. 2-3 [p. 2-5].) This sampler collects a 50-mL aliquot (a small volume of water) every half-hour. Samples are retrieved weekly and composited both monthly and quarterly. (Data are found in Table C-1.4 [p. C1-6].) Weekly samples are analyzed for tritium and gross alpha and beta radioactivity as well as pH and conductivity. The monthly composite is analyzed for strontium-90 and gamma-emitting isotopes. (See *Glossary*, "gamma isotopic.") A quarterly composite is analyzed for carbon-14, iodine-129, alpha-emitting radionuclides, and total uranium.

The most significant beta-emitting radionuclides at WNSP006 were cesium-137 at less than 2.01E-08 µCi/mL (0.74 Bq/L) and strontium-90 at 6.56E-08 µCi/mL (2.43 Bq/L) during the months of highest concentration. This corresponds to less than 0.67% of the DCG for cesium-137 and 6.56% of the DCG for strontium-90. The annual average concentration of cesium-137 at WNSP006 was less than 0.5% of the DCG, and the strontium-90 concentration was 2.5% of the strontium-90 DCG. Tritium, at an annual average of 3.29E-06 µCi/mL (1.22E+02 Bq/L), was 0.16% of the DCG value. Of the fifty-two samples collected and analyzed for gross alpha during 1995, twelve were above the detection limit. The annual average was less than 2.39E-09 µCi/mL (8.86E-02 Bq/L) gross alpha or less than 7.97% of the DCG for americium-241.

The nine-year trends of gross alpha, gross beta, and tritium concentrations at location WNSP006 are shown on Figure 2-5. The trend of baseline gross beta activity seems to be stable over time, with fluctuations related to treated WVDP liquid effluent discharges. A stable trend is also observed farther downstream at the Felton Bridge sampling location, the first point of public access to surface waters leaving the WVDP site.

North Swamp and Northeast Swamp Sampling Locations

The north and northeast swamp drainages on the site's north plateau are two major channels for surface water and emergent groundwater to collect. Samples from the north swamp drainage at location WNSW74A and from the northeast swamp drainage at sampling point WNSWAMP are collected from the automated sampler every week. (See Fig. 2-3 [p. 2-5].) Samples from both locations are analyzed weekly for gross alpha, gross beta, tritium, pH, and conductivity. Composites of weekly samples are also analyzed for a full range of specific radionuclides. Semiannual grab samples from these locations are analyzed for additional chemical parameters.

Results for samples collected at location WNSW74A, which monitors drainage to Quarry Creek from the northern end of the Project premises, are summarized in *Appendix C-1*, Table C-1.8 (p. C1-9). Gross beta concentrations at this location are four to eight times higher than the average value observed at background location WFBCBKG but still are seventy times lower than the DCG for strontium-90. (See *Appendix B* [p. B-3].) Tritium at this location is below the detection limit. The highest monthly strontium-90 result at WNSW74A was less than 2.9% of its DCG.

Sampling point WNSWAMP also monitors surface water drainage from the site's north plateau. (See Tables 2-1 and 2-2 and *Appendix C-1*, Table C-1.7 [p.C1-8].) Waters from this drainage run

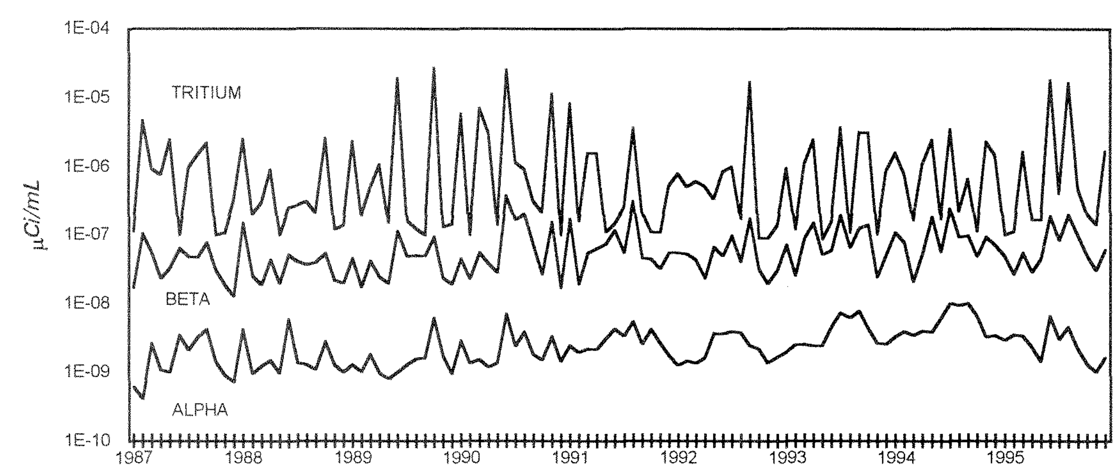


Figure 2-5. Nine-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNSP006

Table 2 - 1

1995 Gross Alpha Activity at Surface Water Sampling Locations

Location	Number of Samples	Range µCi/mL	Range Bq/L	Annual Average µCi/mL	Annual Average Bq/L
OFF-SITE					
WFBIGBR	12	<5.36E-10 — <3.18E-09	<1.98E-02 — <1.18E-01	0.11±1.40E-09	0.39±5.19E-02
WFBCBKG	12	<5.39E-10 — <1.46E-09	<1.99E-02 — <5.40E-02	4.24±9.62E-10	1.57±3.56E-02
WFBCTCB	12	<5.13E-10 — <1.66E-09	<1.90E-02 — <6.14E-02	0.57±1.04E-09	2.10±3.85E-02
WFFELBR	52	4.21E-10 — <3.64E-09	1.56E-02 — <1.35E-01	0.50±1.57E-09	1.85±5.80E-02
ON-SITE					
WNNDADR	12	<6.41E-10 — <5.00E-09	<2.37E-02 — <1.85E-01	0.54±2.67E-09	1.99±9.89E-02
WNSWAMP	52	<1.02E-09 — <9.80E-09	<3.77E-02 — <3.63E-01	2.92±4.25E-09	1.08±1.57E-01
WNSW74A	52	<6.44E-10 — 8.30E-09	<2.38E-02 — 3.07E-01	0.25±2.81E-09	0.09±1.04E-01
WNSP006	52	<4.73E-10 — 1.42E-08	<1.75E-02 — 5.25E-01	1.66±2.39E-09	6.16±8.86E-02

Table 2 - 2

1995 Gross Beta Activity at Surface Water Sampling Locations

Location	Number of Samples	Range µCi/mL	Range Bq/L	Annual Average µCi/mL	Annual Average Bq/L
OFF-SITE					
WFBIGBR	12	9.60E-10 — 4.75E-09	3.55E-02 — 1.76E-01	2.95±1.46E-09	1.09±0.54E-01
WFBCBKG	12	1.04E-09 — 5.27E-09	3.85E-02 — 1.95E-01	2.59±1.20E-09	9.57±4.44E-02
WFBCTCB	12	4.97E-09 — 1.73E-08	1.84E-01 — 6.40E-01	8.77±1.57E-09	3.24±0.58E-01
WFFELBR	52	1.16E-09 — 6.68E-09	4.29E-02 — 2.47E-01	3.15±1.48E-09	1.16±0.55E-01
ON-SITE					
WNNDADR	12	1.43E-07 — 2.97E-07	5.29E+00 — 1.10E+01	2.17±0.10E-07	8.01±0.35E+00
WNSWAMP	52	1.25E-06 — 4.96E-06	4.63E+01 — 1.84E+02	2.81±0.04E-06	1.04±0.01E+02
WNSW74A	52	9.46E-09 — 2.17E-08	3.50E-01 — 8.03E-01	1.42±0.32E-08	5.26±1.19E-01
WNSP006	52	1.74E-08 — 3.49E-07	6.44E-01 — 1.29E+01	7.47±0.56E-08	2.77±0.20E+00

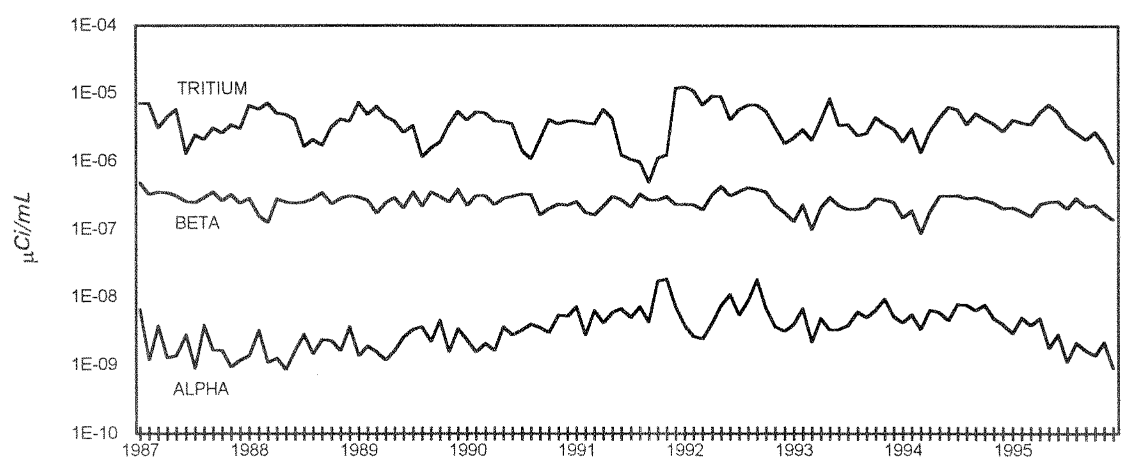


Figure 2-6. Nine-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WNNDADR

into Frank's Creek downstream of location WNSP006. An upward trend in gross beta concentration from 1993 through 1995 at location WNSWAMP is discussed later in this chapter under **Special Monitoring** (p. 2-30). The average tritium concentration at this location in 1995 was 3.39E-07 μCi/mL, which is above that observed at the background location WFBCBKG but well below the 2E-03 μCi/mL DCG for tritium.

Other Surface Water Sampling Locations

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

Another sampling point, WN8D1DR, is at a storm sewer manhole access that originally collected surface and shallow groundwater flow from the high-level waste tank farm area. The access has since been valved off from the original high-level waste tank farm drainage area. A sample is taken from the access point and is analyzed weekly for gross alpha and beta, tritium, and pH. A monthly composite is analyzed for gamma radionuclides and strontium-90. (See **Special Monitoring** [p. 2-30].) However, samples collected from this location are not thought to be indicative of either local groundwater or surface water conditions.

NDA Sampling Locations

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

Gross beta concentrations at location WNNDADR averaged 2.17E-07 μCi/mL in

1995. (See Table 2-2 [p. 2-9] and Table C-1.19 [p. C1-16] in *Appendix C-1*.) Concentrations at this location were above the average seen at background location WFBCBKG but are all well below the DCG for strontium-90 (1E-06 µCi/mL). In fact, the highest quarterly composite isotopic strontium-90 result was only 11% of its DCG. The overall trend for gross beta concentrations at this location has remained relatively constant over time. (See Fig. 2-6.) Except for seasonal variations, the same is true of tritium.

A key indicator of any possible migration of nonradiological contaminant from the NDA would be the presence of significant iodine-129 in samples from WNNDADR. The third- and fourth-quarter 1995 iodine-129 values at WNNDADR were marginally positive, yet they were not significantly higher than the analytical detection limit. By way of comparison, iodine-129 values obtained from waters collected from the NDA interceptor trench (WNNDATR), closer to the NDA, were all below the analytical detection limit. (See *Appendix C-1*, Table C-1.20 [p. C1-17].) It should be noted that while tritium activity in trench waters is generally higher than that seen at WNNDADR farther downstream, gross beta activity is actually higher downstream at WNNDADR than in waters from the interceptor trench. Residual contamination from past waste burial activities in soils outside the NDA are the likely source of gross beta activity in samples from WNNDADR.

Downstream of WNNDADR, on Erdman Brook and to the west of the SDA, is sampling point WNERB53. Weekly samples collected from this point are analyzed for pH, gross alpha, gross beta, and tritium. In addition to samples collected by the WVDP, independent samples are collected and analyzed by the New York State Department of Health (NYSDOH) at this location and at WNFRC67, which monitors waters draining from the east side of the SDA.

Near-site Standing Pond Water

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

Four ponds were tested in 1995 and found to be within the historical range observed at these locations for gross alpha, gross beta, and tritium. These results were also compared to a background sample from a pond 14 kilometers (8.7 mi) north of the Project (WNSTAWB, Fig. 2-4 [p. 2-6]) and were found to be statistically the same. (See Table C-1.21 [p. C1-18].)

Off-site Surface Water Sampling

A map showing off-site surface water and sediment sample locations is found in Figure 2-4 (p. 2-6). Radiological concentration data from off-site sample points show that average gross beta radioactivity concentrations in Buttermilk Creek below (downstream of) the WVDP site generally tend to be higher than concentrations above (upstream of) the site, presumably because small amounts of radioactivity from the site enter Buttermilk Creek via Frank's Creek. This is particularly observable during periods of lagoon 3 discharge. Tables 2-1 and 2-2 (p. 2-9) list the ranges and annual averages for gross alpha and gross beta activity at surface water locations. Additional information is available in the *Appendix C-1* tables for all off-site surface water monitoring locations.

Cattaraugus Creek at Felton Bridge Sampling Location

An off-site sampler (WFFELBR) is located on Cattaraugus Creek at Felton Bridge just downstream of Cattaraugus Creek's confluence with Buttermilk Creek, which is the major surface drainage from the WNYNSC. (See Fig. 2-4 [p. 2-6].)

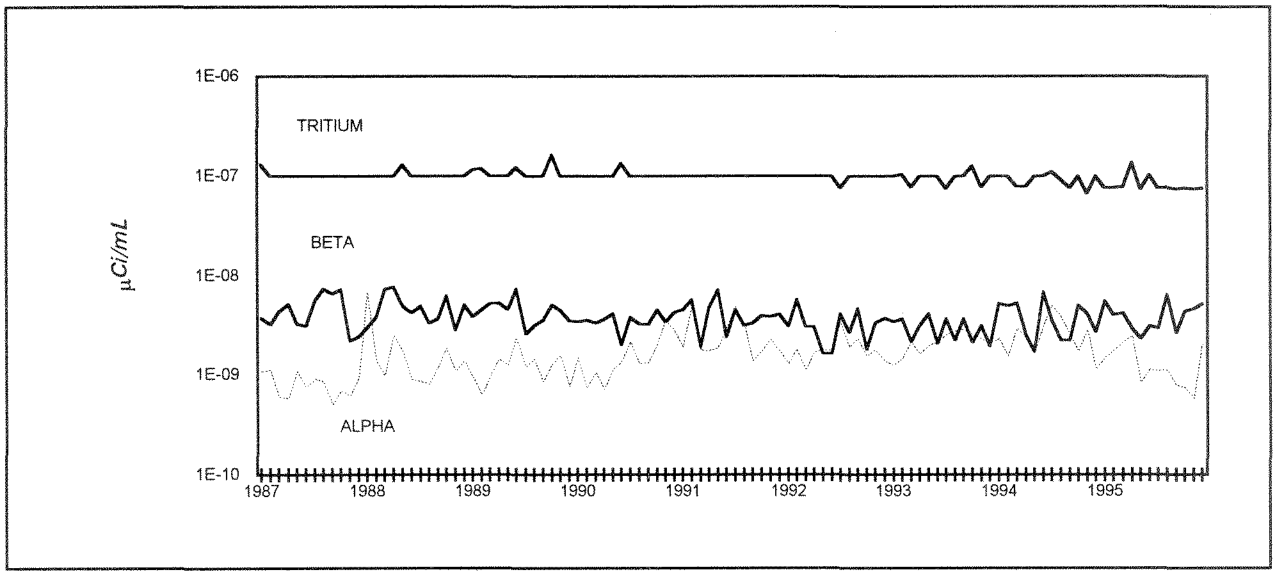


Figure 2-7. Nine-Year Trends of Gross Alpha, Gross Beta, and Tritium Concentrations at Sampling Location WFFELBR

The sampler collects a 50-mL aliquot from the creek every half-hour. A chart recorder registers the stream depth during the sampling period so that a flow-weighted weekly sample can be proportioned into a monthly composite. The weekly samples are analyzed for gross alpha, gross beta, tritium, and pH, and the sample composite is analyzed for gross alpha, gross beta, tritium, strontium-90, and gamma-emitting radionuclides.

The highest concentrations in monthly composite water samples from Cattaraugus Creek during 1995 show strontium-90 to be only 0.6% of the DCG for strontium-90 in water. There were no positive detections of cesium-137 in Cattaraugus Creek during 1995. (See Table C-1.24 [p. C1-20].) The yearly average gross beta activity for Cattaraugus Creek at Felton Bridge is not significantly higher than background levels. Figure 2-7 shows the nine-year trends for Cattaraugus Creek samples analyzed for gross alpha, gross beta, and tritium. Note that for the most part, tritium concentrations represent method detection limits and not actually detected radioactivity. Gross beta activity appears to have remained constant or to have declined slightly at this location since 1987.

Fox Valley Road and Thomas Corners Bridge Sampling Locations

In addition to the Cattaraugus Creek sampler, two surface water monitoring stations are located on Buttermilk Creek both upstream and downstream of the WVDP. (See Fig. 2-4 [p. 2-6].) Samplers collect water from a background location upstream of the Project at Fox Valley Road (WFBCBKG) and from a location at Thomas Corners Road that is downstream of the plant and upstream of Buttermilk Creek's confluence with Cattaraugus Creek (WFBCTCB).

These samplers collect a 25-mL aliquot every half-hour. Samples were retrieved biweekly up to August 1995 and are now collected weekly. Samples are composited monthly and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite is analyzed for gamma-emitting radionuclides and strontium-90. Quarterly composite samples from the Fox Valley Road location also are analyzed for carbon-14, iodine-129, alpha radionuclides, and total uranium. (Table C-1.22 [p. C1-19] shows monthly and quarterly radioactivity concentrations upstream of the site at Fox Valley; Table

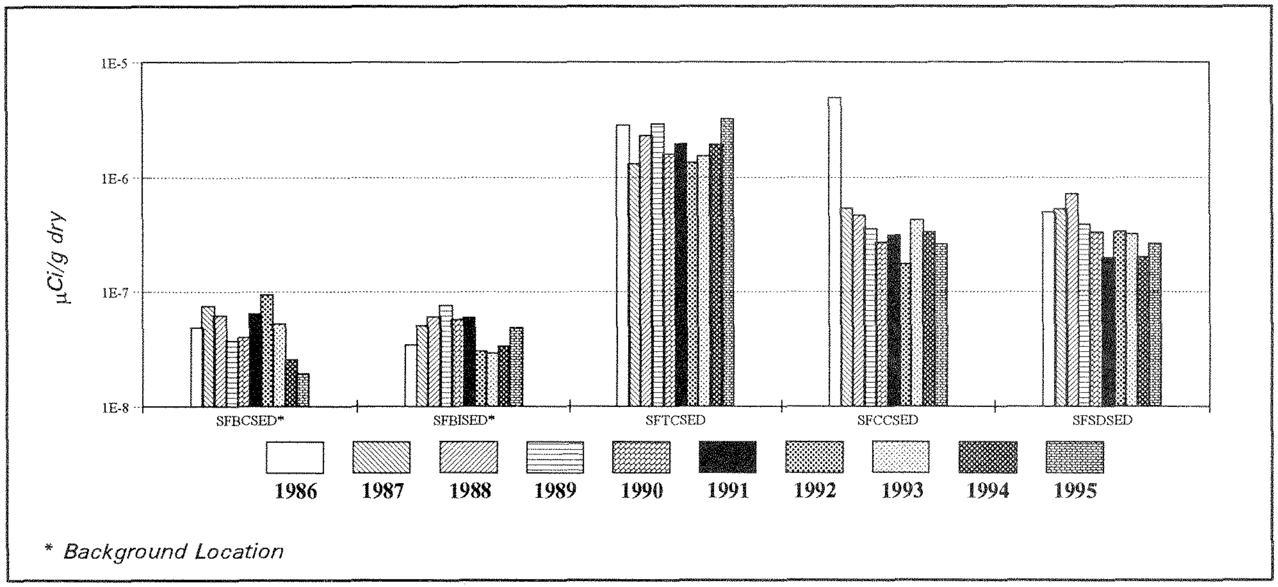


Figure 2-8. Ten-Year Trends of Cesium-137 (µCi/g dry) in Stream Sediment for Two Locations Upstream and Three Locations Downstream of the WVDP

C-1.23 [p. C1-20] shows monthly and quarterly radioactivity concentrations downstream of the site at Thomas Corners.)

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

Because dairy cattle have access to waters at the Thomas Corners Bridge sampling point, this sample point represents an important link in the pathway to humans. In actuality, gross beta includes other radionuclides from naturally occurring sources as well as from manmade sources. If the maximum beta concentration in Buttermilk Creek downstream of the Project at Thomas Corners Bridge were, however, attributable entirely to strontium-90, then the radioactivity would represent only 1.7% of the DCG.

Sediment Sampling

A map showing sediment sampling locations is found on Figure 2-4 (p. 2-6).

Sediments are grab-sampled semiannually at or near three of the automatic water sampling locations and at two additional points. Downstream locations are Buttermilk Creek at Thomas Corners Road (SFTCSED), Cattaraugus Creek at Felton Bridge (SFCCSED), and Cattaraugus Creek at the Springville dam (SFSDSED). Upstream background locations are Buttermilk Creek at Fox Valley Road (SFBCSED) and Cattaraugus Creek at Bigelow Bridge (SFBISED).

A comparison of annual averaged cesium-137 concentrations from 1986 to 1995 for these five sampling locations is illustrated in Figure 2-8. As reported in previous years, cesium-137 concentrations in sediments collected downstream of the WVDP are higher than those observed in samples collected from background locations (SFBCSED or SFBISED). As the figure indicates, although the measured cesium-137 concentrations for 1995 were higher than some previous years' values, overall, the concentrations appear to be decreasing or staying constant with time at the downstream locations. While the cesium-137 activity in downstream Cattaraugus Creek sediments (at locations SFCCSED and SFSDSED) is elevated relative to upstream val-

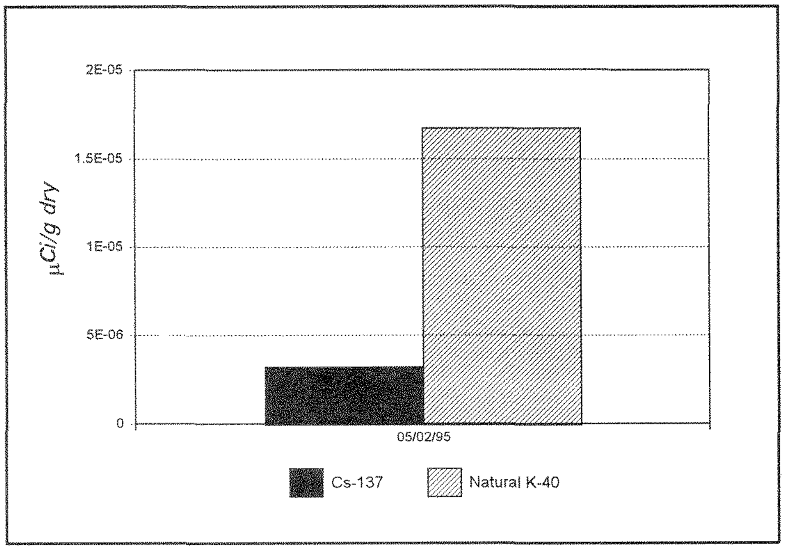


Figure 2-9. Comparison of Cesium-137 with Naturally Occurring Potassium-40 Concentrations (µCi/g dry) in 1995 at Downstream Sampling Location SFTCSED

ues, it is comparable to or less than historical background concentrations (as measured at SFGRVAL and SFDNKRK) in surface soil in Western New York.

A comparison of cesium-137 to the naturally occurring gamma-emitter potassium-40 (Fig. 2-9) for the downstream location nearest the Project (Buttermilk Creek at Thomas Corners Road — SFTCSED) indicates that cesium-137 is present at levels lower than naturally occurring gamma emitters. Results of sediment sampling upstream and downstream of the Project are tabulated in *Appendix C-1*, Table C-1.31 (p. C1-25). When alpha isotopic results for background location SFBCSED are compared to those for SFTCSED, downstream of the site, no significant differences are observed.

Air Monitoring

On-site Ventilation Systems

Permits obtained from the U.S. Environmental Protection Agency (EPA) allow air to be released from plant ventilation stacks during normal operations. The air released must meet criteria specified in the NESHAP regulations to ensure that the environment and the public's health and safety are not adversely affected. Dose-based comparisons of WVDP emissions against NESHAP criteria are presented in Chapter 4. Although less stringent than NESHAP criteria, DOE DCGs are more conducive to concentration-based comparisons and are used here in this chapter for evaluating concentrations of radionuclides in WVDP emissions.

Parameters measured include gross alpha and gross beta, tritium, and various radionuclides such as cesium-137 and strontium-90. When comparing concentrations with dose limits for screening purposes, gross alpha and beta radioactivities are assumed to come from americium-241 and strontium-90, respectively, because the dose effects for these radionuclides are the most limiting for particulate emissions at the WVDP. (DOE standards and DCGs for radionuclides of interest at the WVDP are found in *Appendix B* [p. B-3].)

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

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

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

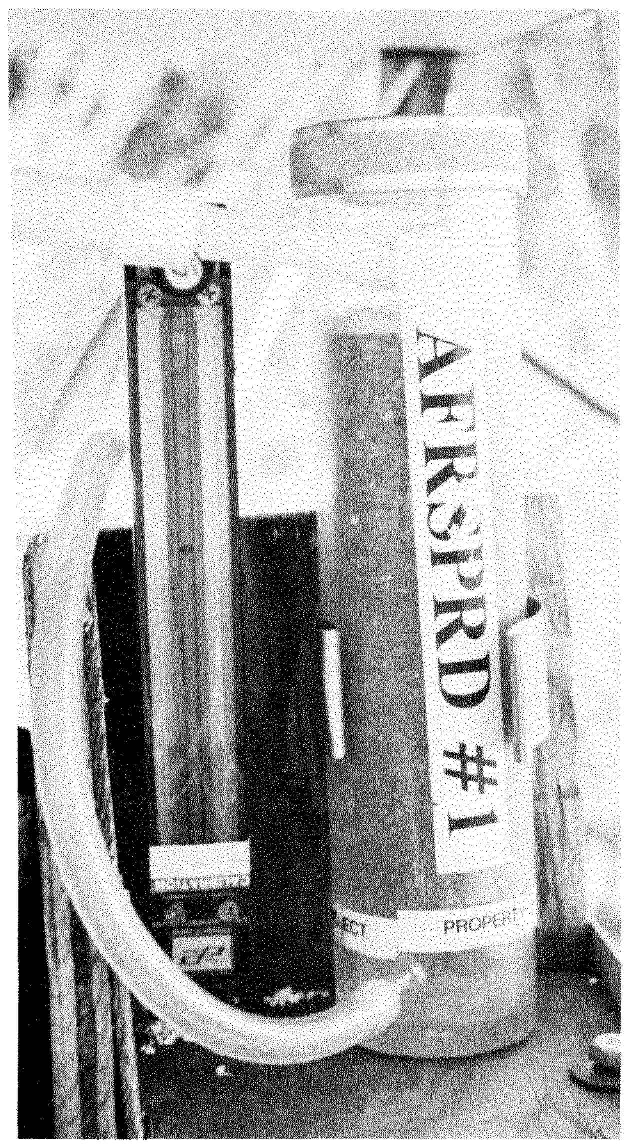
Because tritium, iodine, and other isotopic concentrations are quite low, the large-volume samples collected weekly from the main plant stack and from other emission-point samplers provide the only practical means of determining the amount of specific radionuclides released from the facility. In addition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

The Main Plant Ventilation Stack

A map showing on-site air monitoring and sampling points may be found in Figure 2-1 (p. 2-3).

The main ventilation stack is potentially the greatest contributor to releases. The main stack sampling system collects a continuous air sample from this emission point. A high sample-collection flow rate through multiple intake nozzles ensures a representative sample for both the weekly sample and the on-line monitoring system. The total quantity of gross alpha, gross beta, and tritium released each month from the main stack, based on weekly measurements, is shown in *Appendix C-2,* Table C-2.1 (p. C2-3). Figure 2-10 (p. 2-16) shows the nine-year trends for the main stack samples analyzed for gross alpha and gross beta activity. The figure indicates a steady five-year downward trend in activity observed for both gross alpha and gross beta from 1987 to mid-1992. From mid-1992 throughout mid-1995 both gross alpha and beta activities rose slightly and then leveled off. During the third and fourth quarters of 1995 concentrations of gross alpha, gross beta, and gamma-emitting radionuclides in ventilated air increased due to transfers of cesium-loaded zeolite from waste tank 8D-1 to 8D-2.

A comparison of airborne radioactivity concentrations released from the main plant ventilation system during these operations with the DOE DCG in Table C-2.2 (p. C2-4) indicates that at the point of stack discharge, average radioactivity levels were already below concentration guide-



Silica Gel Columns from the Rock Springs Road Ambient Air Sampler

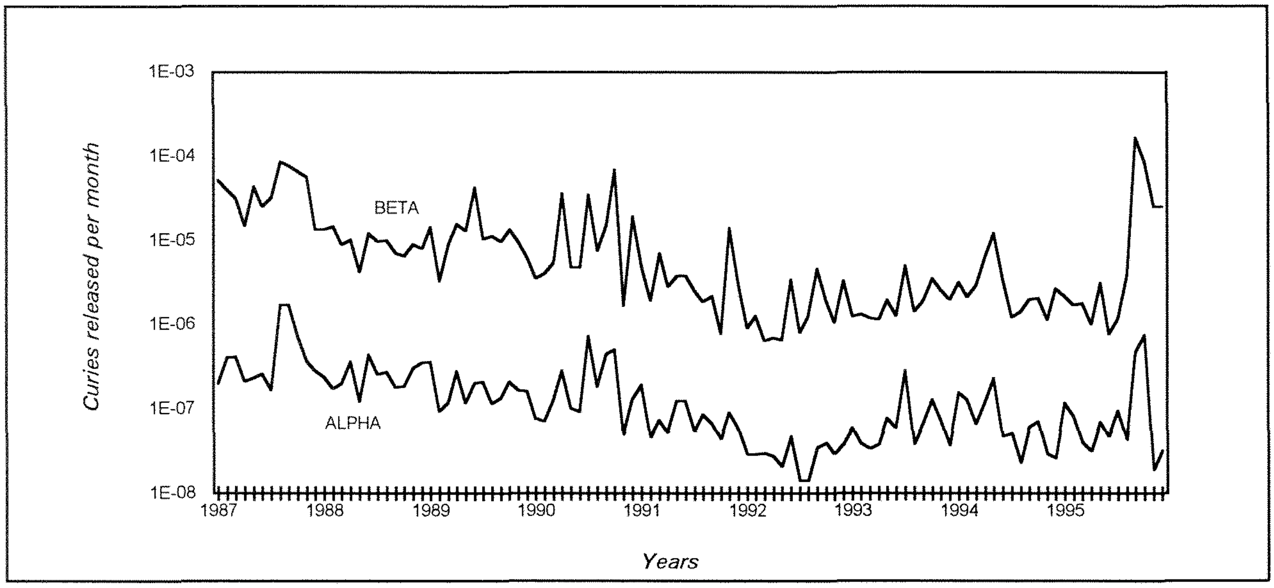


Figure 2-10. Nine-Year Trends of Gross Alpha and Gross Beta Activity at the Main Stack Sampling Location (ANSTACK)

lines for airborne radioactivity in an unrestricted environment. Airborne concentrations from the stack to the site boundary are reduced by an average factor of about 200,000. Samples from ambient air perimeter monitors at the site boundary confirm that these operations had no effect on air quality at these perimeter locations.

Vitrification Facility Sampling System

In November 1995 new sampling and monitoring equipment was brought on-line at the vitrification facility in order to check its operation before it is used during vitrification. The vitrification heating, ventilation, and air conditioning (HVAC) stack — ANVITSK — and the seismically protected backup sampler — ANSEISK — will monitor non-off-gas ventilation releases from the vitrification building. Air exhausted to the environment will be monitored for radioactivity. Results gathered to date (Tables C-2.3 and C-2.4 [p. C2-5]) represent initial pre-vitrification baseline or background levels.

Other On-site Sampling Systems

- Sampling systems similar to those of the main stack monitor airborne effluents from the 01-14 building, formerly the cement solidification system ventilation stack (ANCSSTK), the contact size-reduction facility ventilation stack (ANCSRFK), and the supernatant treatment system ventilation stack (ANSTSTK).

In August 1995, new radioactive-emissions monitoring equipment was brought on-line at the cement solidification ventilation stack (ANCSSTK). This system replaced the original monitoring equipment as part of the changes to the facility from handling cement solidification equipment to containing vitrification off-gas treatment system components.

The 1995 samples from ANCSSTK, ANCSRFK, and ANSTSTK showed detectable gross radioactivity in some cases, including specific beta- and alpha-emitting radionuclides, but did not approach any Department of Energy effluent limitations. Tables C-2.5 through C-2.7 (pp. C2-6 through C2-8) show monthly totals of gross alpha and

Global Fallout Sampling

Global fallout is sampled at four of the perimeter air sampler locations and at the base of the original on-site meteorological tower. Precipitation from all of the locations is collected and analyzed every month. Results from these measurements are reported in nCi/m^2 per month for gross alpha and gross beta and in µCi/mL for tritium. (The 1995 data from these analyses and precipitation pH measurement data are found in Appendix C-2, Table C-2.27 [p. C2-23].)

Fallout-pot data indicate short-term effects. Long-term deposition is measured by surface soil samples collected annually near each air sampling station. Soil sample data are found in Table C-1.30 [p. C1-24] of Appendix C-1.

The measured concentrations are typical of normal background concentrations in the region, with one exception. Soil from the Rock Springs Road air sampler has consistently shown a higher-than-background cesium-137 concentration. This sampler is known to be within an extended area of elevated cesium activity that was identified by a 1979 survey, well before the Project was initiated.

beta radioactivity and quarterly total radioactivity released for specific radionuclides for each of these sampling locations.

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

  Results for samples collected in 1995 from the supercompactor ventilation (ANSUPCV) are presented in Table C-2.8 (p. C2-9). Routine supercompactor system operation was curtailed in April 1994 due to reduced operational needs. Since then, it has operated only for short periods of one day to one week. The supercompactor stack is monitored continuously when the system is operating.

  The low-level waste treatment facility ventilation system and the contaminated clothing laundry ventilation system are sampled for gross alpha and gross beta radioactivity. Data for these two facilities are presented in Tables C-2.9 through C-2.11 (pp. C2-10 and C2-11).

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

  In 1995 average discharges at the point of release from portable outdoor ventilation units were well below DOE guidelines for alpha and beta radioactivity in an unrestricted environment. Dilution from the point of release to the site boundary would further reduce these concentrations.

- In February 1995 ambient air monitors were installed near the lag storage area (ANLAGAM) and near the NDA (ANNDAAM). Results of this monitoring are presented in *Appendix C-2*, Tables C-2.12 and C-2.13 (pp. C2-12 and C2-13).

- An ambient air sampler (ANSDAT9) provides monitoring of potential diffuse releases of radioactivity associated with the SDA, which is managed by the New York State Energy and Research Development Authority. The ANSDAT9 sampler could also detect site-wide releases to ambient air. Results of this monitoring are presented in *Appendix C-2*, Table C-2.14 (p. C2-14).

Perimeter and Remote Air Sampling

Maps of perimeter and remote air sampling locations may be found in Figure 2-2 (p. 2-4) and Figure A-9 (p. A-55).

As in previous years, airborne particulate samples for radiological analysis were collected continuously at six locations around the perimeter of the site and at five remote locations at Great Valley, West Valley, Springville, Dunkirk, and, beginning in 1995, Nashville, New York.

Perimeter locations — on Fox Valley Road, Rock Springs Road, Route 240, Thomas Corners Road, Dutch Hill Road, and at the site's bulk storage warehouse — were chosen to provide historical continuity or because the location would best represent the highest potential airborne concentration of radioactivity. The nine-year trends of gross alpha and gross beta concentrations at the Rock Springs Road location are shown in Figure 2-11.

The remote locations provide data from nearby communities — West Valley and Springville — and from more distant background areas. Concentrations measured at Great Valley (AFGRVAL, 29 km south of the site), Dunkirk (AFDNKRK, 50 km west of the site), and Nashville (AFNASHV, 37 km west of the site in the town of Hanover), are considered representative of regional natural background radiation.

(The Dunkirk air sampler [AFDNKRK] was removed from service in June 1995 because of difficulties in maintaining a lease agreement for the property on which it was placed. The ambient air samplers at Dunkirk and Nashville [AFNASHV] were operated in parallel for six weeks in order to study the effects of relocating the Dunkirk sampler. The results of this study indicated that there is no appreciable difference in the data obtained from the analysis of the air filters collected from the samplers.)

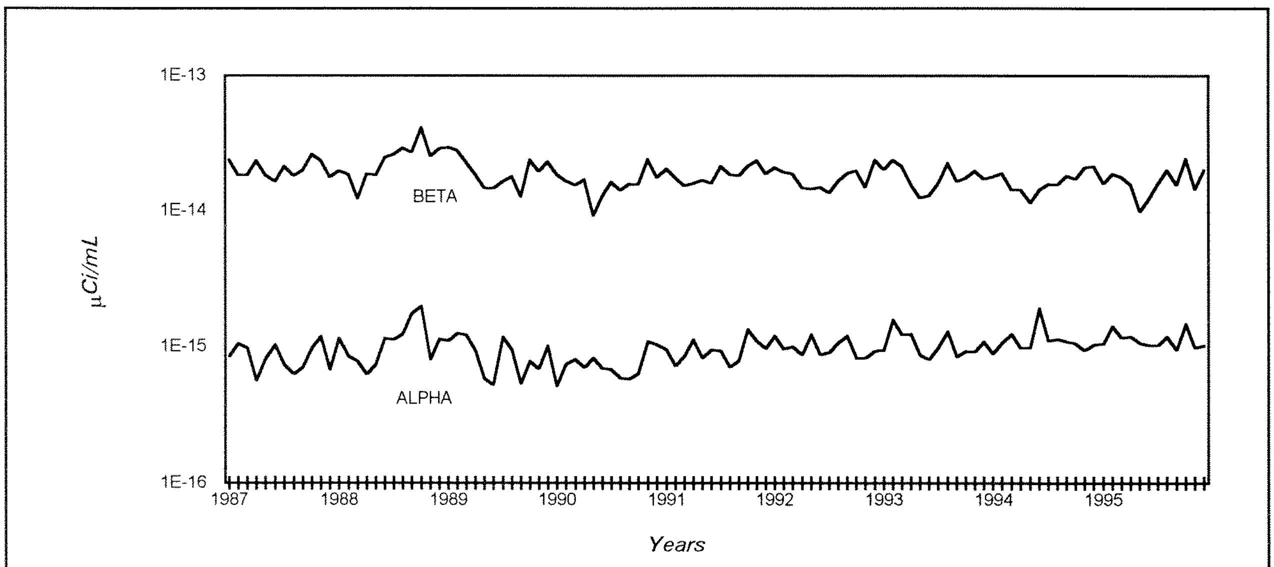


Figure 2-11. Nine-Year Trends of Gross Alpha and Gross Beta Concentrations at the Rock Springs Road Sampling Location (AFRSPRD)

The six perimeter samplers and the four remote 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 for each of the locations are set at 1.7 meters above the ground, the height of the average human breathing zone.

Filters from off-site and perimeter samplers are collected weekly and analyzed after a seven-day "decay" period to remove interference from short-lived naturally occurring radioactivity. Gross alpha and gross beta measurements of each filter are made weekly using a low-background gas proportional counter. The gross alpha and gross beta ranges and annual averages for each of the ambient sampling points are provided in Tables 2-3 and 2-4 (p. 2-20). The 1995 concentration ranges are similar to those seen in 1994. Near-site sample concentrations are indistinguishable from background and all reflect normal seasonal variations.

In addition, quarterly composites, each consisting of thirteen weekly filters from each sample station, are analyzed. Data from these samplers are provided in *Appendix C-2,* Tables C-2.16 through C-2.26 (pp. C2-16 to C2-22). Although tritium (as hydrogen-tritium oxide [HTO]) was positively detected on several occasions at the Rock Springs Road location near the site, those concentrations were the same as positive concentrations observed at the Great Valley background location.

The 1995 data for the three samplers that have been in operation since before 1982 — Fox Valley, Thomas Corners, and Route 240 — averaged about 1.77E-14 μCi/mL (6.56E-04 Bq/m^3) of gross beta activity in air. This average is comparable to 1994 data. The average gross beta concentration at the Great Valley background station was 4.02E-14 μCi/mL (1.49E-03 Bq/m^3) in 1994, and in 1995 averaged 1.78E-14 μCi/mL (6.60E-04 Bq/m^3).

Springville Dam on Cattaraugus Creek

Table 2 - 3

1995 Gross Alpha Activity at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	Number of Samples	Range µCi/mL	Range Bq/m³	Annual Average µCi/mL	Annual Average Bq/m³
AFFXVRD	52	<6.96E-16 — 2.00E-15	<2.58E-05 — 7.40E-05	0.73±1.04E-15	2.69±3.85E-05
AFRSPRD	52	<8.19E-16 — 2.29E-15	<3.03E-05 — 8.47E-05	0.93±1.07E-15	3.44±3.95E-05
AFRT240	52	<4.81E-16 — 2.52E-15	<1.78E-05 — 9.32E-05	0.91±1.07E-15	3.36±3.96E-05
AFSPRVL	52	<7.16E-16 — 2.87E-15	<2.65E-05 — 1.06E-04	0.76±1.03E-15	2.83±3.81E-05
AFTCORD	52	<7.30E-16- — 2.52E-15	<2.70E-05 — 9.32E-05	0.75±1.11E-15	2.76±4.11E-05
AFWEVAL	52	<6.82E-16 — 2.31E-15	<2.52E-05 — 8.55E-05	0.83±1.06E-15	3.07±3.91E-05
AFGRVAL	52	<6.90E-16 — <6.44E-15	<2.55E-05 — <2.38E-04	0.91±1.50E-15	3.37±5.54E-05
AFBOEHN	52	<6.99E-16 — 2.90E-15	<2.59E-05 — 1.07E-04	0.92±1.13E-15	3.40±4.19E-05
AFDNKRK	24	<7.18E-16 — 2.55E-15	<2.66E-05 — 9.44E-05	0.94±1.04E-15	3.50±3.85E-05
AFNASHV	34	<5.47E-16 — 2.40E-15	<2.02E-05 — 8.88E-05	0.93±1.07E-15	3.46±3.97E-05
AFBLKST	52	<5.82E-16 — 3.16E-15	<2.15E-05 — 1.17E-04	0.84±1.06E-15	3.13±3.91E-05
ANLAGAM	44	<3.87E-16 — 1.75E-15	<1.43E-05 — 6.48E-05	5.63±7.04E-16	2.08±2.60E-05
ANNDAAM	44	<5.72E-16 — 3.27E-15	<2.12E-05 — 1.21E-04	9.56±7.92E-16	3.54±2.93E-05

Table 2 - 4

1995 Gross Beta Activity at Off-site, Perimeter, and On-site Ambient Air Sampling Locations

Location	Number of Samples	Range µCi/mL	Range Bq/m³	Annual Average µCi/mL	Annual Average Bq/m³
AFFXVRD	52	7.72E-15 — 3.14E-14	2.86E-04 — 1.16E-03	1.84±0.36E-14	6.82±1.32E-04
AFRSPRD	52	8.74E-15 — 3.38E-14	3.23E-04 — 1.25E-03	1.69±0.33E-14	6.25±1.23E-04
AFRT240	52	6.70E-15 — 3.19E-14	2.48E-04 — 1.18E-03	1.77±0.34E-14	6.56±1.26E-04
AFSPRVL	52	8.04E-15 — 2.79E-14	2.97E-04 — 1.03E-03	1.55±0.33E-14	5.73±1.21E-04
AFTCORD	52	8.10E-15 — 3.38E-14	3.00E-04 — 1.25E-03	1.71±0.36E-14	6.35±1.32E-04
AFWEVAL	52	7.12E-15 — 4.50E-14	2.63E-04 — 1.67E-03	2.03±0.36E-14	7.50±1.32E-04
AFGRVAL	52	7.42E-15 — 3.60E-14	2.75E-04 — 1.33E-03	1.78±0.42E-14	6.60±1.55E-04
AFBOEHN	52	6.74E-15 — 4.44E-14	2.49E-04 — 1.64E-03	2.02±0.37E-14	7.48±1.36E-04
AFDNKRK	24	8.77E-15 — 2.49E-14	3.24E-04 — 9.21E-04	1.67±0.32E-14	6.16±1.20E-04
AFNASHV	34	8.13E-15 — 3.85E-14	3.01E-04 — 1.42E-03	1.90±0.35E-14	7.01±1.29E-04
AFBLKST	52	4.40E-15 — 3.42E-14	1.63E-04 — 1.27E-03	1.76±0.34E-14	6.50±1.25E-04
ANLAGAM	44	<1.32E-15 — 2.51E-14	<4.88E-05 — 9.29E-04	1.08±0.22E-14	4.01±0.81E-04
ANNDAAM	44	7.52E-15 — 3.09E-14	2.78E-04 — 1.14E-03	1.64±0.25E-14	6.08±0.92E-04

Off-site Surface Soil Sampling

Maps of off-site surface soil sampling locations may be found in Figures A-6 and A-9 (pp. A-52 and A-55).

Soil from the upper two inches of the ground near the perimeter air samplers is collected annually to measure the radioactivity deposited by worldwide fallout. Samples were collected in 1995 from ten locations: six points on the perimeter of the retained premises (WNYNSC), two in nearby communities, and two in locations 30 to 50 kilometers distant from the Project. Analyses for cesium-137, strontium-90, plutonium-239/240, and americium-241 at all ten locations and analyses for uranium radionuclides at three points were compared among the sample locations.

The 1995 results (Table C-1.30 [p. C1-24]) show that with the exception of two cesium-137 results from the northeast and northwest perimeter sampler locations and one cesium-137 result from the West Valley sampler, detectable concentrations of strontium-90, cesium-137 (both present in worldwide fallout), cobalt-60, and manmade alpha-emitting radionuclides were within the same range of uncertainty as background samples. Even the slightly higher cesium-137 results remain within the range observed at background locations during the past five years.

It should be noted that the consistency of low-level positive cesium-137 results over the years at the SFRSPRD location does support the existence of known cesium contamination of soil in that area, thought to have originated from previous plant operations.

Radioactivity in the Food Chain

Maps showing biological sampling points are found in Figures A-9 (p. A-55) and 2-12 (p. 2-22).

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

Fish

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

Twenty fish samples are collected every year (ten semiannually) above the Springville dam from the portion of Cattaraugus Creek that is downstream of WNYNSC drainage (BFFCATC). Ten fish samples are also collected annually from Cattaraugus Creek below the dam (BFFCATD), including species that migrate nearly forty miles upstream from Lake Erie. These specimens are representative of sport fishing catches in the creek downstream of the dam at Springville.

Twenty control fish are taken every year (ten semiannually) from waters that are not influenced by site runoff (BFFCTRL). These control samples, containing no radioactivity from WVDP effluents, allow comparisons with the concentrations found in fish taken from site-influenced waters. The control samples are representative of the species collected in Cattaraugus Creek downstream from the WVDP. A combined total of fifty fish were collected from these locations.

The edible portion of each individual fish collected was analyzed for strontium-90 content and the gamma-emitting radionuclides cesium-134 and cesium-137. (See Table C-3.4 [p. C3-6] in *Appendix C-3* for a summary of the results.) Throughout the year concentrations of strontium-90 ranged from below the minimum detectable con-

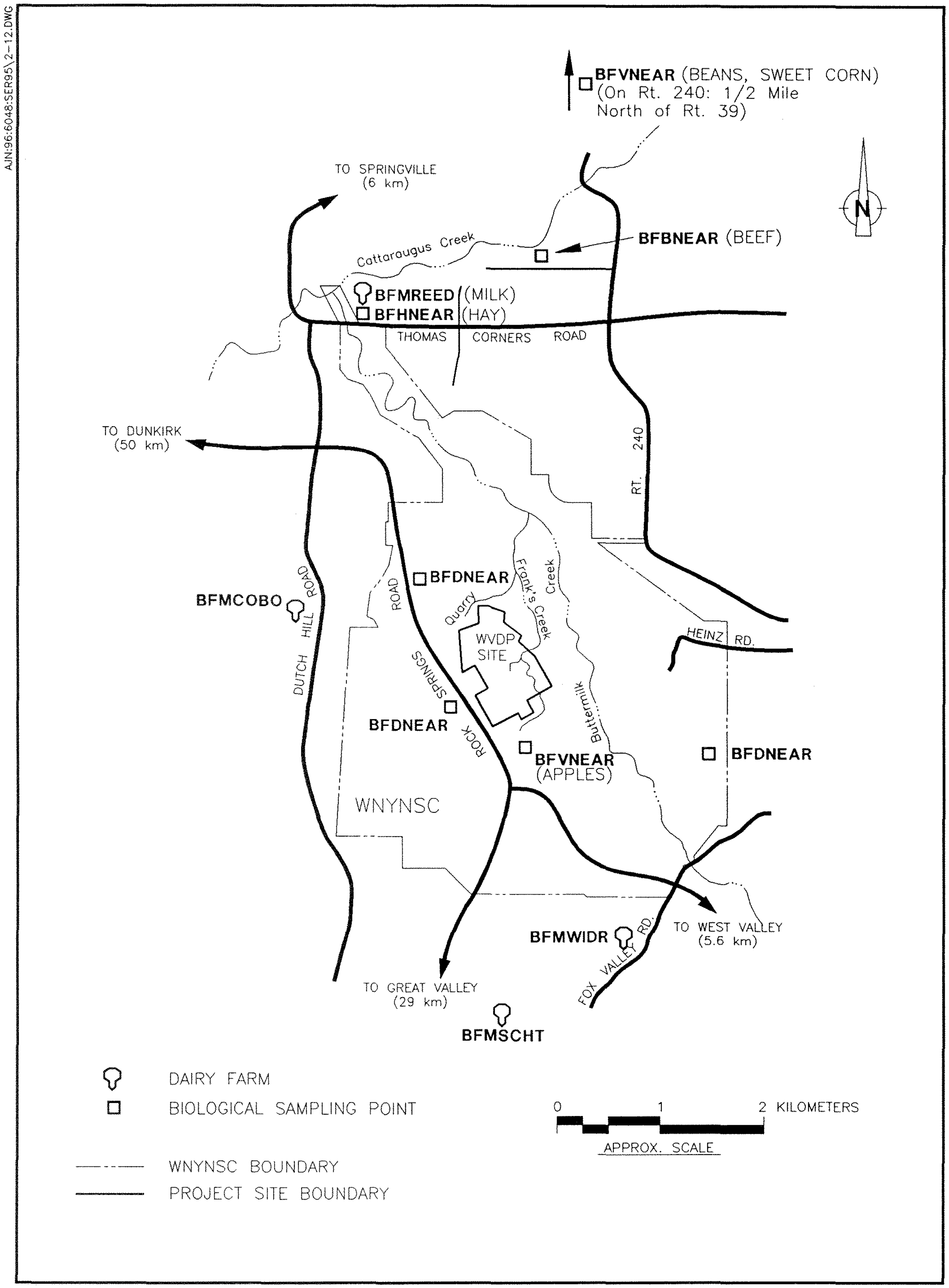


Figure 2-12. Near-site Biological Sampling Points.

Electrofishing in Cattaraugus Creek

centration (see *Glossary*) to a maximum of 1.01E-07 µCi/g at BFFCATC and from below the minimum detectable concentration to 1.94E-08 µCi/g at the control location (BFFCTRL). As discussed in *Chapter 4, Radiological Dose Assessment* [p. 4-9], strontium-90 has been observed in marginally higher concentrations than background in the population of bottom-feeding fish downstream of the site but above the Springville dam. Despite this small difference, all downstream fish concentrations are still within the range of Project historical background values.

Although six fish collected downstream of the site showed marginally positive detections for cesium-137, these cesium concentrations were all within the range of those seen at the background location. Two downstream fish samples had positive detections of cesium-134 but were not statistically different from concentrations in background fish.

Venison

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

For the second year during the large-game hunting season, hunters were allowed access to the WNYNSC, excluding the WVDP premises, during the large-game hunting season, in a controlled hunting program established by the New York State Energy Research and Development Authority (NYSERDA). Thirty-eight deer were collected during this program.

Venison from three deer taken by hunters from the area around the WNYNSC was analyzed and the data compared with those from deer collected far from the site in the towns of Friendship, Carrollton, and Hinsdale, New York. Low levels of radioactivity were detected for both near-site and control samples for cesium-137 and naturally occurring potassium-40. Results for these samples are shown in Table C-3.2 (p. C3-4) in *Appendix C-3*. Concentrations in near-site deer were at or below background levels for those radionuclides in 1995. The range in concentrations observed was similar to previous years. Cesium-134 was not detected in any near-site or control deer during 1995. Tritium concentrations in near-site deer were the same as those found in background deer. Positive strontium-90 concentrations in near-site deer were not statistically different from levels seen at control locations.

Beef

Again in 1995, as in previous years, very little difference in isotopic concentration has been observed between near-site and control herds. Beef samples taken semiannually from near-site and remote locations are analyzed for tritium, strontium-90, and gamma-emitting radionuclides such as cesium-134 and cesium-137.

In 1995 there was one marginally positive detection for strontium-90 in a near-site beef sample. However, this value was not statistically different from a control sample. Results for all near-site and control samples were near or below the minimum detectable concentrations for tritium and cesium-134. Although two positive cesium-137 results were obtained, both were for control samples. These results are presented in Table C-3.2 (p. C3-4) in *Appendix C-3*.

Milk

Monthly milk samples were taken in 1995 from dairy farms near the site and from control farms at some distance from the site. (See Fig. 2-12 [p. 2-22].) Quarterly composites of monthly samples from the maximally exposed herd to the north (BFMREED) and quarterly composites of milk from a nearby herd to the northwest (BFMCOBO) were prepared. Single annual samples were taken from herds near the WVDP to the southeast (BFMWIDR) and the south (BFMSCHT). Monthly samples from control herds (BFMCTLN and BFMCTLS) were also prepared as quarterly composites. (See Fig. A-9 in *Appendix A* [p. A-55] for control sample locations.)

Each milk sample was analyzed for strontium-90, iodine-129, gamma-emitting radionuclides (naturally occurring potassium-40 and cesium-134 and cesium-137), and tritium. Strontium-90 was detectable in all near-site and control samples. The strontium-90 results for near-site milk ranged from 7.33E-10 to 4.19E-09 μCi/mL (0.027 to 0.155 Bq/L), and the control milk samples ranged from 8.71E-10 to 2.96E-09 μCi/mL (0.032 to 0.110 Bq/L). Although the first-quarter composite result for near-site location BFMCOBO was higher than the highest control sample seen in 1995, it is statistically the same as historical background values.

One near-site composite showed a positive value for cesium-137. This positive detection is not statistically different from historical background values. Two marginally positive iodine-129 results seen in near-site milk samples were not statistically different from marginally positive background concentrations seen in 1995. Three marginally positive tritium detections were not statistically different from the range of background values seen. The results of all of these analyses are shown in Table C-3.1 (p. C3-3) in *Appendix C-3*.

Fruit and Vegetables

Results from the analysis of beans, apples, sweet corn, and hay collected during 1995 are presented in Table C-3.3 (p. C3-5) in *Appendix C-3*. Tritium was detected in near-site corn and bean samples at levels that were not significantly higher than historical background samples.

Positive strontium-90 results were obtained in all samples in 1995. Of these positive results, only the near-site apple sample, collected from on-site trees not used for human consumption, indicated strontium at a significantly higher concentration than its background. This value is several times higher than that observed in 1994 but is still within the range of other biological matrix control values.

Cesium-137 was detected in near-site hay samples but at a concentration statistically identical to its background.

Two marginally positive cobalt-60 values observed in near-site beans and apples were at levels statistically no different from background bean and apple values. Overall results obtained for 1995 are comparable to previous years.

Direct Environmental Radiation Monitoring

The current monitoring year, 1995, was the twelfth full year in which direct penetrating radiation was monitored at the WVDP using TLD-700 lithium fluoride thermoluminescent dosimeters (TLDs). These dosimeters, used solely for environmental monitoring, consist of five TLD chips laminated on a card bearing the location identification and other information. The cards are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure.

During 1995, the WVDP switched from processing TLD packages on-site to supply and processing by an independent off-site contractor. The same TLD materials, packaging, and placement have been retained with the new contract. (See *Appendix D*, Table D-4 [p. D-7] for a comparison of on-site and subcontractor results.)

Monitoring points are located around the WNYNSC perimeter and the access road, at the waste management units, at the site security fence, and at background locations remote from the WVDP site. (See Figs. 2-13 and 2-14 [pp. 2-26 and 2-27] and Fig. A-9 [p. A-55].) The TLDs are numbered in order of their installation. The monitoring locations are as follows:

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

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

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

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

BACKGROUND: TLDs #17 (Five Points Landfill in Mansfield); #23 (Great Valley); #37 (Dunkirk/Nashville); #41 (Sardinia). The Nashville location replaced the Dunkirk location in June 1995.

Measured exposure rates were comparable to those of 1994. There was no significant difference between the pooled quarterly average background TLDs (#17, #23, #37, and #41) and the pooled average for the WNYNSC perimeter locations for the 1995 reporting period.

Appendix C-4 (pp. C4-1 through C4-5) provides a summary of the results by calendar quarter for each of the environmental monitoring locations along with averages for comparison. The fourth-quarter data were provided by the new subcontractor.

The quarterly averages and individual location results show differences due to seasonal variation. The data obtained for all four calendar quarters compared favorably to the respective quarterly data in 1994. The quarterly average of the seventeen WNYNSC perimeter TLDs was 18.4 milliroentgen (mR) per quarter (17.6 mrem per quarter) in 1995.

The perimeter TLD quarterly averages since 1987, expressed in microroentgen per hour (μR/hr), are shown in Figure 2-15.

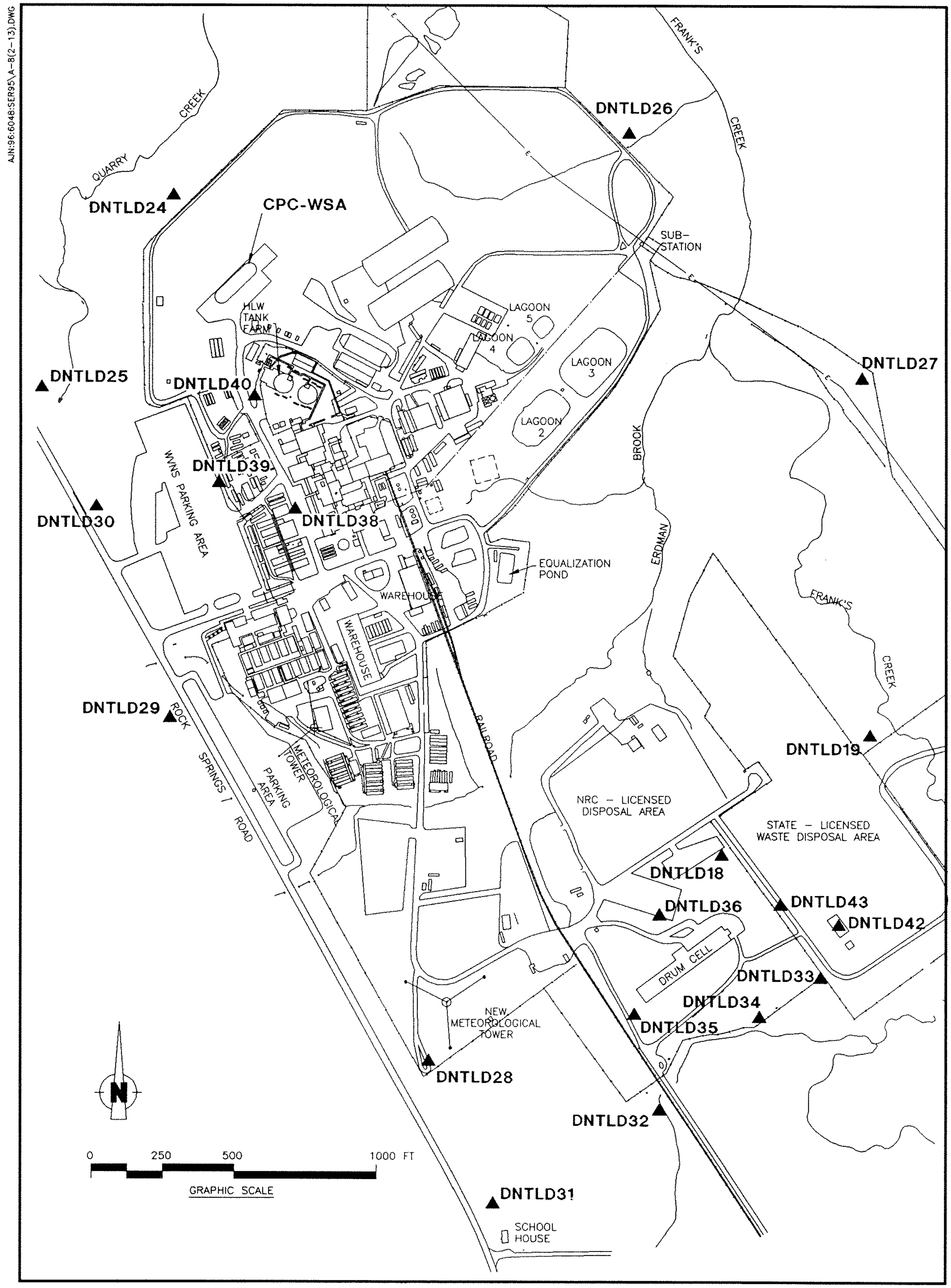


Figure 2-13. Location of On-site Thermoluminescent Dosimeters (TLDs).

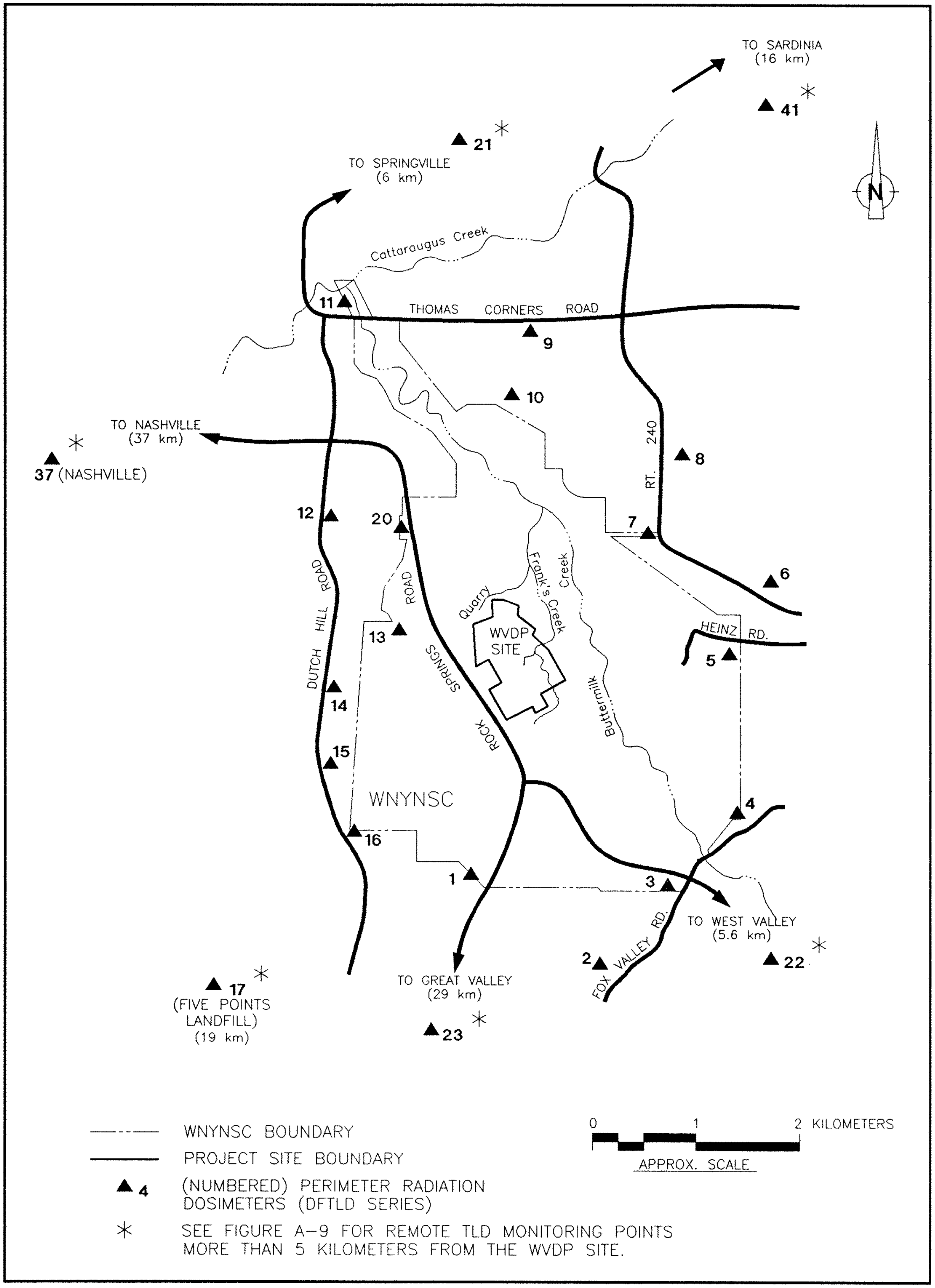


Figure 2-14. Location of Off-site Thermoluminescent Dosimeters (TLDs).

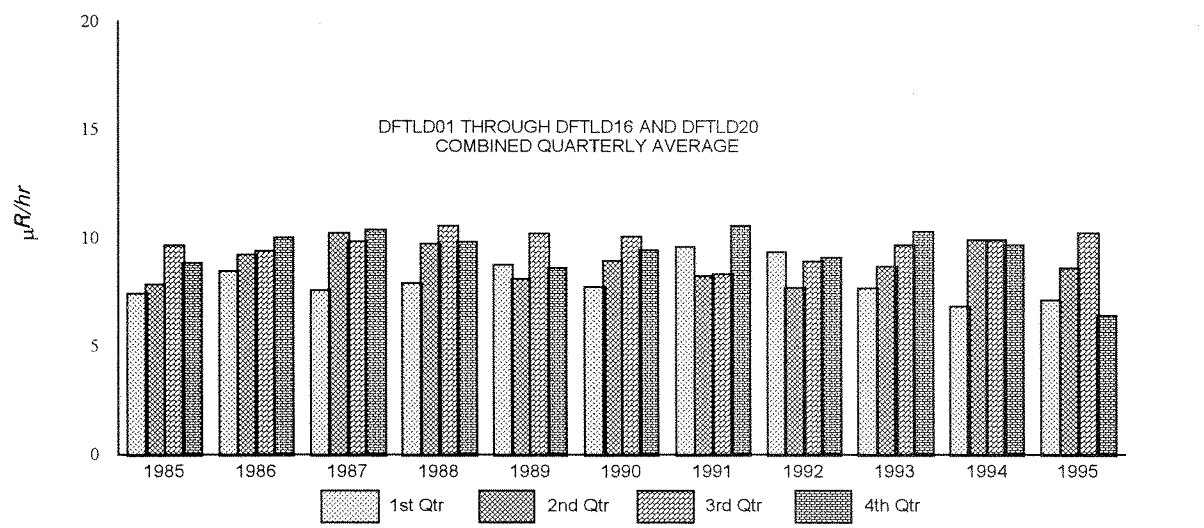


Figure 2-15. Ten-Year Trend of Environmental Radiation Levels (µR/hr)

On-site Radiation Monitoring

The dosimeter at location #19 near the SDA routinely shows radiation exposures slightly above those seen at WNYNSC perimeter locations. Locations #25, #29, and #30 on the public access road west of the facility and #26 at the east security fence also showed small elevations above background. Although above background, the readings are relatively stable from year to year. (See *Appendix C-4*, Table C-4.1 [p. C4-3].)

Location #24 on the north inner facility fence is a co-location site for one NRC TLD. (See *Appendix D*, Table D-4 [p. D-7].) This point received an average exposure of 0.39 milliroentgens (mR) per hour during 1995, as opposed to 0.47 mR/hr in 1994, 0.48 mR/hr in 1993, and 0.52 mR/hr in 1992. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby. The decline in exposure rate over time is due to radioactive decay of the materials stored within. The storage area is well within the WNYNSC boundary and is not accessible by the public.

Locations around the integrated radwaste treatment storage building — the drum cell — for the most part stayed the same or decreased slightly during the 1995 calendar year. The average dose rate at location #35, however, increased slightly, possibly due to the rearrangement of waste packages in the drum cell. The average dose rate at these locations (TLDs #18, #32, #33, #34, #35, and #36) was 0.024 mR/hr in 1995, similar to the level observed in 1994. These exposure rates, which are above background levels, reflect the placement in the building of drums containing decontaminated supernatant mixed with cement. The drum cell and the surrounding TLD locations are well within the WNYNSC boundary and are not accessible by the public.

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

Results for two new locations added in 1994, #42 and #43, are above background locations, reflecting their positions near waste storage areas.

Perimeter and Off-site Radiation Monitoring

The perimeter TLDs (TLDs #1-16 and #20) are located in the sixteen compass sectors around the facility near the WNYNSC boundary. The quarterly averages for these TLDs (Fig. 2-15 [p. 2-28]) indicate no trends other than normal seasonal fluctuations. TLDs #17, #21-23, #37, and #41 monitor near-site community and background locations. The results from these monitoring points are essentially the same as the perimeter TLDs. Figure C-4.1 in *Appendix C-4* (p. C4-3) shows the average quarterly exposure rate at each off-site TLD location. Figure C-4.2 (p. C4-4) shows the average quarterly exposure rate at each on-site TLD.

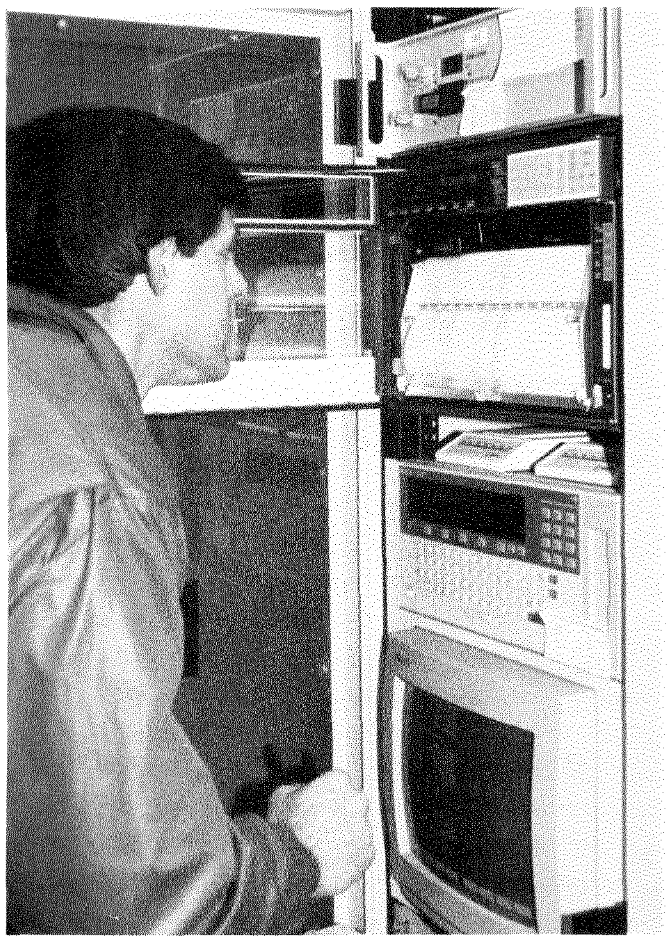
Meteorological Monitoring

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 calculate dispersion models for any releases that may exceed DOE effluent limits.

Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which is a function indicated by the difference in temperature between the 10-meter and 60-meter elevations), these parameters are closely monitored and are available to the emergency response organization at the WVDP.

The on-site 60-meter meteorological tower (Fig. 2-1 [p. 2-3]) 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 5 kilometers south of the site on a hillcrest on Dutch Hill Road continuously monitors wind speed and wind direction. (See Fig. A-9 [p. A-55].) Dewpoint, precipitation, and barometric pressure are also monitored at the on-site meteorological tower location.

The two meteorological locations supply data to the primary digital and analog data acquisition systems located within the Environmental Laboratory. On-site systems are provided with either uninterruptible or standby power backup in case of site power failures. In 1995 the on-site system data recovery rate (time valid data was logged versus total elapsed time) was 97.7%. Figures C-6.1 and C-6.2 in *Appendix C-6* (pp. C6-3 and



Checking Data from the Meteorological Tower

C6-4) illustrate 1995 mean wind speed and wind direction at the 10-meter and 60-meter elevations. Regional data at the 10-meter elevation are shown in Figure C-6.3 (p. C6-5).

Weekly and cumulative total precipitation data are illustrated in Figures C-6.4 and C-6.5 in *Appendix C-6* (p. C6-6). Precipitation in 1995 was approximately 87 centimeters (34 in), 17% below the annual average of 104 centimeters (41 in).

Information such as meteorological system calibration records, site log books, and analog strip charts are stored in protected archives. Electronic files containing meteorological data are copied (downloaded) daily and stored off-site. Meteorological towers and instruments are examined three times weekly for proper function and are calibrated semiannually and/or whenever instrument maintenance might affect calibration.

Special Monitoring

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

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

The trench was designed to intercept and collect subsurface water, which could be carrying n-dodecane/TBP, in order to prevent the material from entering the surface water drainage ditch leading into Erdman Brook. The LPS was installed to decant the n-dodecane/TBP from the water and to remove iodine-129 from the collected water before its transfer to the low-level waste treatment facility. The separated n-dodecane/TBP would be stored for subsequent treatment and disposal. In response to a 1994 functional readiness review of the system, operator training was conducted and LPS structure make-up air control was improved.

In 1995 no water containing n-dodecane/TBP was encountered in the trench and no water or n-dodecane/TBP has been treated by the LPS. It should be noted that although it does not by itself demonstrate the effectiveness of the interceptor trench, environmental monitoring results for samples collected just outside of the NDA have never contained analytes indicating the presence of n-dodecane/TBP.

Water-level data from wells and piezometers monitoring the weathered Lavery till indicate that the water table in the NDA is sloping towards and is captured by the trench, further supporting the effectiveness of the trench in intercepting and collecting groundwater.

Radiological and nonradiological monitoring data for waters collected from the trench (WNNDATR) and from the drainage just downstream (WNNDADR) have been discussed in this chapter under the on-site surface water section. Results of sampling of the NDA monitoring wells 909 and 910 are presented in *Chapter 3, Groundwater Monitoring*, Table 3-1 (pp. 3-7 through 3-12).

Northeast Swamp Drainage Monitoring

In 1993 trend analyses of surface and groundwater monitoring results began to indicate increasing gross beta concentrations in waters discharged through the northeast swamp drainage as monitored at sampling points WNDMPNE and WNSWAMP. (WNDMPNE and WNSWAMP monitored the same location; samples collected as part of the groundwater program were identified as WNDMPNE and surface water samples were identified as WNSWAMP. See *Chapter 3, Groundwater Monitoring* [p. 3-23].)

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

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

During 1995, routine ground- and surface water sampling continued to monitor radiological discharges through the northeast swamp drainage. (See *Appendix C-1*, Table C-1.7 [p. C1-8] and *Appendix E*, Table E-1 [p. E-3].)

The maximum monthly gross beta concentration observed at WNSWAMP during 1995 was 4.55±0.04E-06 µCi/mL (168 Bq/L) during September. Since then, gross beta and strontium-90 concentrations have diminished somewhat.

The mean gross beta result for December 1995 was 2.12±0.02E-06 µCi/mL (78.4 Bq/L). The December 1995 strontium-90 composite result for location WNSWAMP was 9.89±0.21E-07 µCi/mL (36.6 Bq/L). The DOE DCG of 1.0E-06 µCi/mL for strontium-90 pertains to an annualized average, which currently (January 1995 – December 1995) is 1.25±0.03E-06 µCi/mL (125% of the DOE DCG). Although the annualized average surface water strontium-90 concentration exceeded the strontium-90 DOE DCG at sampling location WNSWAMP (on the WVDP premises), monitoring downstream at the first point of possible public access (WFFELBR) continued to show gross beta concentrations to be indistinguishable from background (WFBIGBR).

A number of actions were undertaken by the WVDP in 1995 to communicate north plateau contamination issues to concerned regulatory agencies and to mitigate the movement of strontium-90 in site groundwater:

- The final Geoprobe® report describing the principal findings of this investigation, including potential sources and mitigative alternatives, was completed and submitted to NYSDEC in April 1995. This report complied with schedule provisions of the WVDP's SPDES permit.

- In November 1995, the WVDP installed and began operation of a groundwater pump-and-treat system. Recovered well water, after pretreatment, is directed to the site's low-level waste treatment facility for additional treatment before it is discharged to the environment through the monitored lagoon system. In

1995 approximately 935,000 liters (247,000 gal) were processed in this manner. The pump-and-treat system is currently being evaluated along with other technologies to determine if there are more effective methods for treating the groundwater.

Waste Tank Farm Underdrain Monitoring

Notable increases in gross beta and tritium activity at location WN8D1DR, attributable to surface contamination, were described in the 1993 and 1994 annual Site Environmental Reports. In the past this location received subsurface drainage from the high-level waste tank farm area and channeled it to a nearby surface water drainage. Since July 1993 this underdrain has been valved off (isolated) from the site's storm drain system, preventing water from freely flowing to the surface drainage. However, samples continue to be taken from the original collection point, a storm sewer access.

Drum Cell Monitoring

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

Most of the gamma radiation emitted from these drums is shielded by the configuration in which the drums are stacked. However, some radiation is emitted through the roof of the drum cell, which is unshielded. This radiation scatters in air and adds to the existing naturally occurring gamma-ray background.

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

The strength of the gamma-ray field can vary considerably from day to day because of changes in meteorological conditions. TLD measurements provide a more accurate estimate of long-term changes in the radiation field because they integrate the radiation exposure over an entire calendar quarter. Such quarterly readings show evidence of a seasonal cycle. Background radiation levels can vary annually depending on such factors as average temperature, air pressure, humidity, precipitation (including snow cover on the ground), and solar activity during a particular year. The TLD measurements at the Rock Springs Road location (TLDs #28 and #31) are presented in *Appendix C-4*, Table C-4.1 (p. C4-3).

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

Closed Landfill Maintenance

Closure of the on-site nonradioactive construction and demolition debris landfill (CDDL) was completed in August 1986. The landfill area was closed in accordance with the New York State Department of Environmental Conservation (NYSDEC) requirements for this type of landfill, following a closure plan (Standish 1985) approved by NYSDEC. To meet routine post-closure requirements, the CDDL cover was inspected in March and September 1995 and was found to be in proper condition. Adequate drainage was maintained to ensure that no obvious ponding or soil erosion occurred and that the grass planted on the clay and soil cap was cut.

Results of groundwater monitoring in the general area of the closed landfill are presented in *Chapter 3, Groundwater Monitoring* (p. 3-24).

Storm Water Monitoring Program

During the summer and fall of 1995, eleven storm water outfalls were sampled to characterize the storm water leaving the WVDP site and to collect data for use in a storm water permit reapplication. First-flush grab samples were collected during the first thirty minutes of the storm and flow-weighted composite samples were collected over the duration of the storm. The samples were analyzed for the parameters currently monitored as part of the existing State Pollutant Discharge Elimination System (SPDES) permit program and for several radionuclides.

The applicable regulations require that samples be collected from the discharge resulting from a storm event that precipitates more than 0.1 inches and begins at least seventy-two hours after the previous measurable storm event.

Qualifying events were identified by monitoring storm rainfall amounts and measuring the period of time after the end of each event.

The analytical data measured from the storm water samples were compiled in a new SPDES permit application for the site, encompassing all storm water outfalls and the previously permitted outfalls. The permit application is to be submitted to NYSDEC early in 1996.

For more information see the *Environmental Compliance Summary: Calendar Year 1995* (p. lvii).

Residential and Municipal Well Sampling

In addition to sampling at the locations listed in *Appendix A* (A-vi and A-vii), the on-site Environmental Laboratory occasionally is authorized to analyze samples sent in by local residents and municipalities at their request and at no cost to the residents or municipalities. Potable water samples from private residences near the site were analyzed this year for gross alpha, gross beta, tritium, potassium-40, cobalt-60, and cesium-137. All samples were at or below background activity.

Special Studies

Evaporation Rate Study

A special study was conducted in October 1995 to provide a realistic estimate of the evaporation rate of tritiated water from the low-level waste treatment facility lagoons during 1994. This study was initiated in response to concerns that the calculations performed for the 1994 National Emissions Standard for Hazardous Air Pollutants (NESHAP) report might be overly conservative.

Two computational methods were evaluated and compared to published estimated values for evaporation rates from shallow lakes and reservoirs in the Western New York region. The first method involved the same calculation performed for the 1994 report except that daily average WVDP meteorological values were used instead of annual average values in order to provide a more realistic estimate. In addition, more detailed data for lagoon 3 water temperatures and tritium concentrations were obtained for this study. The evaporation rate derived using the first method was 34 inches per year (or 0.17 Ci H-3/yr). The second computational approach incorporated estimates of the site humidity over different periods of the year and also provided an estimate of daily evaporation rates. This second method resulted in an estimate of up to 50 inches per year (or 0.25 Ci H-3/yr).

The conclusion reached by this study was that the estimate of 30 inches per year evaporation from the lagoons used in the 1994 annual NESHAP report is not overly conservative and is within the expected 25 to 35 inches per year water evaporation rate cited in the literature for the Western New York region.

Other Studies

No other special studies such as the previously completed small mammal study and the survey of trees near the NDA were conducted in 1995. (See the 1994 Site Environmental Report for a discussion of these studies.)

Nonradiological Monitoring

Air Monitoring

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

The nonradiological air permits are for sources of regulated pollutants that include particulates, ammonia, nitric acid mist and oxides of nitrogen, and sulfur. However, monitoring of these parameters currently is not required.

Surface Water Monitoring

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook (Fig. 2-16) and specifies the sampling and analytical requirements for each outfall. This permit was modified in 1990 to include additional monitoring requirements at outfall WNSP001. The WVDP applied for a renewed SPDES permit in 1992. It was received in early January 1994 and went into effect on February 1, 1994 with the expanded monitoring requirements and, in some cases, more stringent discharge limitations. The permit was again modified in April and November of 1994 and in June 1995.

Three outfalls were identified in the 1995 permit:

- outfall WNSP001, discharge from the low-level waste treatment facility
- outfall WNSP007, discharge from the sanitary and industrial wastewater treatment facility
- outfall WNSP008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons.

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

Some of the more significant features of the SPDES permit are the requirements to report five-day biochemical oxygen demand (BOD-5), total dissolved solids, iron, and ammonia data as flow-weighted concentrations and to apply a net discharge limit for iron. The net limit allows the Project to account for amounts of iron that are naturally present in the site's incoming water. The flow-weighted limits apply to the sum of the Project effluents but allow the more dilute effluents to be factored into the formula for determining compliance with permit conditions.

The SPDES monitoring data for 1995 are displayed in Figures C-5.2 through C-5.53 in *Appendix C-5* (pp. C5-6 through C5-23). The WVDP reported six noncompliance episodes in 1995 (Table C-5.2 [p. C5-4]). See the *Environmental Compliance Summary: Calendar Year 1995* (p. li).

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 1995. These samples are screened

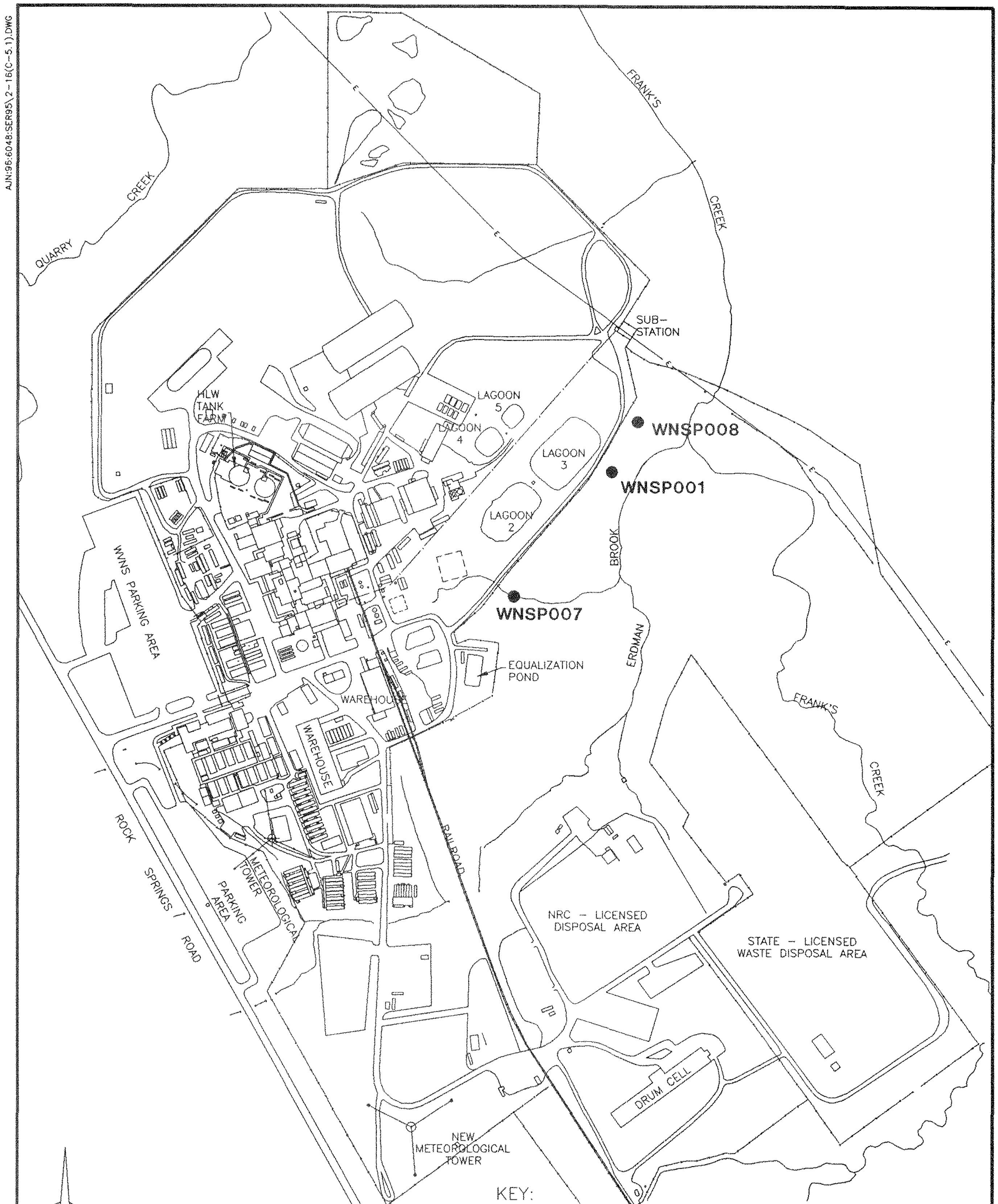


Figure 2-16. SPDES Monitoring Points.

for organic constituents and selected anions, cations, and metals. Results of these measurements for all of these locations are found in Table C-1.27 (p. C1-22) in *Appendix C-1*.

Appendix C-1, Tables C-1.19 and C-1.20 (pp. C1-16 and C1-17), present NPOC (nonpurgeable organic carbon), total organic halogens (TOX), and pH data for two locations that help monitor the NDA, WNNDADR and WNNDATR. (See Fig. 2-3 [p. 2-5].) When NPOC and TOX values at both locations are compared, the data suggest that even with moderate fluctuation there is little if any significant difference.

Drinking Water Monitoring

As a result of changes in EPA and New York State monitoring requirements, the site drinking water was sampled for copper and lead concentrations. (See **Safe Drinking Water Act** in the *Environmental Compliance Summary: Calendar Year 1995* [p. liv].) Samples also were collected for nitrate, fluoride, and metals concentrations analyses. This sampling activity will be repeated annually as part of the site's drinking water monitoring effort.

Lagoon 3 Phytoplankton and Chlorophyll Sampling

As part of the investigation into lagoon 3 BOD-5 increases during the summer months, the effects of both phytoplankton and chlorophyll in the lagoon system were investigated. The Environmental Laboratory collected several samples from the lagoons that were then analyzed by the State University of New York at Brockport. The investigation indicated that the lagoon system produces high phytoplankton biomass and chlorophyll levels. The conclusion drawn from the sampling was that phosphorous levels in the lagoon system, which were producing high organic matter, were the ultimate cause of the elevated BOD.

Lagoon 3 was treated with hydrogen peroxide and resampled. The results from this sampling showed that the addition of hydrogen peroxide did not significantly reduce chlorophyll or phytoplankton biomass levels. Brockport recommended the use of an algicide that would not increase the total phosphorous levels in the lagoon to control the biomass levels in the lagoon system. This recommendation is under consideration.

GROUNDWATER MONITORING

Geological History of the West Valley Site

The West Valley Demonstration Project (WVDP) is located on the dissected and glaciated Allegheny Plateau at the northern border of Cattaraugus County in southwestern New York. The site is underlain by a thick sequence of Holocene (recent) and Pleistocene (ice age) sediments contained in a steep-sided bedrock valley. From youngest to oldest, these unconsolidated deposits consist of alluvial and glaciofluvial silty coarse-grained deposits, which are found almost exclusively in the northern part of the site, and a sequence of up to three fine-grained glacial tills of Lavery, Kent, and possible Olean age, which are separated by stratified fluvio-lacustrine deposits. These glacial sediments are underlain by bedrock composed of shales and interbedded siltstones of the upper Devonian Canadaway and Conneaut Groups, which dip southward at about 5 m/km (Rickard 1975).

The most widespread glacial unit in the site area is the Kent till, deposited between 18,000 and 24,000 years ago toward the end of the Wisconsin glaciation (Albanese et al. 1984). At that time the ancestral Buttermilk Creek Valley was covered with ice. As the glacier receded, debris trapped in the ice was left behind in the vicinity of West Valley. Meltwater, confined to the valley by the debris dam at West Valley and the ice front, formed a glacial lake that persisted until the glacier receded far enough northward to uncover older drainageways. As the ice continued to melt (between 15,500 and 18,000 years ago), more material was released and deposited to form the recessional sequence (lacustrine and kame delta deposits) that presently overlies the Kent till. Continued recession of the glacier ultimately led to drainage of the proglacial lake and exposure of its sediments to erosion (LaFleur 1979).

Between 15,000 and 15,500 years ago the ice began its last advance (Albanese et al. 1984). Material from this advance covered the recessional deposits with as much as 40 meters (130 ft) of glacial till. This unit, the Lavery till, is the uppermost unit throughout much of the site.

The retreat of the Lavery ice left behind another proglacial lake that ultimately drained, allowing the modern Buttermilk Creek to flow northward to Cattaraugus Creek. Post-Lavery outwash and alluvial fans, including the fan that overlies the northern part of the WVDP, were deposited on

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The retreat of the Lavery ice left behind another proglacial lake that ultimately drained, allowing the modern Buttermilk Creek to flow northward to Cattaraugus Creek. Post-Lavery outwash and alluvial fans, including the fan that overlies the northern part of the WVDP, were deposited on the Lavery till between 15,000 and 14,200 years ago (LaFleur 1979). The modern Buttermilk Creek has cut the present valley since the final retreat of the Wisconsin glacier.

Surface Water Hydrology of the West Valley Site

The Western New York Nuclear Service Center (WNYNSC) lies within the Cattaraugus Creek watershed, which empties into Lake Erie about 43 kilometers (27 mi) southwest of Buffalo.

The 80-hectare (200-acre) WVDP site is contained within the smaller Frank's Creek watershed. Frank's Creek is a tributary of Buttermilk Creek; Buttermilk Creek, a tributary of Cattaraugus Creek, drains most of the WNYNSC and all of the WVDP facilities.

The WVDP is bounded by Frank's Creek to the east and south and by Quarry Creek (a tributary of Frank's Creek) to the north. Another tributary of Frank's Creek, Erdman Brook, bisects the WVDP into a north and south plateau (Fig. 3-1).

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 on the south plateau.

Hydrogeology of the West Valley Site

The WVDP site area is underlain by glacial tills comprised primarily of clays and silts separated by coarser-grained interstadial layers. The sediments above the second (Kent) till (the Kent recessional sequence, the Lavery till, the 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 Figures 3-2 and 3-3 (pp. 3-4 and 3-5), which show relative locations of these sediments on the north and south plateaus.

The Lavery till and the Kent recessional sequence underlie both the north and south plateaus. On the south plateau the upper 2 to 4 meters (7 to 13 ft) of the Lavery till is exposed at the ground surface and is weathered and fractured. It is referred to as the weathered Lavery till. The remaining thickness of the Lavery till is unweathered and is called the unweathered Lavery till.

The unweathered Lavery till is predominantly an olive gray, silty clay glacial till with scattered lenses of silt and sand. The till ranges up to 40 meters (130 ft) in thickness beneath the active areas of the site, generally increasing towards Buttermilk Creek and the center of the bedrock valley.

Groundwater flow in the unweathered till is predominantly vertically downward at a relatively slow rate, towards the underlying recessional sequence. The hydraulic conductivities of the unweathered till are roughly equal to flow velocities and range from 10^{-8} to 10^{-7} cm/sec (10^{-5} to 10^{-4} ft/day). Values of vertical and horizontal hydraulic conductivity obtained from laboratory analysis of undisturbed cores and field analyses of piezometer recovery data suggest that the unweathered till is essentially isotropic, i.e., it has equal flow properties in both vertical and horizontal directions.

The underlying Kent recessional sequence consists of alternating deposits of lacustrine clayey silts and coarse-grained kame delta and outwash sands and gravels. These deposits underlie the Lavery till beneath most of the site, pinching out along the southwestern corner where the bedrock valley intersects the sequence. Groundwater flow is predominantly to the northeast, towards Buttermilk Creek, at an estimated ve-

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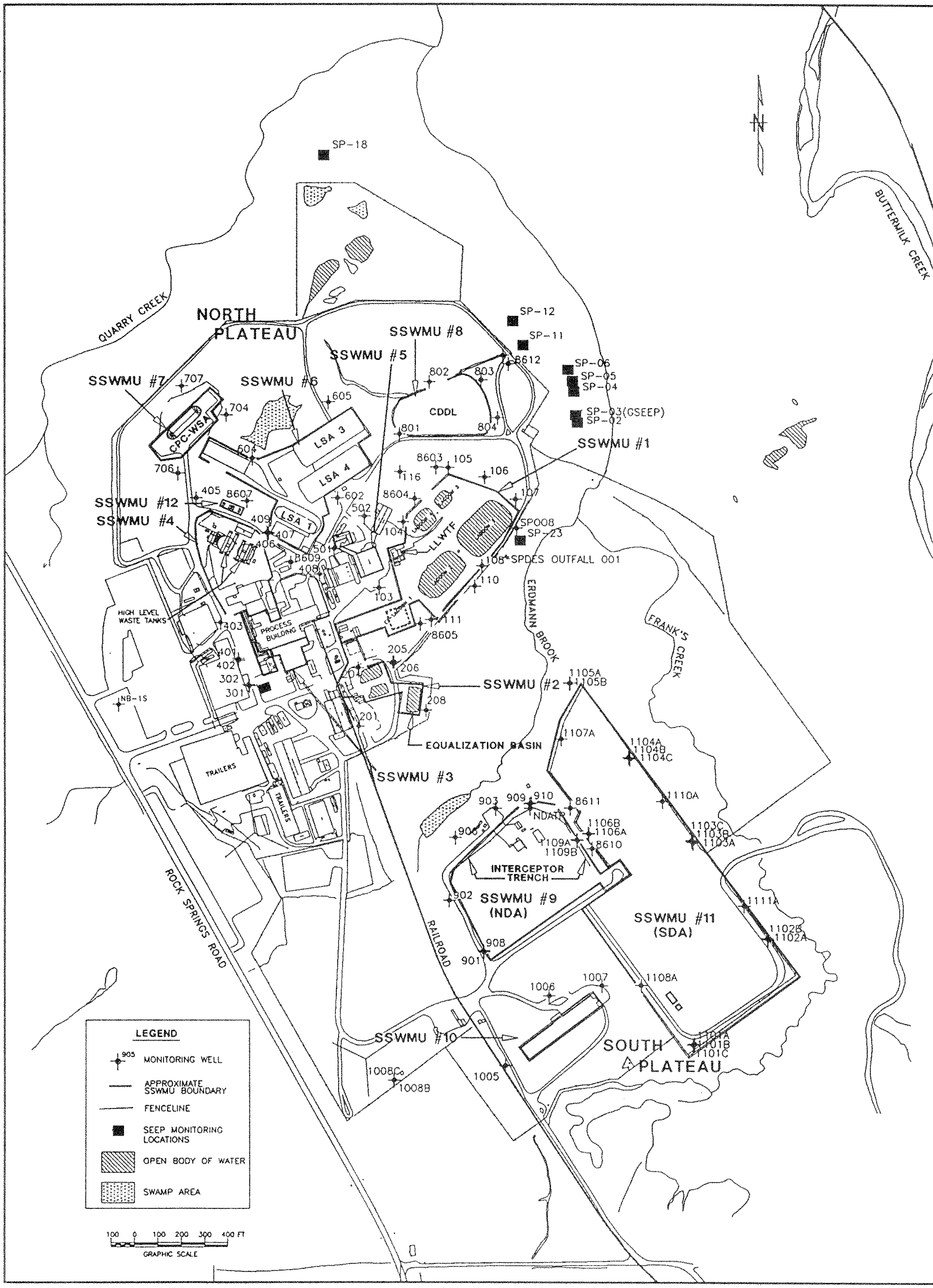


Figure 3-1. Actively Monitored On-Site Groundwater Monitoring Network (Implemented after May 1995).

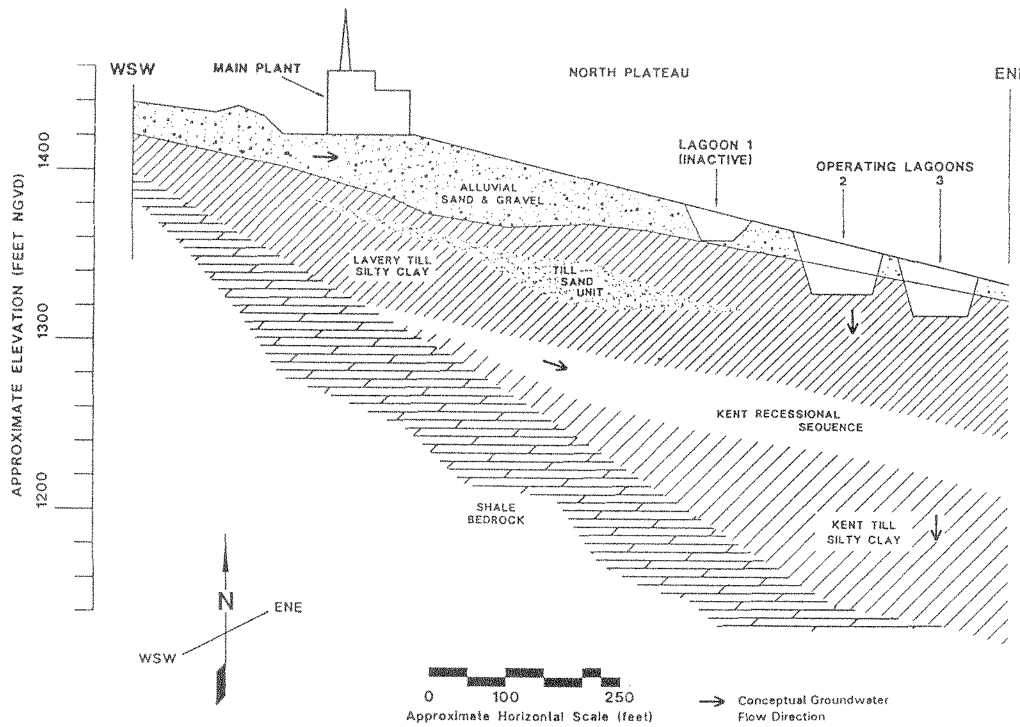


Figure 3-2. Geologic Cross Section through the North Plateau

locity of 13 cm/year (0.4 ft/yr). The hydraulic conductivity is approximately 10^{-6} cm/sec (10^{-3} ft/day). Recharge comes from the overlying till and the bedrock in the southwest, and discharge is to Buttermilk Creek. Underneath the recessional sequence is the less permeable Kent till, which does not provide a pathway for contaminant movement from the WVDP and so is not discussed further.

North Plateau

On the north plateau, where the main plant, waste tanks, and lagoons are located, the unweathered Lavery till is immediately overlain by the surficial sand and gravel layer. Within the Lavery till on the north plateau is another unit, the till-sand.

Surficial Sand and Gravel Layer

The surficial sand and gravel 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 gullies.

Depth to groundwater within this layer 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 surface farther north towards the security fence. Groundwater in this layer generally flows across the north plateau from the southwest (near Rock Springs Road) to the northeast (towards Frank's Creek). Based on the testing of forty-one wells in 1995, the geometric mean saturated hydraulic conductivity is $3.1x10^{-4}$ cm/sec (0.87 ft/day). These new data indicate higher velocities than noted in earlier site reports, which used a smaller data set of twenty-one wells. Groundwater near the northwestern and southeastern margins of the sand and gravel layer flows radially outward toward Quarry Creek and Erdman Brook, respectively. There is minimal groundwater flow downward into the underlying Lavery till.

Lavery Till-sand

On-site investigations from 1989 through 1990 identified a lenticular sandy unit of limited areal extent and variable thickness within the Lavery till, primarily beneath the north plateau. Groundwater flow through this unit apparently is limited by the cross sectional area of the unit's erosional exposure, and surface discharge locations have not been observed.

South Plateau

Weathered Lavery Till

On the south plateau, the upper portion of Lavery till exposed at the surface is referred to as the weathered till. It is physically distinct from the underlying unweathered till as it has been oxidized to a brown color and contains numerous fractures and root tubes. The thickness of this layer generally varies from 0.9 meters to 4.9 meters (3 ft to 16 ft). On the north plateau, the weathered till layer is much thinner or nonexistent.

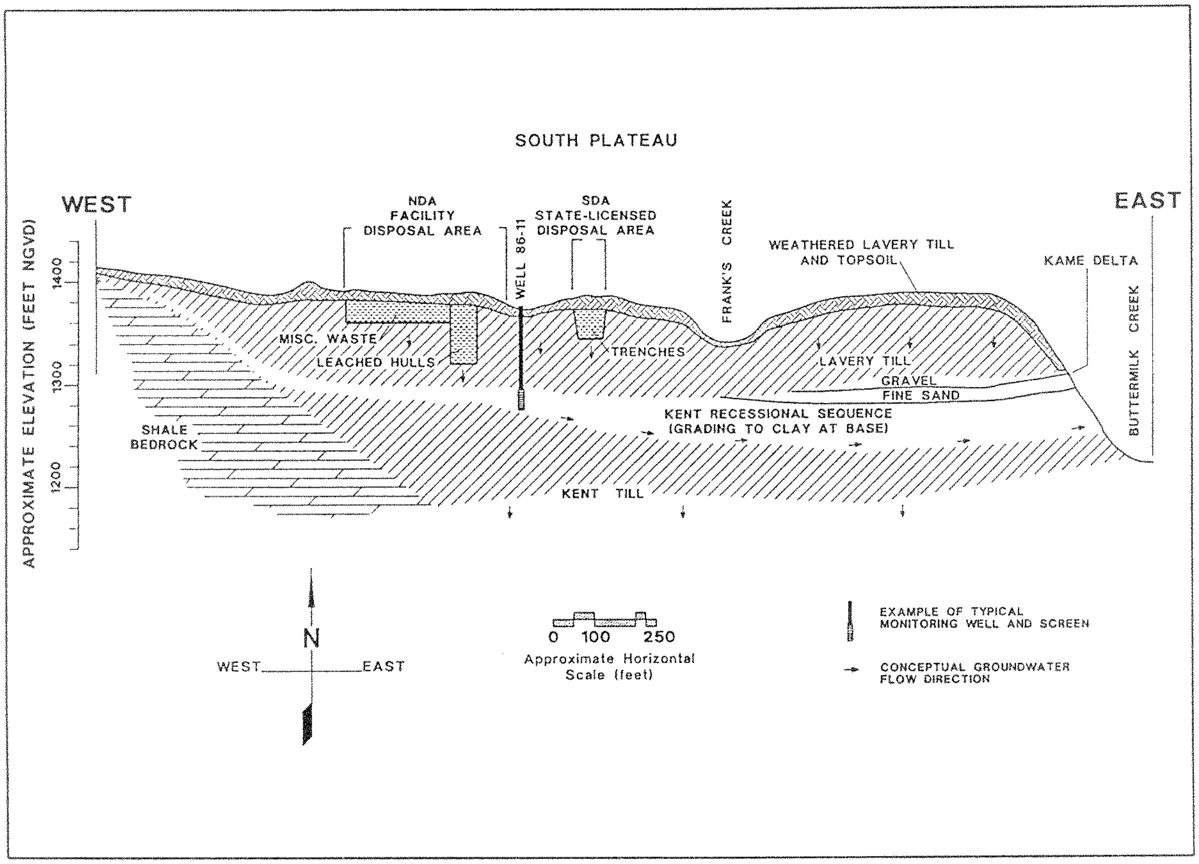


Figure 3-3. Geologic Cross Section through the South Plateau

Groundwater flow in the weathered till that occurs in the upper 4.9 meters (16 ft) has both horizontal and vertical components. This enables the groundwater to move laterally across the plateau before moving downward into the unweathered Lavery till or discharging to nearby incised stream channels. The hydraulic conductivity of the weathered till varies from 10^{-8} to 10^{-5} cm/sec (10^{-5} to 10^{-2} ft/day), with the highest conductivities associated with the dense fracture zones (found within the upper 2 meters [7 ft] of the unit).

Groundwater Monitoring Program Overview

Monitoring Well Network

Monitoring provides coverage for the five different hydrogeologic units discussed above: the sand and gravel unit, the weathered Lavery till, the unweathered Lavery till, the Lavery till-sand unit, and the Kent recessional sequence.

Table 3-1 lists the twelve identified super solid waste management units (SSWMUs), eleven of which are directly monitored by the well network; the hydraulic position of each well within the waste management unit; the geologic unit monitored; and the depth of each well. Note that monitoring of wells marked by an asterisk is required by the 3008(h) Administrative Order of Consent. (See the *Environmental Compliance Summary: Calendar Year 1995*, **RCRA Facility Investigation [RFI] Program** [p. xlvi] .)

Figure 3-1 (p. 3-3) shows the boundaries of these twelve super solid waste management units at the WVDP. (Twenty-one of the wells are in the SDA and are the responsibility of the New York State Energy Research and Development Authority [NYSERDA]. Although the SDA is a closed radioactive waste landfill contiguous with the Project premises, the WVDP is not responsible for the facilities or activities relating to it. Under a joint agreement with NYSERDA, however, the Project provides specifically requested technical support to NYSERDA in SDA-related matters. Groundwater monitoring results for 1995 for the SDA are reported in this document in *Appendix F* [pp. F-1 through F-11].)

Table 3-1 identifies the position of a well relative to the waste management unit monitored. The

Four designations are often used to indicate a well's function within the 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 unit in question.*

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 waste management units 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 units, which makes them unsuitable for use as true background wells. However, they are still useful for providing upgradient information about the unit under study.*

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 3 - 1

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	*Well ID Number*	*Hydrogeologic Unit Monitored[1]*	*Analytes as of May 1995[2]*	*Well Position in SSWMU[3]*	*Well Depth (ft) Below Grade*
SSWMU #1 - Low-level Waste Treatment Facilities:					
	*103**	*S*	*M*	*D*	*21.0*
• *Former Lagoon 1*	*104*	*S*	*M, SV*	*U*	*23.0*
• *LLWTF Lagoons*	*105*	*S*	*M*	*D*	*28.0*
• *LLWTF Building*	*106*	*S*	*M*	*D*	*14.5*
• *Interceptors*	*107*	*T*	*M*	*D*	*28.0*
• *Neutralization Pit*	*108*	*T*	*M*	*D*	*33.0*
	109	*T*	*p*	*D*	*33.0*
	*110**	*T*	*M*	*D*	*33.0*
	*111**	*S*	*E, S, SV, M*	*D*	*11.0*
	114	*T*	*p*	*D*	*29.0*
	115	*T*	*p*	*U*	*28.0*
	*116**	*S*	*M, S*	*U*	*11.0*
	8604	*S*	*M*	*U*	*22.6*
	*8605**	*S*	*E, S, SV, M*	*D*	*12.0*
	WNSP008	*Groundwater French Drain Monitoring Point*			
SSWMU #2 - Miscellaneous Small Units:					
	201	*S*	*M*	*U*	*20.0*
• *Sludge Ponds*	*202*	*TS*	*p*	*U*	*38.0*
• *Solvent Dike*	*203*	*S*	*p*	*D*	*18.0*
• *Equalization Mixing Basin*	*204**	*TS*		*U*	*43.0*
• *Paper Incinerator*	*205*	*S*	*M*	*D*	*11.0*
	206	*TS*		*D*	*37.8*
	207	*S, (T)*	*p*	*D*	*11.0*
	208	*TS*		*D*	*23.0*
	8606	*S*	*p*	*D*	*12.1*

***** Monitoring for certain parameters is required by the 3008(h) Order on Consent.***

[1] Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.

[2] These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.
See Table 3-3 for a description of codes and analytes.

[3] Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.

Table 3 - 1 (continued)

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	*Well ID Number*	*Hydrogeologic Unit Monitored[1]*	*Analytes as of May 1995[2]*	*Well Position in SSWMU[3]*	*Well Depth (ft) Below Grade*
SSWMU #3 - Liquid Waste Treatment System:					
	*301**	*S*	*M*	*B*	*16.0*
• *Liquid Waste Treatment System*	*302*	*TS*	*M*	*U*	*28.0*
• *Cement Solidification System*	*305*	*S*	*p*	*D*	*31.0*
• *Main Process Bldg. (specific areas)*	*306*	*K*	*p*	*D*	*81.0*
	307	*S*	*p*	*D*	*16.0*
• *Background (north plateau)*	*NB1S*	*S, (WT)*		*B*	*13.0*
SSWMU #4 - HLW Storage and Processing Area:					
	*401**	*S, (T)*	*M, R*	*B*	*16.0*
• *Vitrification Facility*	*402*	*TS*			*29.0*
• *Vitrification Test Tanks*	*403*	*S*	*M*	*U*	*13.0*
• *HLW Tanks*	*404*	*TS*	*P*	*U*	*36.5*
• *Supernatant Treatment System*	*405*	*T*		*C*	*12.5*
	*406**	*S*	*M, R*	*D*	*16.8*
	407	*K, (T)*		*D*	*75.5*
	*408**	*S*	*M, R*	*D*	*38.0*
	409	*T*		*D*	*55.0*
	410	*K*	*p*	*U*	*78.0*
	411	*K, (T)*	*p*	*U*	*66.0*
SSWMU #5 - Maintenance Shop Leach Field:					
	*501**	*S*	*M, S*	*U*	*33.0*
• *Maintenance Shop Leach Field*	*502**	*S*	*M, S, SM*	*D*	*18.0*

** Monitoring for certain parameters is required by the 3008(h) Order on Consent.*

[1] Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.

[2] These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.
See Table 3-3 for a description of codes and analytes.

[3] Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.

Table 3 - 1 (continued)

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	*Well ID Number*	*Hydrogeologic Unit Monitored*[1]	*Analytes as of May 1995*[2]	*Well Position in SSWMU*[3]	*Well Depth (ft) Below Grade*
SSWMU #6 - Low-level Waste Storage Area:					
	601	S	p	D	6.0
• Hardstands (old & new)	602	S	M, S	D	13.0
• Lag Storage	603	S	p	U	13.0
• Lag Storage Additions (LSAs 1, 2, 3, 4)	604	S	M	D	11.0
	605	S, (T)	M, S	D	11.0
	8607*	S	M	U	17.6
	8608	S	p	U	19.0
	8609*	S	M, S	U	24.7
SSWMU #7 - CPC Waste Storage Area:					
	701	TS	p	U	28.0
• CPC Waste Storage Area	702	T	p	C	38.0
	703	T	p	D	21.0
	704	T	M	D	15.5
	705	T	P	C	21.0
	706	S	M	B	11.0
	707	T, (WT)	M	D	11.0
SSWMU #8 - Construction and Demolition Debris Landfill					
	801*	S	M, S	U	17.5
• Former Construction and Demolition Debris Landfill	802*	S, (T)	M	D	11.0
	803*	S	E, M	D	18.0
	804*	S	M	D	9.0
	8603*	S	M, S	U	24.8
	8612*	S	E, M	D	18.1
	WNGSEEP*		M		
			Groundwater Seepage Monitoring Point		
	WNDMPNE		N/A		

** Monitoring for certain parameters is required by the 3008(h) Order on Consent.*

N/A - Not applicable. Monitoring point was discontinued after May 1995.

[1] *Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.*

[2] *These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.*
See Table 3-3 for a description of codes and analytes.

[3] *Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.*

Table 3 - 1 (continued)

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	*Well ID Number*	*Hydrogeologic Unit Monitored*[1]	*Analytes as of May 1995*[2]	*Well Position in SSWMU*[3]	*Well Depth (ft) Below Grade*
SSWMU #9 - NRC-licensed Disposal Area:					
	*901**	*K, (T)*	*M*	*U*	*136.0*
• *NRC-licensed Disposal Area*	*902**	*K, (T)*	*p*	*U*	*128.0*
• *Container Storage Area*	*903**	*K, (T)*	*M*	*D*	*133.0*
• *Trench Interceptor Project*	*904*	*T*	*p*	*D*	*26.0*
	905	*S*	*M, R*	*D*	*23.0*
	*906**	*WT*	*M*	*D*	*10.0*
	907	*WT, (T)*	*p*	*D*	*16.0*
	*908**	*WT, (T)*	*M*	*U*	*21.0*
	*909**	*WT, (T)*	*E, M, R*	*D*	*23.0*
	*910**	*T*	*M*	*D*	*29.6*
	*8610**	*K*		*D*	*114.0*
	*8611**	*K*	*M*	*D*	*120.0*
	WNNDATR		*E, R, M* *Interceptor Trench Manhole Sump*		
SSWMU #10 - IRTS Drum Cell:					
	1001	*K, (T)*	*p*	*U*	*116.0*
• *IRTS Drum Cell*	*1002*	*K, (T)*	*p*	*D*	*113.0*
• *Background (south plateau)*	*1003*	*K*	*p*	*D*	*138.0*
	1004	*K, (T)*	*p*	*D*	*108.0*
	*1005**	*WT, (T)*	*M*	*U*	*19.0*
	*1006**	*WT, (T)*	*M*	*D*	*20.0*
	1007	*WT, (T)*	*M*	*D*	*23.0*
	1008B	*K, (T)*	*M*	*B*	*51.0*
	*1008C**	*WT, (T)*	*M*	*B*	*18.0*

***** Monitoring for certain parameters is required by the 3008(h) Order on Consent.***

[1] Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.

[2] These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.
See Table 3-3 for a description of codes and analytes.

[3] Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.

Table 3 - 1 (continued)

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	*Well ID Number*	*Hydrogeologic Unit Monitored*[1]	*Analytes as of May 1995*[2]	*Well Position in SSWMU*[3]	*Well Depth (ft) Below Grade*
SSWMU #11 - State-licensed Disposal Area:					
	1101A	WT, (T)	See	U	16.0
• State-licensed Disposal Area	1101B	T	Appendix F	U	30.0
(SDA)[NYSERDA]	1101C	K		U	110.0
NOTE: The SDA is sampled by NYSERDA	1102A	WT, (T)		D	17.0
under an independent monitoring program	1102B	T		D	31.0
	1103A	WT, (T)		D	16.0
	1103B	T		D	26.0
	1103C	K		D	111.0
	1104A	WT, (T)		D	19.0
	1104B	T		D	36.0
	1104C	K		D	114.0
	1105A	WT, (T)		D	21.0
	1105B	T		D	36.0
	1106A	K		U	16.0
	1106B	T		U	31.0
	1107A	T		D	19.0
	1108A	WT, (T)		U	16.0
	1109A	T		U	16.0
	1109B	WT, (T)		U	31.0
	1110A	WT, (T)		D	20.0
	1111A	WT, (T)		D	21.0

** Monitoring for certain parameters is required by the 3008(h) Order on Consent.*

[1] *Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.*

[2] *These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.*
See Table 3-3 for a description of codes and analytes.

[3] *Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.*

Table 3 - 1 (concluded)

Groundwater Monitoring Network: Super Solid Waste Management Units

SSWMUs and Constituent SWMUs	***Well ID Number***	***Hydrogeologic Unit Monitored[1]***	***Analytes as of May 1995[2]***	***Well Position in SSWMU[3]***	***Well Depth (ft) Below Grade***
SSWMU #12 - Hazardous Waste Storage Lockers		*(No wells installed for SSWMU #12)*			
Motor Fuel Storage Area (Monitors underground storage tanks. Not a SSWMU.)	*R8613A*	*S, (T)*	*p*	*C*	*8.0*
	R8613B	*S*	*p*	*C*	*8.0*
	R8613C	*S*	*p*	*D*	*6.5*

Well ID Number	***Hydrogeologic Unit Monitored[1]***	***Sampling Agenda****	***Well Depth (ft) Below Grade***
WP-A	*S*	*RI*	*33*
WP-C	*S*	*RI*	*23*
WP-D	*S*	*RI*	*26*
WP-E	*S*	*RI*	*22*
WP-F	*S*	*RI*	*36*
WP-G	*S*	*RI*	*34*
WP-H	*S*	*RI*	*17*

** Monitoring for certain parameters is required by the 3008(h) Order on Consent.*

[1] Hydrogeologic units monitored are: WT = weathered Lavery till; T = unweathered Lavery till; S = sand and gravel; K = Kent recessional sequence; TS = till-sand. Units enclosed in parentheses indicate the hydrogeologic unit is only a secondary monitoring unit.

[2] These parameters are in addition to the contamination indicator parameters, radiological indicator parameters, groundwater quality parameters, and VOCs as scheduled before and after May 1995. p = analytical monitoring discontinued after May 1995; well measured for potentiometric (water-level) data only.
See Table 3-3 for a description of codes and analytes.

[3] Well position in SSWMU: U = upgradient; D = downgradient; B = background; C = crossgradient.

wells monitoring a given hydrogeologic unit (e.g., sand and gravel, weathered Lavery till) also may be 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, depending on the geographic position of the SSWMU within 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 hydrogeologic unit perspective.

History of the Monitoring Program

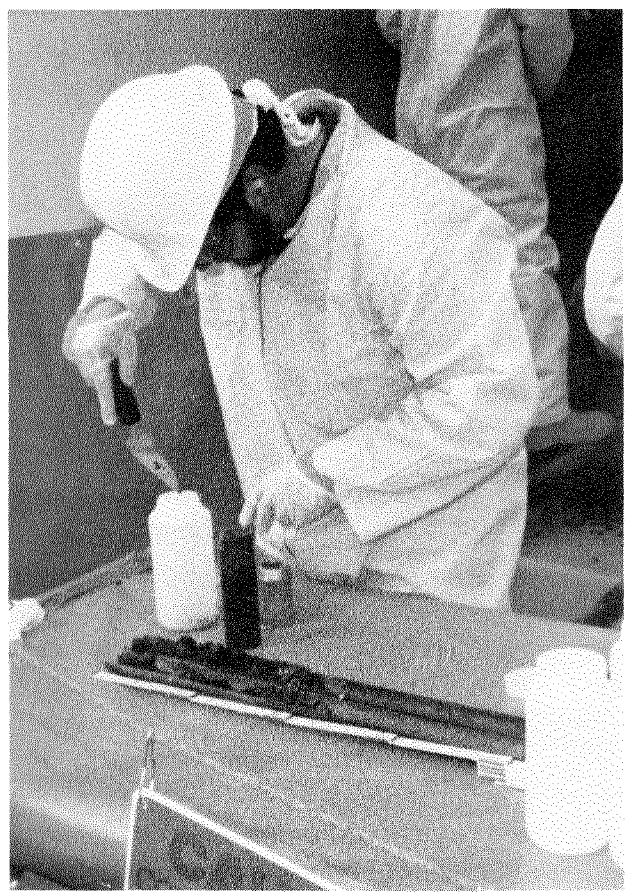
The groundwater monitoring program is designed to support DOE Order 5400.1 requirements and the RCRA 3008(h) Order on Consent. In general, the nature of the program is dictated by these requirements in conjunction with current operating practices and historical knowledge of previous site activities.

Monitoring Program: 1984 - 1994

The WVDP groundwater monitoring program has evolved over the years to meet changing needs: The pre-operational monitoring program began in 1984 with twenty wells located around the main plant and the NDA. In 1986 the program was expanded to accommodate technical requirements for groundwater monitoring at facilities holding RCRA interim status: the areas identified for additional groundwater monitoring were the lagoon system, the waste tank farm, and the NDA. An additional network of fourteen wells, a groundwater seep, and the french drain was designed to monitor the three waste management units.

The groundwater monitoring program was expanded in 1989 and 1990 (Fig. A-3 [p. A-49] in *Appendix A*) in order to provide more detailed characterization of the groundwater and to provide information for the environmental information documents (EIDs). The EIDs were being prepared to support the environmental impact statement (EIS) that would detail possible alternatives for eventual closure of the WVDP site.

The RFI program, established to protect human health and the environment from potential releases of RCRA-regulated hazardous wastes and/or constituents from solid waste management units, focuses on determining the nature and extent of existing releases and evaluating the potential for future releases of RCRA-regulated hazardous waste or constituents from solid waste management units.



Collecting a Soil Core Sample for Analysis

The wells installed in 1989 and 1990 were gradually incorporated into the program during 1991, and the entire network followed full sampling schedules in 1992, 1993, and 1994 except for the two wells that were added to the network in 1992 (wells 909 and 910).

The parameters measured included both chemical and radiological constituents.

Monitoring Program: 1995

Table 3-2 indicates that all the actively monitored locations continued to be sampled routinely in 1995 for indicator parameters (pH and specific conductance) and radiologic indicator parameters (gross alpha, gross beta, and tritium), just as in previous years. All locations were sampled for groundwater quality parameters once during 1995. Samples from selected locations were analyzed for additional parameters such as organics, metals, and radioisotopic analytes during the last two quarters of 1995.

The WVDP is currently continuing the RCRA facility investigations, and reports on each SSWMU are being completed. However, because most of the baseline data has been collected, the groundwater program can now focus on routine, long-term monitoring.

In May 1995, an analysis of the groundwater monitoring program with respect to long-term monitoring indicated that certain well placements and/or monitoring parameters were now redundant. A new program was developed, evolving from one that required an intensive collection of data, as required by the RFIs and EIDs, to one that provides long-term environmental surveillance as required by the DOE 5400-series Orders and agreements with the EPA and NYSDEC. The new program incorporates three major changes:

- The number of wells monitored was reduced. This change was implemented in May 1995. By the end of calendar year 1995 a total of fifty-six groundwater monitoring points were providing radiological and chemical surveillance of both active and inactive SSWMUs and of general site-wide conditions. On-site actively monitored groundwater locations are shown on Figure 3-1 (p. 3-3). The benefits of reducing unnecessary monitoring include the ability to focus more attention on specific areas of interest.

- The analyte list was modified to focus on specific parameters of interest. As the RFIs are reviewed, the list will continue to be modified as necessary.

- Finally, the new program will institute the use of "trigger levels" for all chemical and radiological analytes. These pre-set limits are conservative values for chemical or radiological concentrations that have been developed by the WVDP and entered into a database. Actual measured values are compared to the trigger limits as data are entered into the database. When the actual value exceeds the conservative trigger limit, the data are flagged by the computer and results are investigated. The trigger levels have been entered into the Laboratory Information Management System (LIMS). As new results are entered into the site database, they are electronically compared with these pre-set trigger levels, and ex-

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 annually 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.

Table 3 - 2

1995 Groundwater Monitoring Schedule

Sampling Quarter	1	2	3	4
Sample Date	12/01/94-12/08/94	4/01/95-4/16/95	6/01/95-6/15/95	9/06/95-9/15/95
Contamination Indicators (I) and Radiological Indicators (RI)	✓	✓	*	*
Groundwater Quality Parameters (G)	N/S	✓	N/S	N/S
Volatile Organic Compounds (V)	*	*	*	*
Semivolatile Organic Compounds (SV)	N/A	N/A	*	*
Metals (M)	N/A	N/A	*	*
Strontium-90 (S)	N/A	N/A	*	*
Radioisotopic Parameters (R)	N/A	N/A	*	N/S
Special Monitoring Parameters (SM)	N/A	N/A	*	*

N/S - Not sampled.
N/A - Not applicable.
✓ Analysis performed at all locations.
** Analysis performed at selected monitoring locations only. See Table 3-3 for a description of each analyte group.*

Sampling Methodology

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 used depends on well construction, water depth, and the water-yielding characteristics of the well. Teflon® bailers are used in wells with low standing water volume; 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 Teflon® bailer, a tube with a check valve at the bottom and the top, is lowered into the well until it reaches the desired point in the water column. The bailer is lowered slowly to ensure that the water column is not agitated 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 used exclusively for that well at all times.

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 drive air is always kept separate from the sample and is expelled to the surface by a separate line.

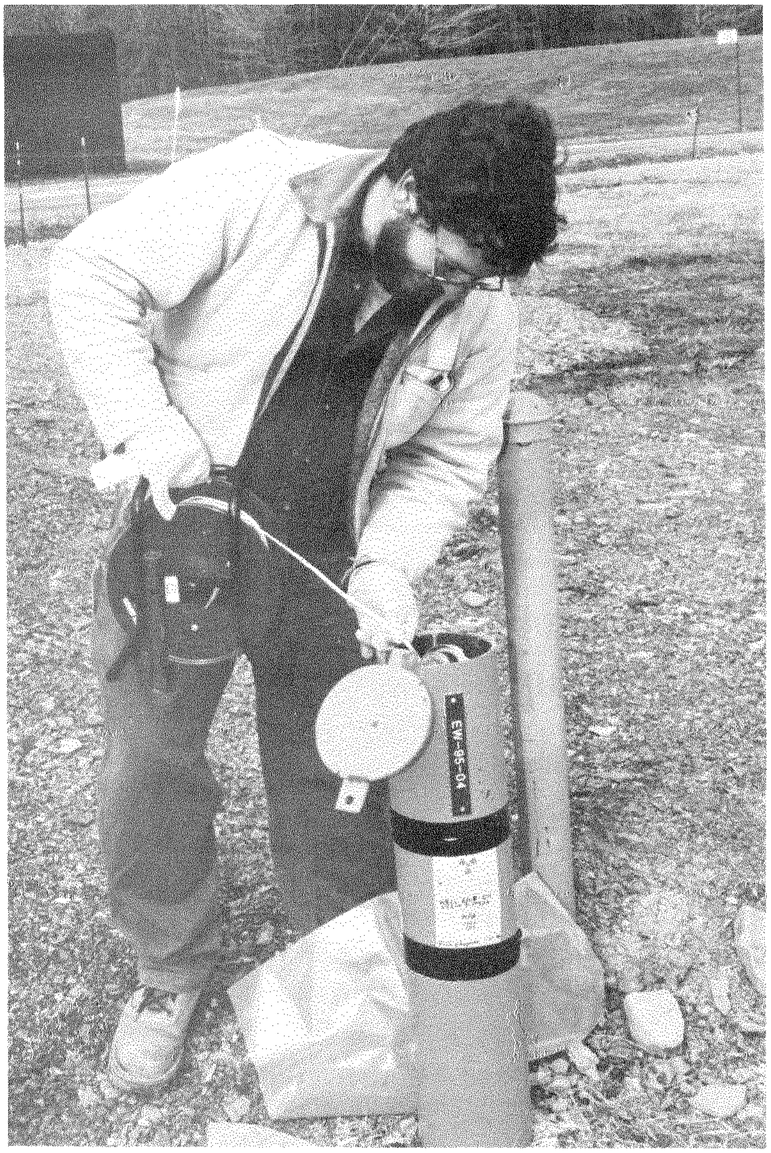
Bladder pumps reduce mixing and agitation of the water in the well. Each bladder pump system is dedicated to its individual well to reduce the likelihood of sample contamination from external materials or cross contamination. The compressor and air control box can be used from well to well because they 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 then either packaged for expedited delivery to an off-site contract laboratory or put into controlled storage to await on-site testing.

ceedances are flagged for evaluation. (In many cases exceedances are found to be a result of an analytical or data entry error, while other cases of confirmed exceedances are evaluated further.) Using trigger levels allows a prompt focus on any monitoring anomalies.

Groundwater monitoring activities at the WVDP are summarized in two primary documents, the Groundwater Monitoring Plan (West Valley Nuclear Services Co., Inc. December 1995) and the Groundwater Protection Management Program Plan (West Valley Nuclear Services Co., Inc. 1994). The Groundwater Monitoring Plan focuses on long-term monitoring requirements specified under the RCRA and DOE programs. The Groundwater Protection Management Program Plan provides additional information regarding groundwater quality activities in place at the WVDP.

The categories of groundwater sampling parameters collected are noted in Table 3-3 (p. 3-20). Table 3-2 (p. 3-15) indicates the sampling schedule for these parameters during 1995.



Measuring Water Levels in a Groundwater Monitoring Well

Ten off-site water supply wells, sampled for radiological parameters, pH, and conductivity, were also part of the groundwater monitoring program during 1995. These wells are used by site neighbors as sources of drinking water (Fig. 3-4 [p. 3-19]).

Groundwater Monitoring Results

Successful implementation of the WVDP's groundwater monitoring program includes proper placement of groundwater monitoring wells, using appropriate methods of sample collection, reviewing analytical data and quality control information, and presenting, summarizing, and evaluating the resulting data appropriately.

Data are presented in this report through tables and graphs.

Presentation of Results in Tables

Appendix E tables contain the results of sampling for contamination indicator parameters (Tables E-1 through E-5 [pp. E-3 through E-10]), groundwater quality parameters (Tables E-6 through E-10 [pp. E-11 through E-18]), and the results of sampling for focused parameters (Tables E-12 through E-16 [pp. E-23 through E-31]). Table E-11 (p. E-19) lists the practical quantitation limits (PQLs) for individual analytes. Analyte groups are described in Table 3-3 (p. 3-20).

The tables in *Appendix E* (pp. E-1 through E-31) present the results of the groundwater monitoring program 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.

The tables summarizing the contamination indicator parameters, the groundwater quality parameters, and the other focused parameters also display each well's hydraulic position relative to other wells within the same hydrogeologic unit. These positions are identified as UP, which refers to either background or upgradient wells, and DOWN - B, DOWN - C, and DOWN - D. Upgradient locations are designated UP because they are upgradient of all the other locations. Downgradient locations are designated B, C, or D to indicate their positions along the groundwater flow path relative to each other. For example, wells denoted as DOWN - C in the sand and gravel unit are downgradient of both UP and DOWN - B wells but are upgradient of DOWN - D wells. Grouping the wells by hydraulic position provides a logical basis for presenting the groundwater monitoring data in the tables and figures in this report.

These tables also list the sample collection periods. Samples were collected each quarter from December 1994 (the first quarter of 1995) through October 1995 (the fourth quarter of 1995). Wells were sampled for the indicator parameters as listed in Table 3-3 (p. 3-20).

Presentation of Results in Graphs

High-low graphs have been prepared to present contamination indicator data for individual locations within the same hydrogeologic unit. All the 1995 results obtained for selected parameters (pH, conductivity, total organic carbon, total organic halogens, gross alpha, gross beta, and tritium) were used to construct the high-low graphs for each well within each hydrogeologic unit. These graphs allow results for wells within a given hydrogeologic unit to be visually compared to each other.

All high-low graphs shown at the end of this chapter 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 nonradiological graphs (pH, conductivity, total organic carbon, and total organic halogens), the upper and lower tick marks on the vertical bar indicate the highest and lowest measurements recorded during 1995. The middle tick represents the arithmetic mean of all 1995 results. The vertical bar thus represents the total range of the data set for each monitoring location.

On radiological graphs (gross alpha, gross beta, and tritium), the upper and lower tick marks on the vertical bar indicate the upper and lower ranges of the pooled error terms. This is a more accurate method of representing radiological data than presenting only the mean, which does not show the whole range of possible values. By displaying the uncertainty together with the mean, a more realistic perspective is obtained. (See also *Chapter 5*, **Data Reporting** [p. 5-7].)

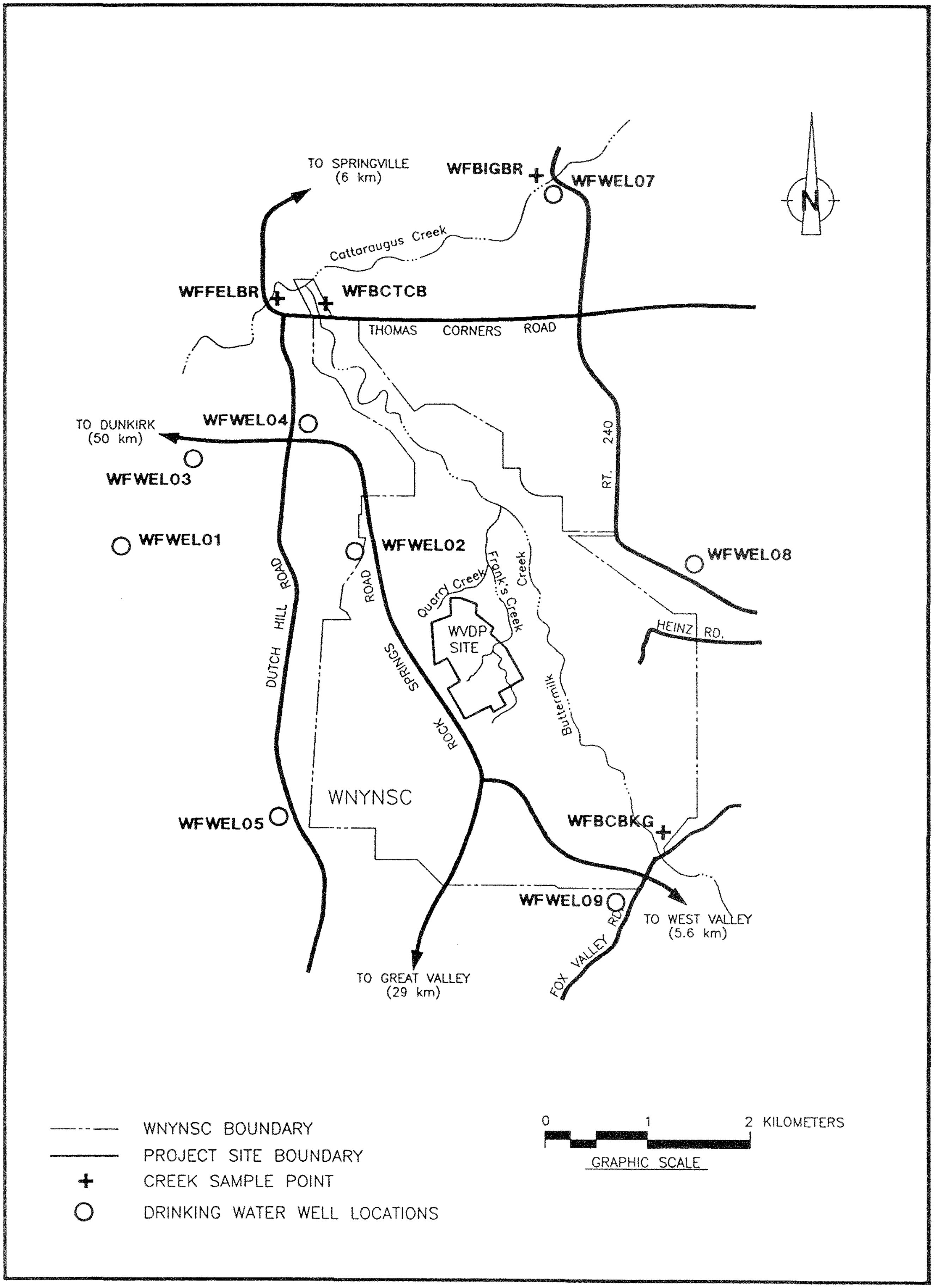


Figure 3-4. Off-site Groundwater Monitoring Wells and Surface Water Samplers.

Table 3 - 3

Description of 1995 Groundwater Sampling and Analysis Agenda

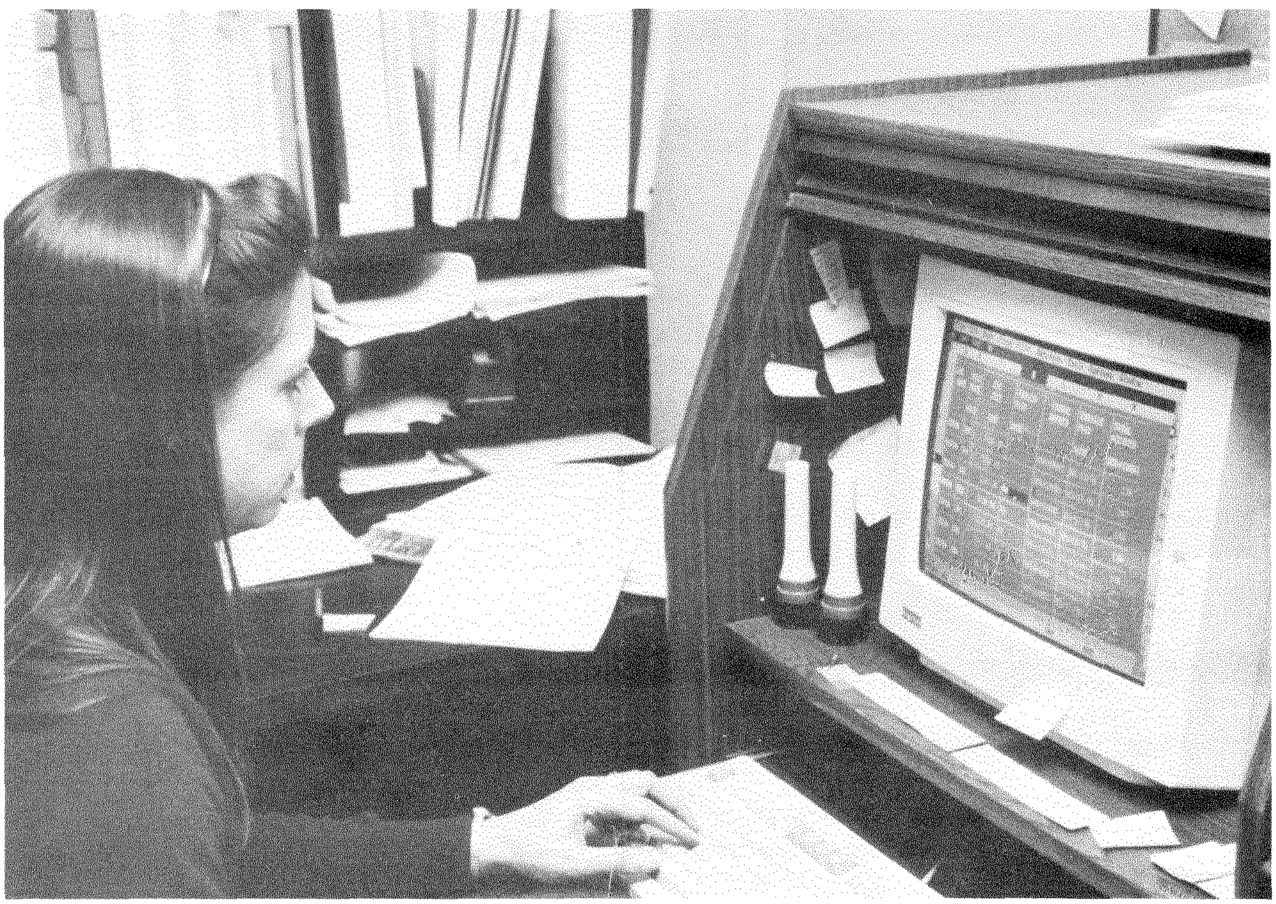
ANALYTE GROUP	DESCRIPTION OF PARAMETERS
Indicator Parameters (I)	pH[1], specific conductance[1], total organic carbon (TOC)[2,3] total organic halogens (TOX)[3], gamma scan[3]
Radiological Indicator Parameters (RI)	Gross alpha, gross beta, tritium
Groundwater Quality Parameters	Alkalinity, aluminum, calcium, chloride, iron, magnesium, manganese, nitrate/nitrite, phosphate, potassium, sodium, silica, sulfate, sulfide
RCRA Hazardous Constituent Metals (M)	Antimony, arsenic, barium, beryllium, cadmium, lead, chromium, mercury, nickel, selenium, silver, thallium
Volatile Organic Compounds (V)	Appendix IX VOCs (see Table E-11)
Semivolatile Organic Compounds (SV)	Appendix IX SVOCs (see Table E-11)
Expanded Compound List: V, SV, and Appendix IX metals (E)	Appendix IX VOCs, SVOCs, and metals (see Table E-11)
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
Strontium-90 (S)	Sr-90
Special Monitoring Parameters (SM)	Arsenic, aluminum, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, vanadium, zinc

[1] *Field measurement.*
[2] *Comprises only nonpurgeable organic carbon (NPOC).*
[3] *Discontinued after second-quarter sampling.*

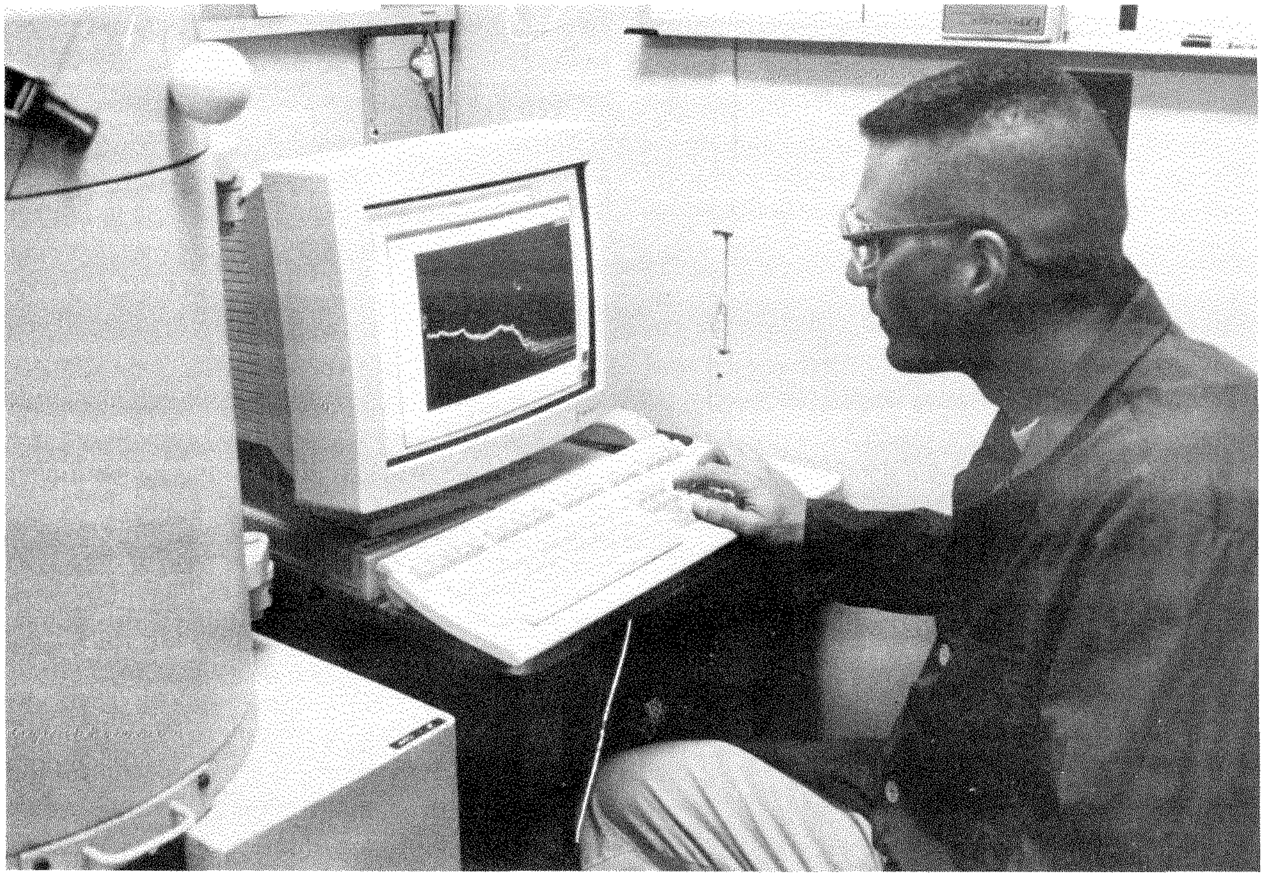
The sample counting results for gross alpha, gross beta, and tritium, even if below the minimum detectable concentrations, were used to generate the high-low graphs. Thus, negative values were included. This is most common for the gross alpha analyses, where sample radiological counting results may be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

Analyses for total organic carbon (TOC) and total organic halogens (TOX) were discontinued after the first two rounds of 1995 because they provided little value in the past and because the program has evolved to comprise analyses of specific organic compounds at selected locations where organic contamination has been detected or locations that are downgradient of suspected sources. As in 1994, low concentrations of acetone (17 µg/L and 21 µg/L on replicate analyses) were detected at well 103. The pH at this location also continues to be elevated.

Trend line graphs have been used to show concentrations of a particular parameter over time at monitoring locations of interest. Results for the volatile organic compounds 1,1-dichloroethane (1,1-DCA) at wells 8609 and 8612, 1,2-dichloroethylene (1,2-DCE) at well 8612, and dichlorodifluoromethane (DCDFMeth) at wells 803 and 8612 are plotted using this format in Figures 3-41 and 3-41a (p. 3-40). See also Tables E-12 and E-13 (p. E-23). Long-term trends (five- and ten-year) of gross beta and tritium for selected groundwater monitoring locations (104, 111, 408, 501, 502, 801, 8603, 8604, 8605, [WN]GSEEP, and [WN]SP008) are also shown in Figures 3-42 through 3-43a (pp. 3-41 and 3-42).



Receiving Groundwater Samples at the Environmental Laboratory Computerized Log-in Station



On-screen Review of a Gamma Count

The 1995 sampling results are grouped and summarized according to the five hydrogeologic units in order to present the results of the groundwater monitoring program on a site-wide basis and to provide intra-unit comparisons. (More detailed assessments of potential releases from SSWMUs are being prepared in accordance with the site's RCRA Facility Investigation Work Plan, as required by the RCRA 3008(h) Order on Consent.)

With the exception of groundwater monitoring results for gross beta on the north plateau, there have been no new developments in 1995. Monitoring results have been consistent with historical levels, which have been discussed in previous site reports. Updated 1995 concentrations are presented in *Appendix E* (pp. E-1 through E-31).

Previous site reports have referred to specific monitoring locations as exhibiting notable concentrations of particular analytes. As a result of the reduction in 1995 in the number of wells monitored, many of these locations previously discussed (as well as others not discussed) are no longer routinely sampled. In every such case, ongoing monitoring coverage of nearby locations provides sufficient surveillance. Wells falling into this category that were previously discussed and are now discontinued are 109, 114, 115, 203, 207, 305, 307, 404, 410, 411, 601, 603, 701, 702, 703, 705, 904, 905, 907, 1001, 1002, 1003, 1004, 8606, 8608, and 8613a, b, and c.

Well 202, previously noted for high pH, is no longer sampled because it has been determined that cement grout used to install the well is responsible for the anomalous pH. The very high pH of samples from that well tended to interfere with other analyses.

Sampling location WNDMPNE was discontinued as a groundwater monitoring location after May 1995 because, as defined in the *Glossary*, it is technically a surface water sampling location. Sampling of WNDMPNE up to May 1995 is reported in *Appendix E*. Groundwater seepage continues to contribute to total discharges at this location. This location, which exhibited the earliest evidence in 1993 that elevated gross beta on the north plateau may have been discharging at the plateau edge, continues to be monitored as surface water location WNSWAMP and is reported in *Appendix C-1*, Table C-1.7 (p. C1-8).

In 1993 and 1994, the expanded characterization of groundwater included sampling and analysis for several radionuclides. Of these radionuclides, strontium-90 was most frequently found to exceed background concentrations. Since concentrations of strontium-90 can be inferred as a percentage of gross beta concentrations, there is no longer a continuing need to analyze for both parameters. Results from the less expensive analyses for gross beta (allowing at least ten days for samples to reach equilibrium with respect to yttrium-90 ingrowth) can be multiplied by 40% to 50% to arrive at an approximation of the strontium-90 concentrations.

Technetium-99, iodine-129, and carbon-14 radionuclides, which were previously noted at several monitoring locations at concentrations above background levels, have been demonstrated to comprise very small percentages of total gross beta concentrations. While elevated levels in 1993 and 1994 were noted at specific locations, none were above DCGs, and gross beta analyses continue to provide surveillance on a quarterly basis.

Elevated alpha-emitting radionuclides such as radium-228, uranium-232, uranium-233/234, and uranium-238 were noted in the 1994 site report for isolated monitoring locations. However, in all cases, these levels were low (far below DCGs) and close to background levels. The site continues to monitor all these areas for gross alpha on a quarterly basis.

Long-term Trends of Gross Beta and Tritium at Selected Groundwater Monitoring Locations

Trend graphs showing results of groundwater monitoring at monitoring locations 8603, 8604, 8605, WNGSEEP, and WNSP008 from 1986 through 1995 for gross beta (Fig. 3-42 [p. 3-41]) and tritium (Fig. 3-43 [p. 3-42]) were prepared for selected locations in the unit of greatest concern. Results are presented on a logarithmic scale to adequately represent locations of differing concentrations. These specific groundwater monitoring locations in the sand and gravel unit were selected for trending because they have shown elevated or rising levels of these constituents (gross beta) or falling trends (tritium).

The graph of gross beta activity at monitoring locations 8603, 8604, 8605, WNGSEEP, and WNSP008 (Fig. 3-42 [p. 3-41]) indicates steadily rising trends at wells 8603 and 8604. Well 8604 is located to the north of lagoon 4 in SSWMU #1 and extends to 23.0 feet below grade. Results from well 8603, which is north of 8604, at a depth of 25.4 feet, have continued to show a steady upward trend. The source of the increasing gross beta activity is associated with the groundwater plume originating from below the process building.

Lagoon 1, formerly part of the low-level waste treatment facility, was identified as a source of north plateau contamination contributing to the gross beta activity at wells 8605 and 111. The gross beta concentrations at both wells have remained at a steady level over the entire ten-year (well 8605) and five-year (well 111) monitoring periods.

Figure 3-43 (p. 3-42) shows the ten-year trend for tritium concentrations for the same monitoring locations (8603, 8604, 8605, WNGSEEP, and WNSP008). All of these points, with the exception of WNGSEEP, indicate gradually declining trends in tritium.

Figures 3-42a (p. 3-41) and 3-43a (p. 3-42) present gross beta and tritium concentrations for wells 104, 111, 408, 501, 502, and 801 over the five-year period that the WVDP's current groundwater monitoring program has been in place. (For the sake of clarity, these graphs now show annual averages rather than individual results to accommodate the increased amount of data that has been collected.) The wells selected for these five-year trend graphs represent on-site locations with levels of gross beta and/or tritium activity that are elevated above background levels. The two graphs used last year to show trends in beta activity have been merged into one. Monitoring location WNDMPNE has been removed because it is technically a surface water sampling location and is now discussed in *Chapter 2, Environmental Monitoring*. Background well NB1S was also removed from the graph to allow the illustration of additional wells where elevated radiological activity (i.e., wells 104, 111, and 801) may be a concern. However, the average background concentration is plotted on each graph for comparison purposes. All wells shown in these figures monitor the sand and gravel unit. Well 111 exhibits a relatively steady decreasing trend in tritium concentrations. This well is located near former lagoon 1 within SSWMU #1.

Interim Mitigative Measures Near the Leading Edge of the Gross Beta Plume on the North Plateau

Although elevated gross beta has been reported historically in localized areas north and east of the process building, 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 which groundwater and soil was sampled using the Geoprobe®, a mobile sampling system, 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 located near the southwest 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 responsible for most of the elevated gross beta in the groundwater and soil beneath and downgradient of the process building (West Valley Nuclear Services Co., Inc. 1995).

The interim measure designed to mitigate the gross beta plume on the north plateau is located near the leading edge of a lobe of the plume that is preferentially flowing from the main plume body towards the edge of the plateau (Fig. 3-5). Two extraction wells (RW-01 and RW-02) were installed near the leading edge of the plume.

A pump-and-treat system was installed to treat groundwater extracted from these two wells using an ion-exchange resin column that removes strontium from the groundwater before it is discharged to the low-level waste treatment facility (lagoons 2, 4, or 5). As necessary for treatment in the LLWTF and as required by the current SPDES permit for radiologic species, this pretreatment reduces both the activity and hardness of the groundwater being routed to the LLWTF.

An ongoing analysis of water-level data obtained during the operation of these two wells indicates that they capture a majority of the gross beta lobe. A third extraction well will be positioned between

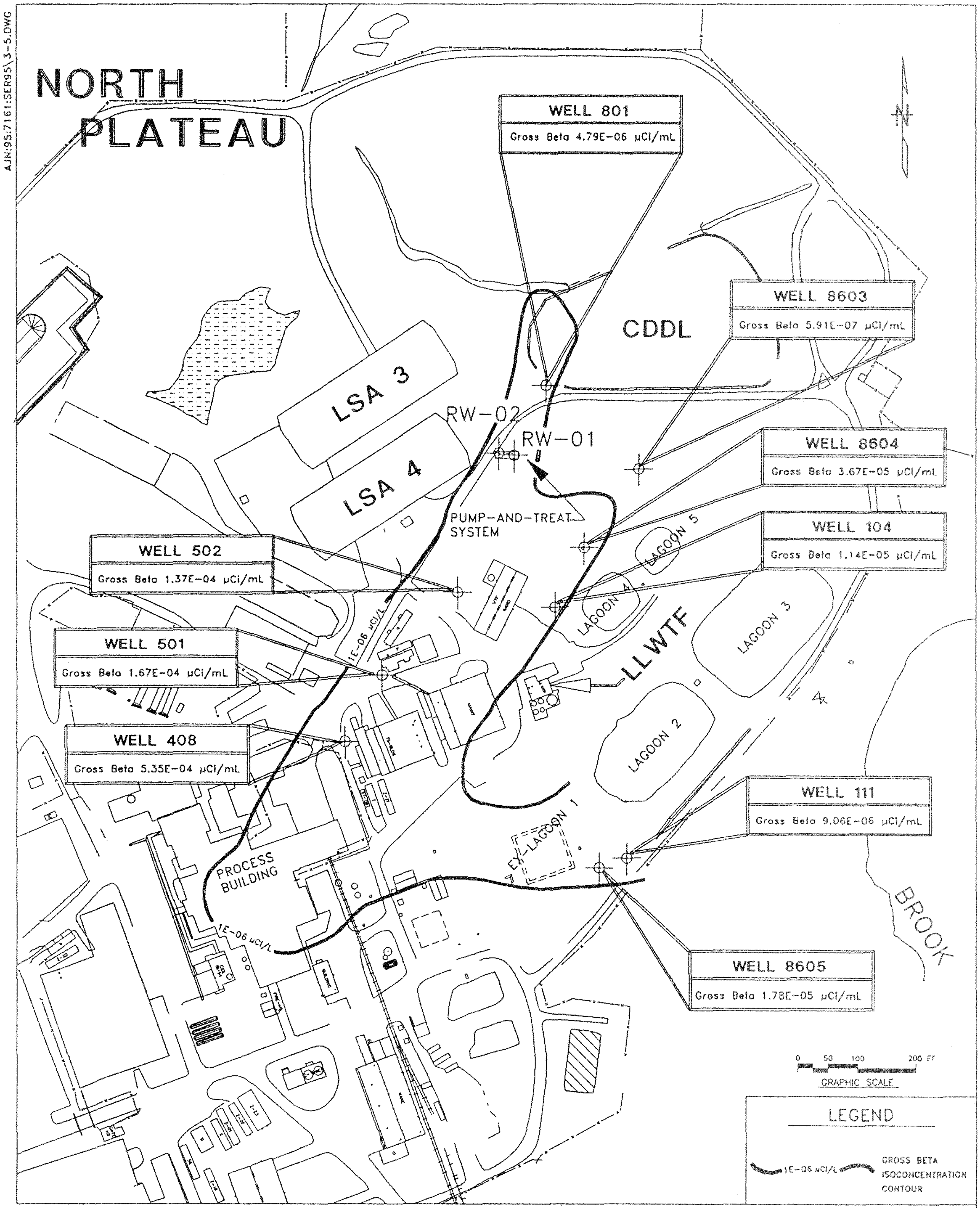


Figure 3-5. North Plateau Gross Beta Plume Area Illustrating the Fourth-Quarter 1995 Results and the Location of the Pump-and-Treat System.

the two current wells to increase the groundwater capture zone and intercept a greater volume of the groundwater plume in order to decrease the amount of contaminated water flowing towards the edge of the plateau.

Discussion of Site Groundwater Monitoring

The groundwater monitoring program was considerably revised in 1995. Revisions were aimed at using the knowledge gained from recent characterization efforts to focus the overall program. By the end of 1995, fewer wells were sampled and, in many cases, fewer parameters were analyzed than in 1994. This reflects the expected transition of the program from one dominated by data collection needs for adequate characterization to one more focused on providing efficient ongoing monitoring surveillance. Data collection needs are expected to further decrease as the RCRA facility investigation reports are made final.

Off-site Groundwater Monitoring Program

During 1995 all of the off-site groundwater residential wells were sampled for radiological constituents, pH, and conductivity. Sampling and analysis indicated no evidence of contamination by the WVDP of these off-site water supplies. Analytical results are found in Table C-1.26 (p. C1-21) in *Appendix C-1.*

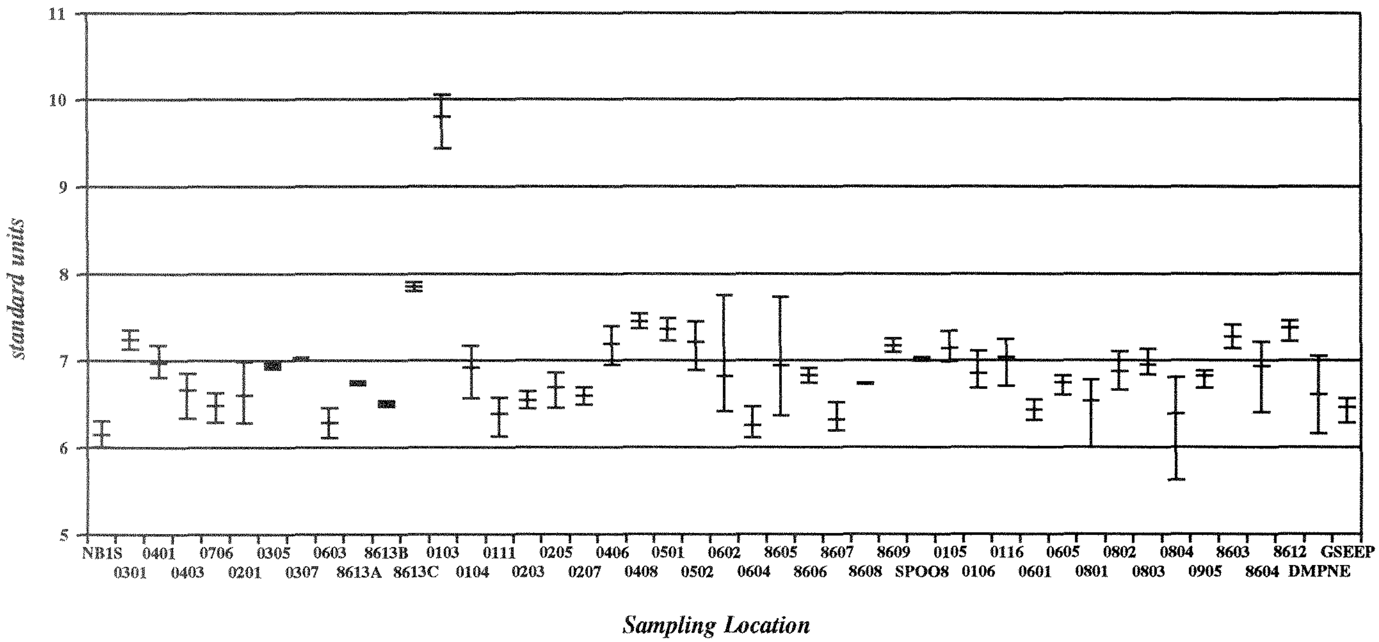


Figure 3-6. pH in Groundwater Samples from the Sand and Gravel Unit

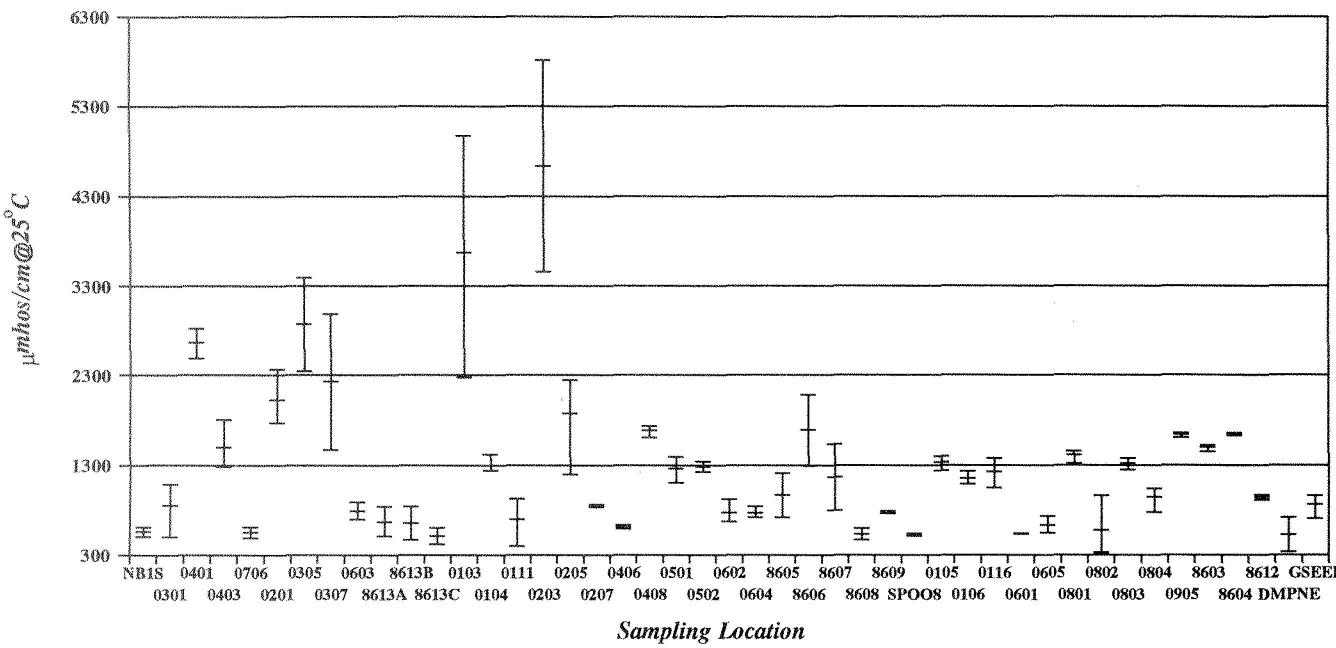


Figure 3-7. Conductivity (μmhos/cm@25°C) in Groundwater Samples from the Sand and Gravel Unit

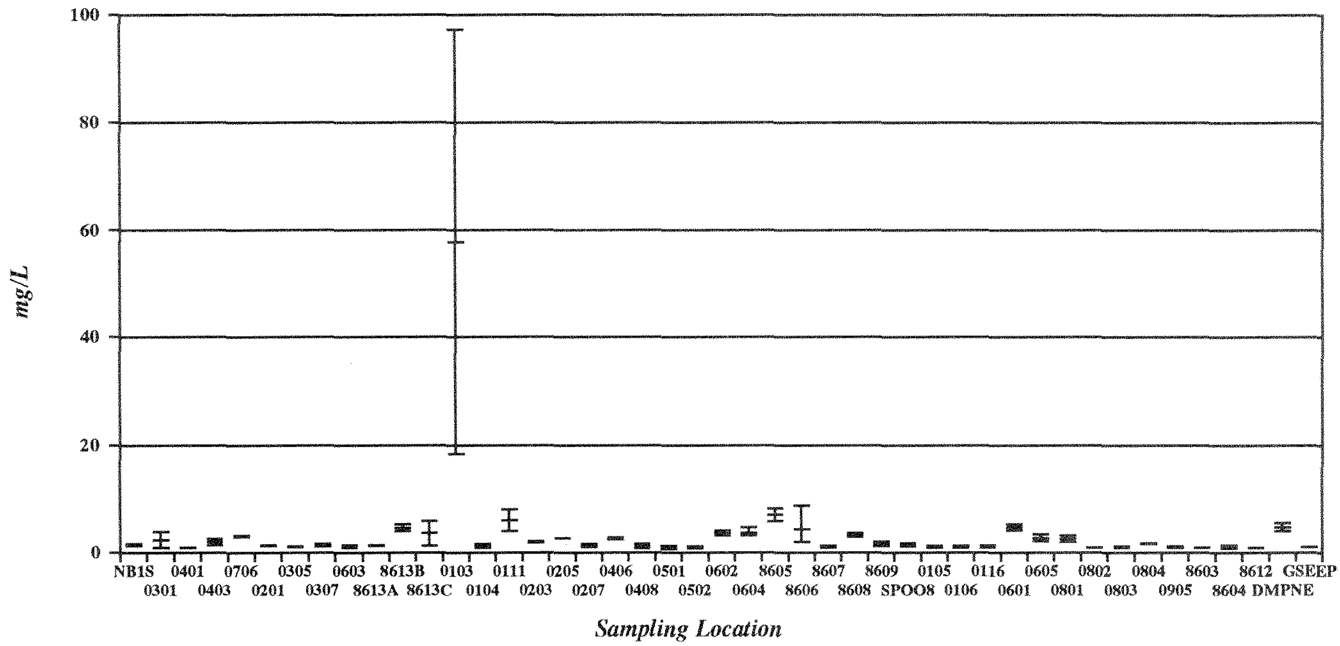


Figure 3-8. Total Organic Carbon (mg/L) in Groundwater Samples from the Sand and Gravel Unit

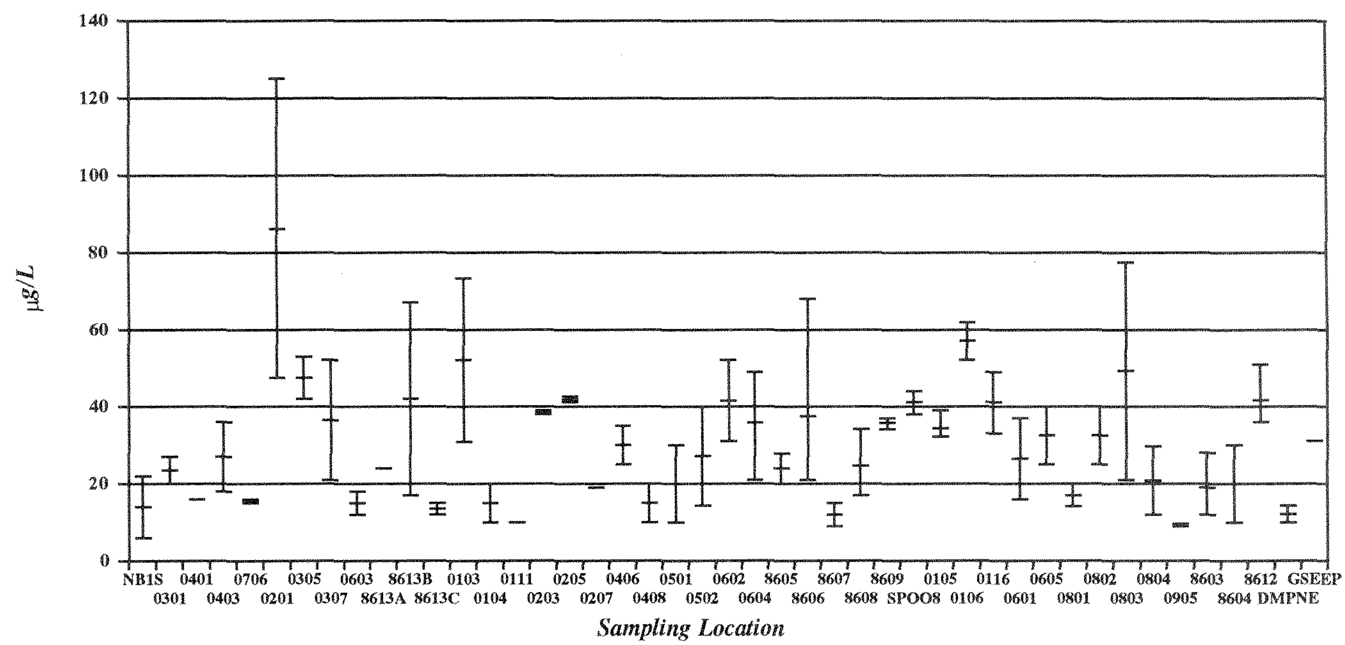


Figure 3-9. Total Organic Halogens (µg/L) in Groundwater Samples from the Sand and Gravel Unit

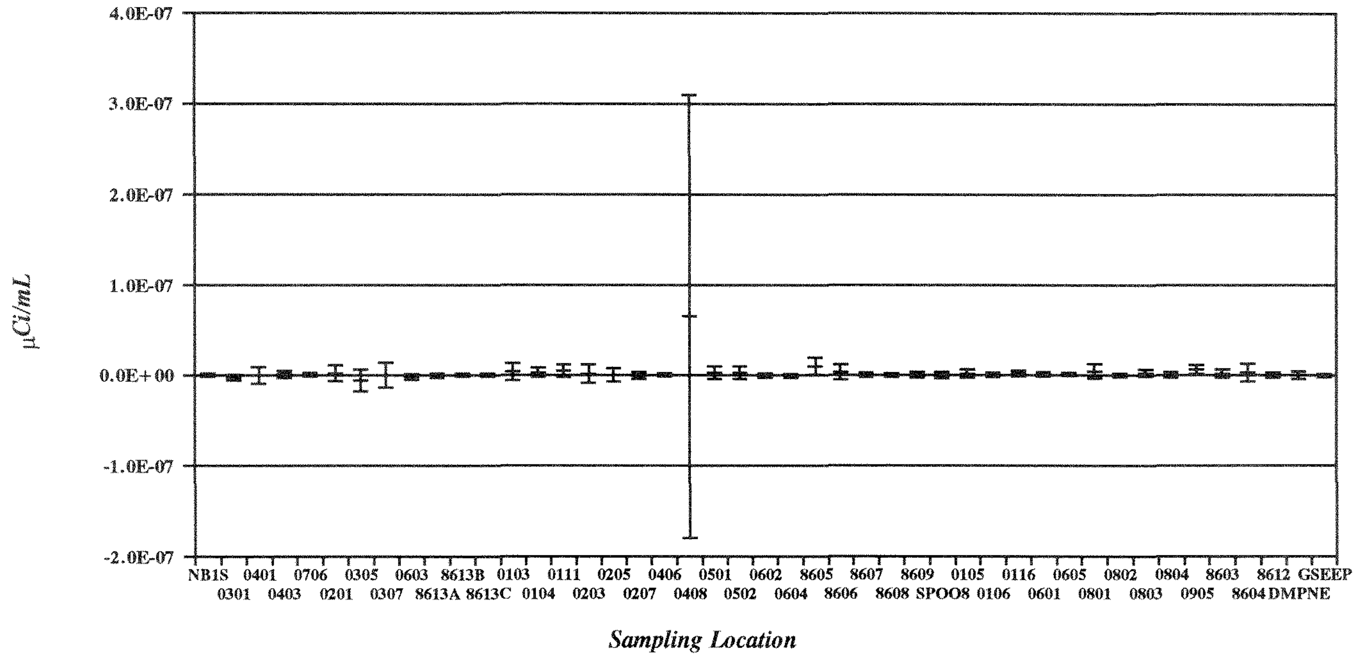


Figure 3-10. Gross Alpha (μCi/mL) in Groundwater Samples from the Sand and Gravel Unit

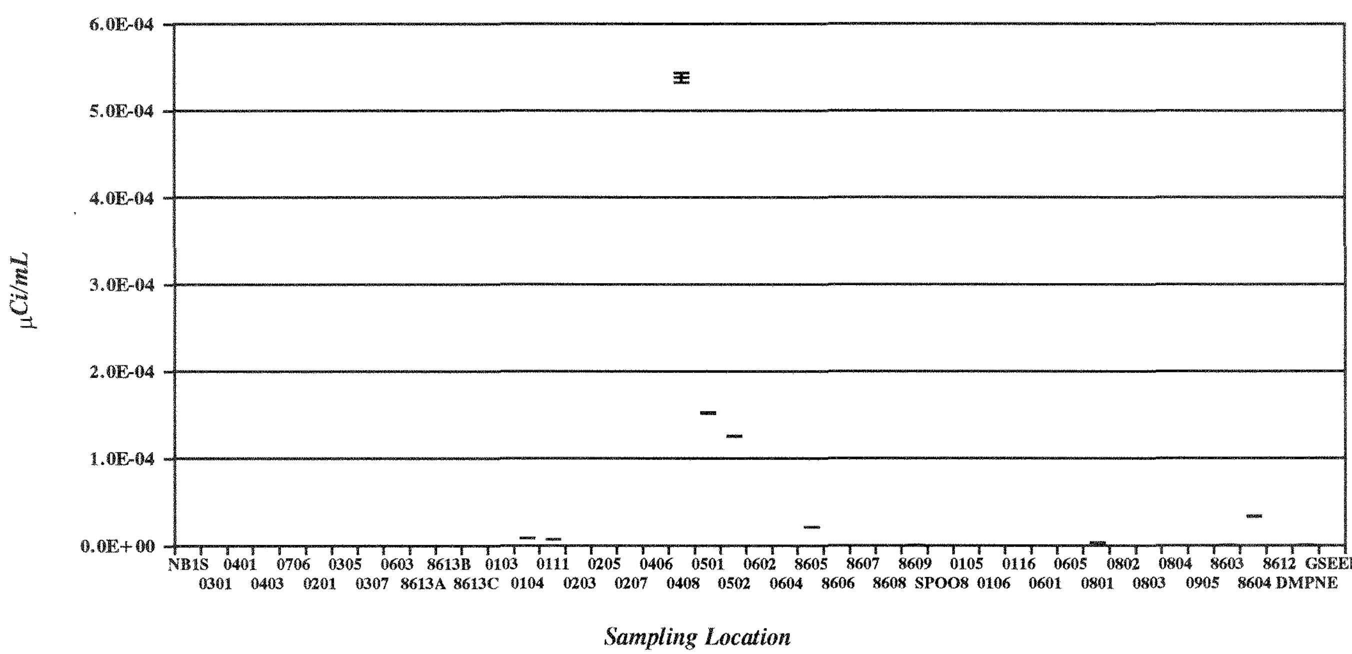


Figure 3-11. Gross Beta (μCi/mL) in Groundwater Samples from the Sand and Gravel Unit
(Figs. 3-11a and 3-11b follow with magnified scales.)

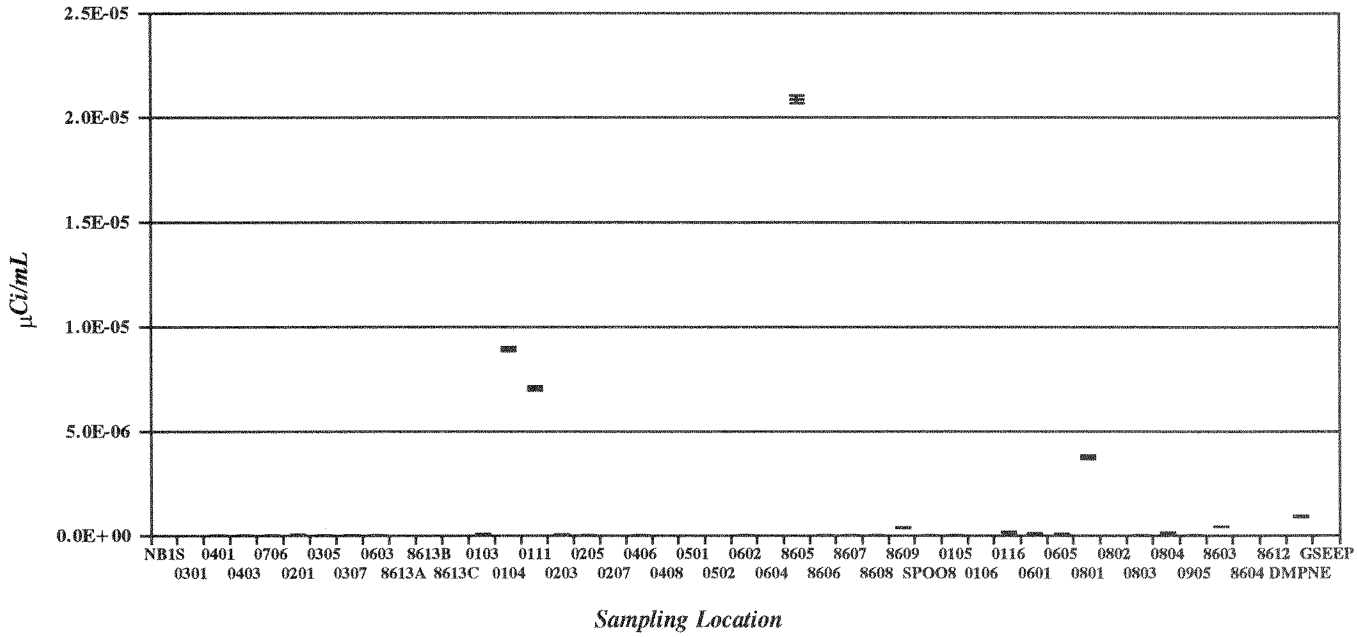


Figure 3-11a. Gross Beta (µCi/mL) in Groundwater Samples from the Sand and Gravel Unit (magnified scale of Fig. 3-11)

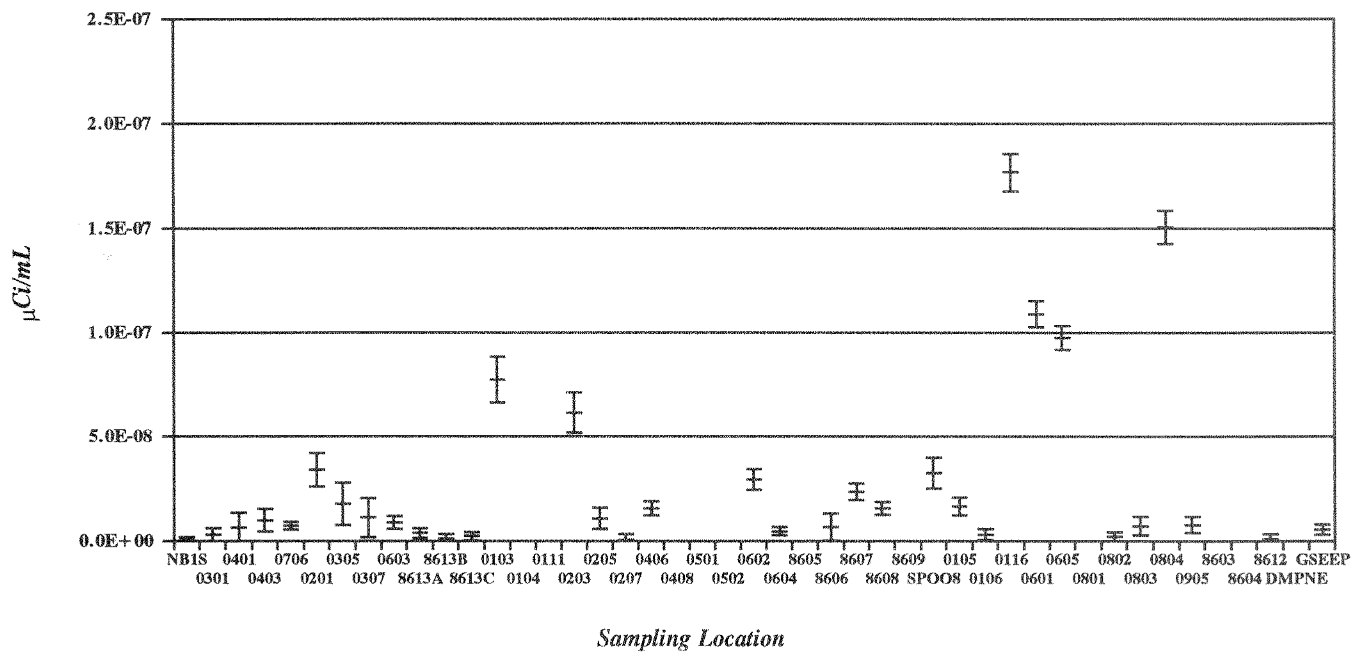


Figure 3-11b. Gross Beta (µCi/mL) in Groundwater Samples from the Sand and Gravel Unit (magnified scale of Fig. 3-11a)

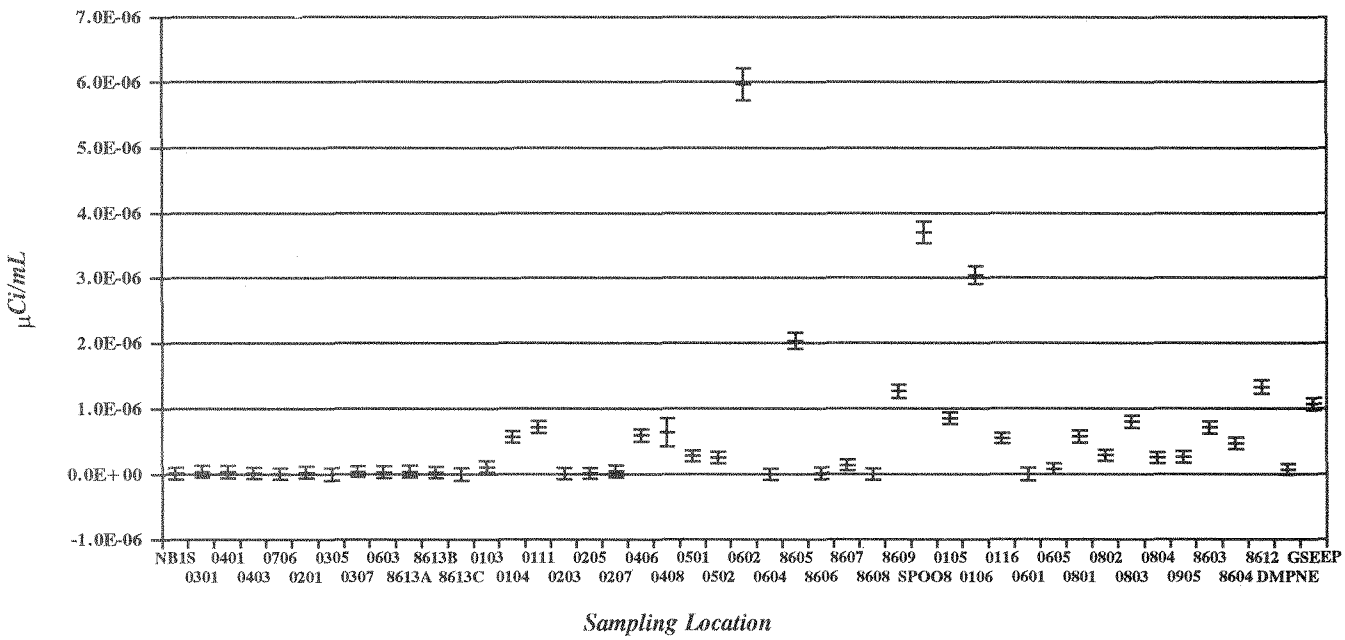


Figure 3-12. Tritium Activity (μCi/mL) in Groundwater Samples from the Sand and Gravel Unit (Fig. 3-12a follows with magnified scale.)

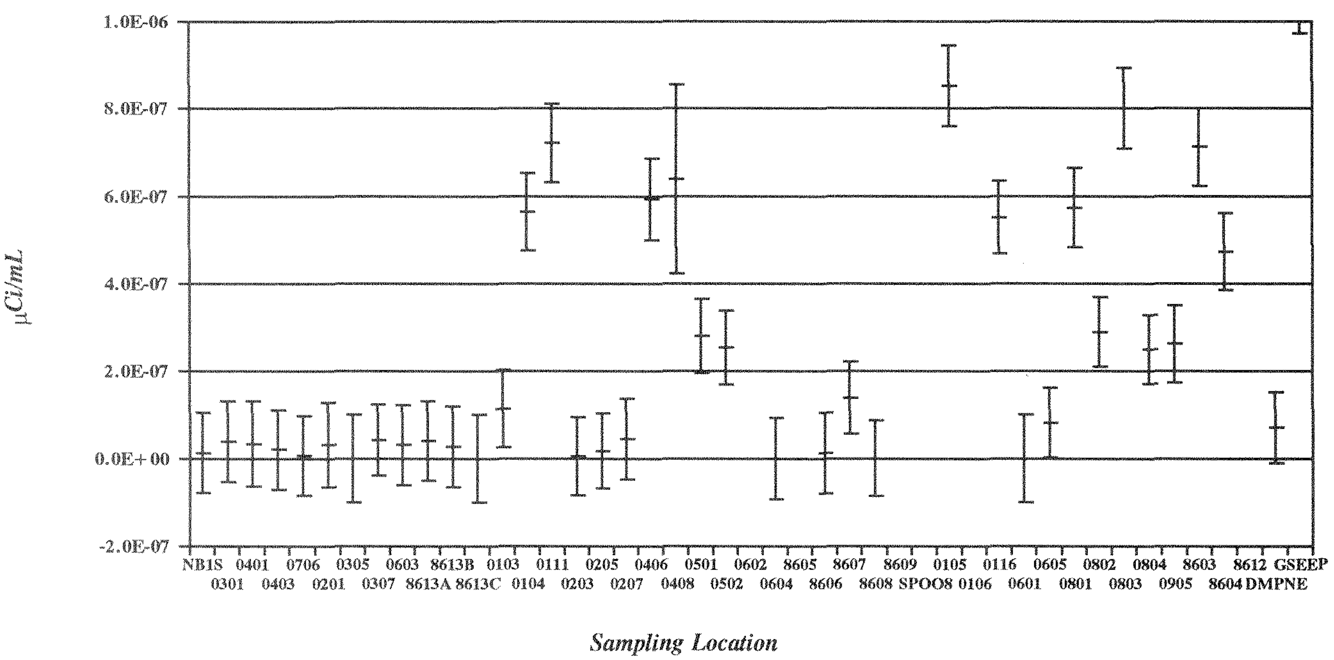


Figure 3-12a. Tritium Activity (μCi/mL) in Groundwater Samples from the Sand and Gravel Unit (magnified scale of Fig. 3-12)

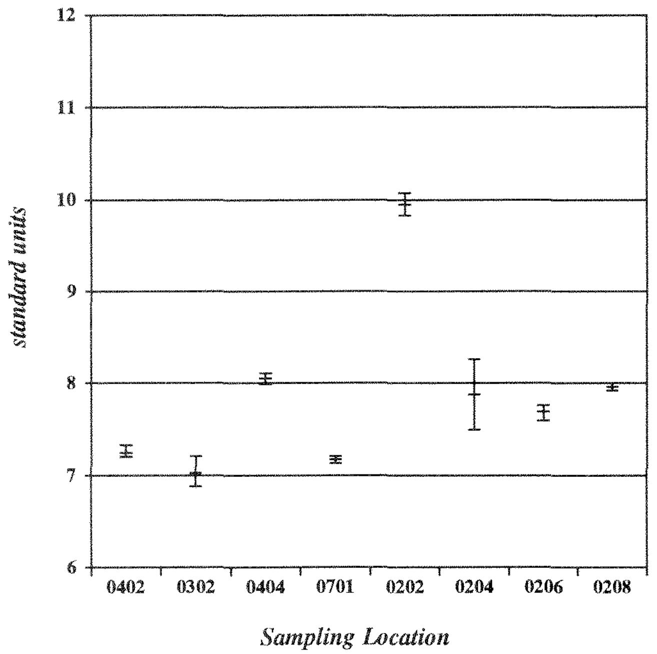


Figure 3-13. pH of Groundwater Samples from the Till-Sand Unit

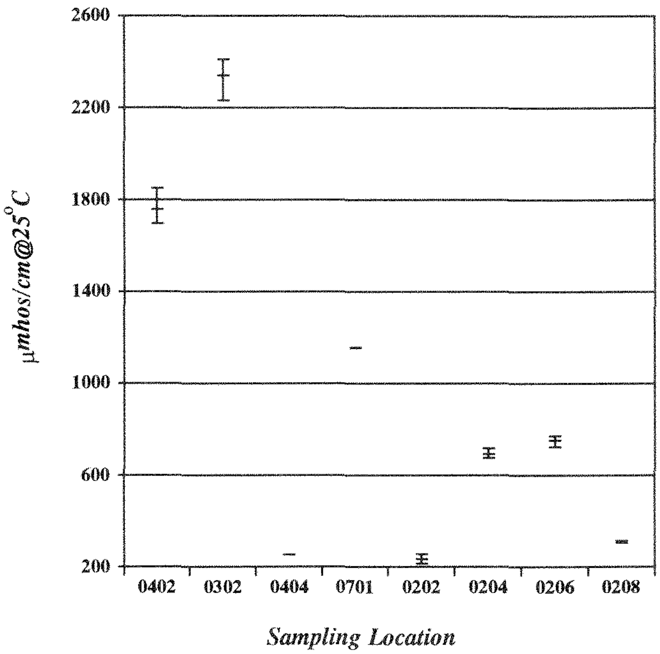


Figure 3-14. Conductivity (μmhos/cm@25°C) of Groundwater Samples from the Till-Sand Unit

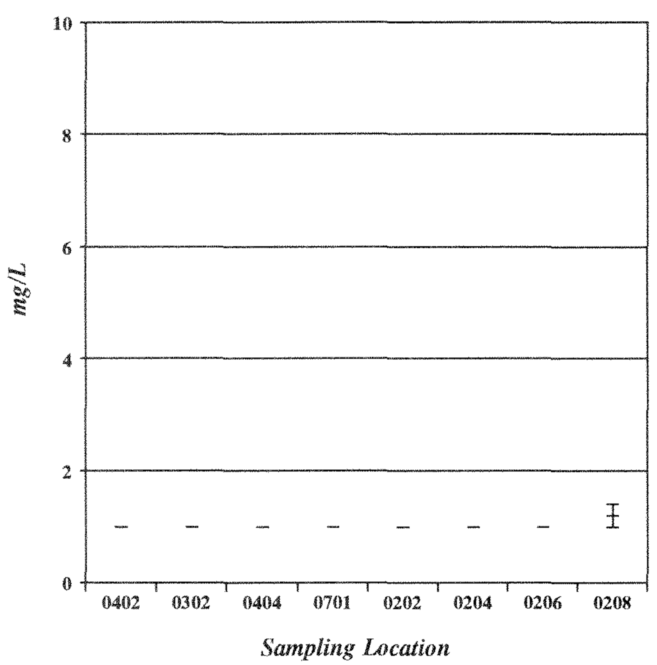


Figure 3-15. Total Organic Carbon (mg/L) in Groundwater Samples from the Till-Sand Unit

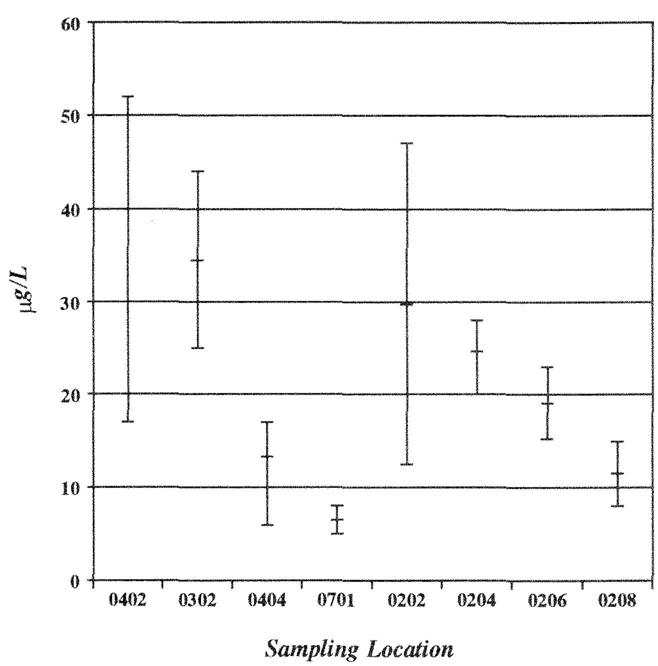


Figure 3-16. Total Organic Halogens (μg/L) in Groundwater Samples from the Till-Sand Unit

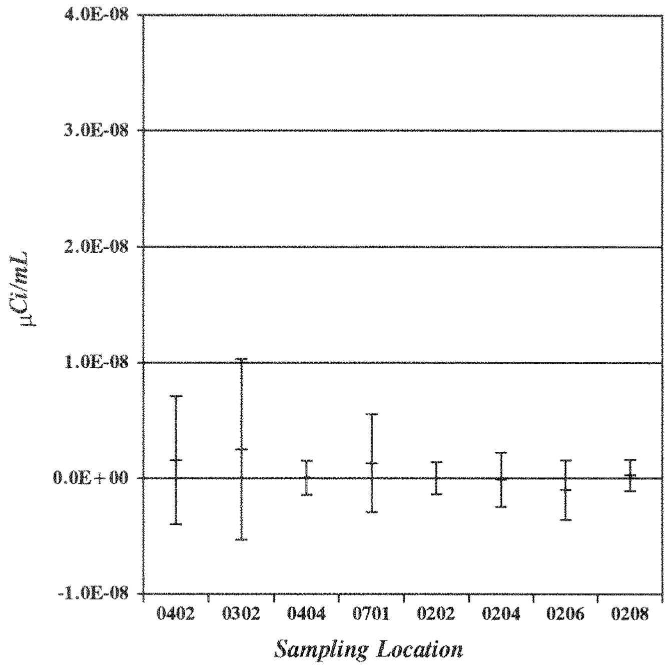


Figure 3-17. Gross Alpha (μCi/mL) in Groundwater Samples from the Till-Sand Unit

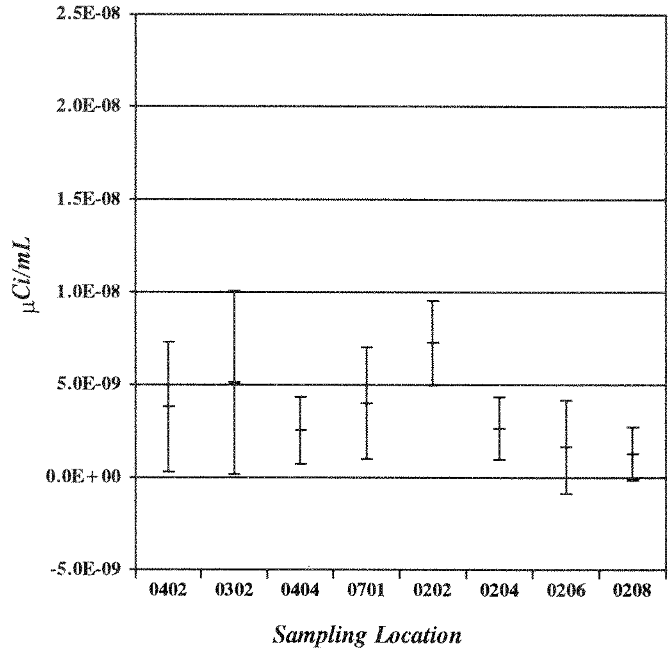


Figure 3-18. Gross Beta (μCi/mL) in Groundwater Samples from the Till-Sand Unit

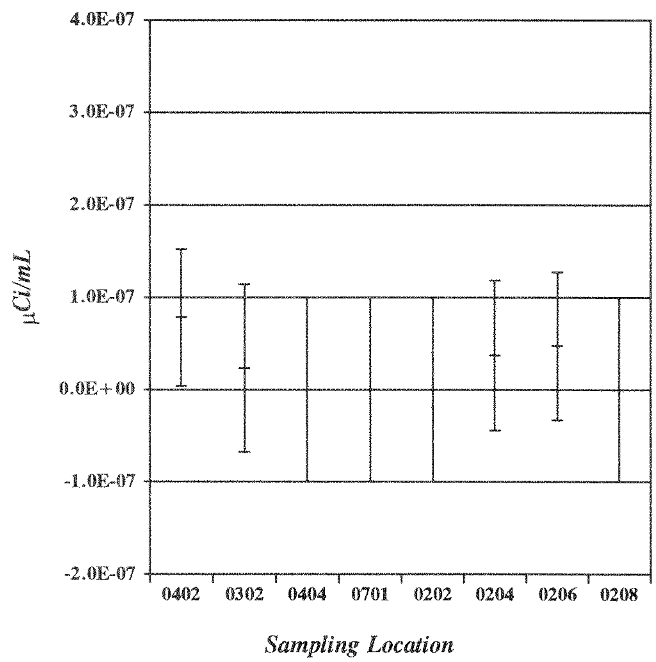


Figure 3-19. Tritium Activity (μCi/mL) in Groundwater Samples from the Till-Sand Unit

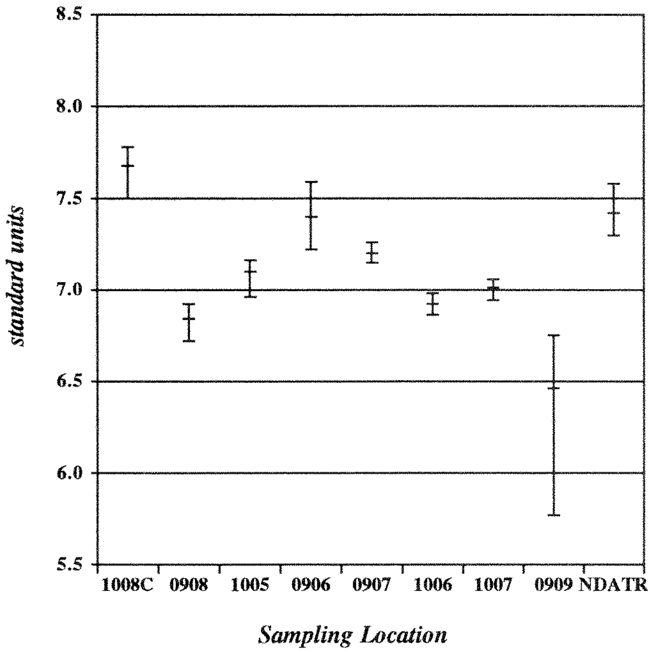


Figure 3-20. pH of Groundwater Samples from the Weathered Lavery Till Unit

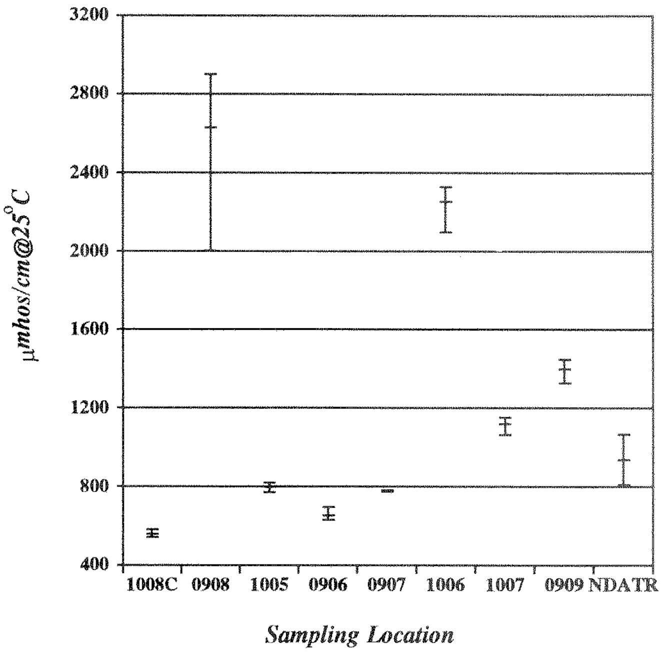


Figure 3-21. Conductivity (μmhos/cm@25°C) of Groundwater Samples from the Weathered Lavery Till Unit

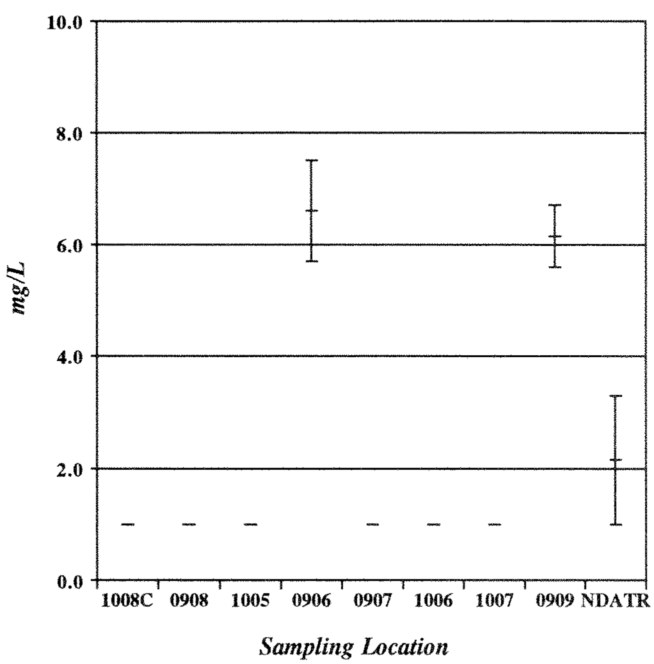


Figure 3-22. Total Organic Carbon (mg/L) in Groundwater Samples from the Weathered Lavery Till Unit

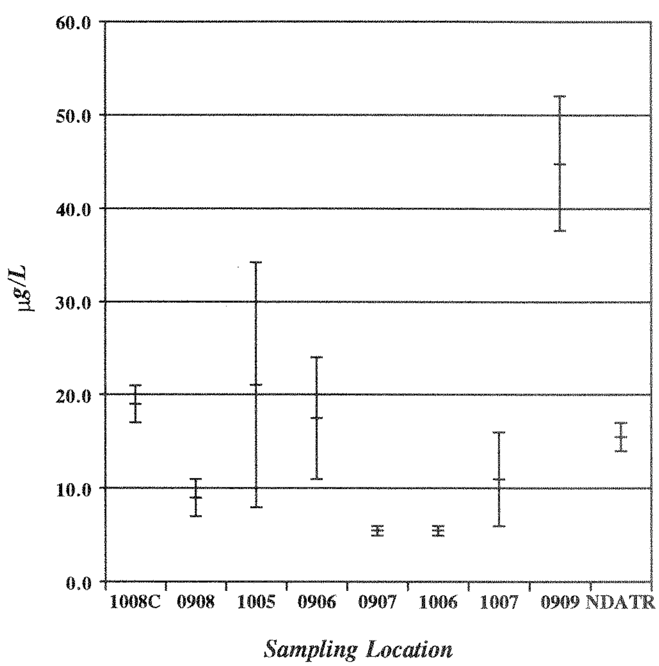


Figure 3-23. Total Organic Halogens (μg/L) in Groundwater Samples from the Weathered Lavery Till Unit

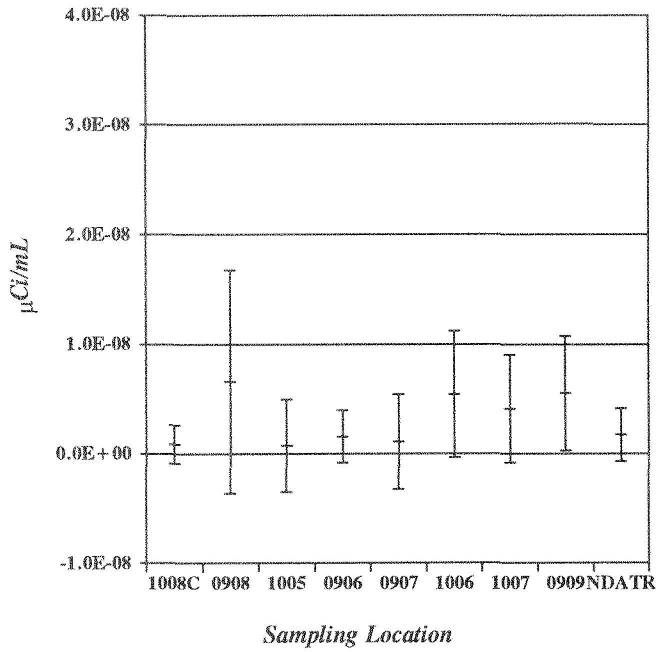


Figure 3-24. Gross Alpha (μCi/mL) in Groundwater Samples from the Weathered Lavery Till Unit

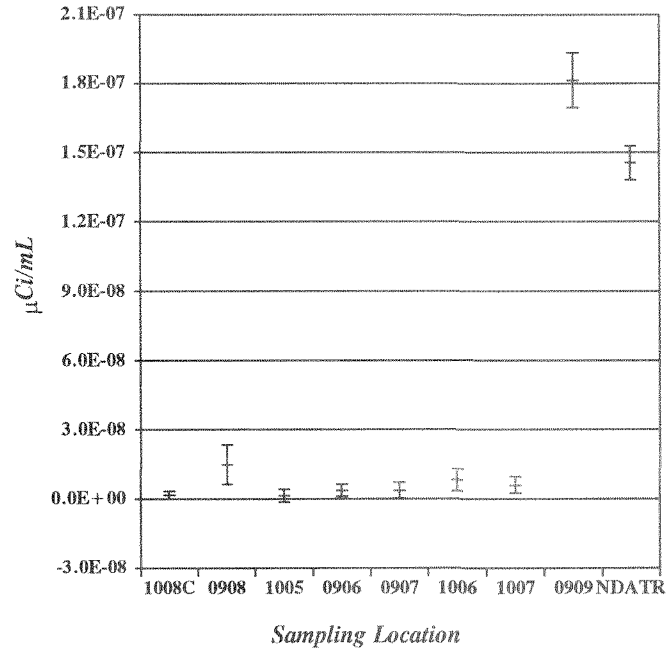


Figure 3-25. Gross Beta (μCi/mL) in Groundwater Samples from the Weathered Lavery Till Unit

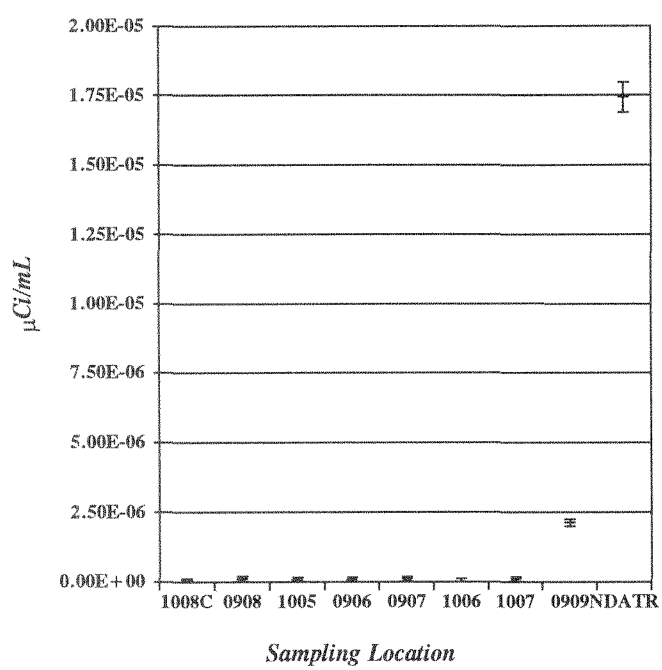


Figure 3-26. Tritium Activity (μCi/mL) in Groundwater Samples from the Weathered Lavery Till Unit (Fig. 3-26a follows with magnified scale.)

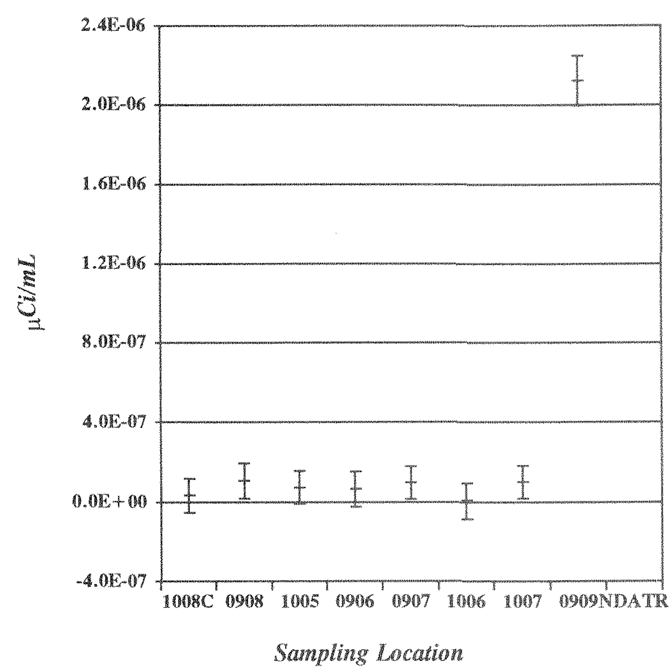


Figure 3-26a. Tritium Activity (μCi/mL) in Groundwater Samples from the Weathered Lavery Till Unit (magnified scale of Fig. 3-26)

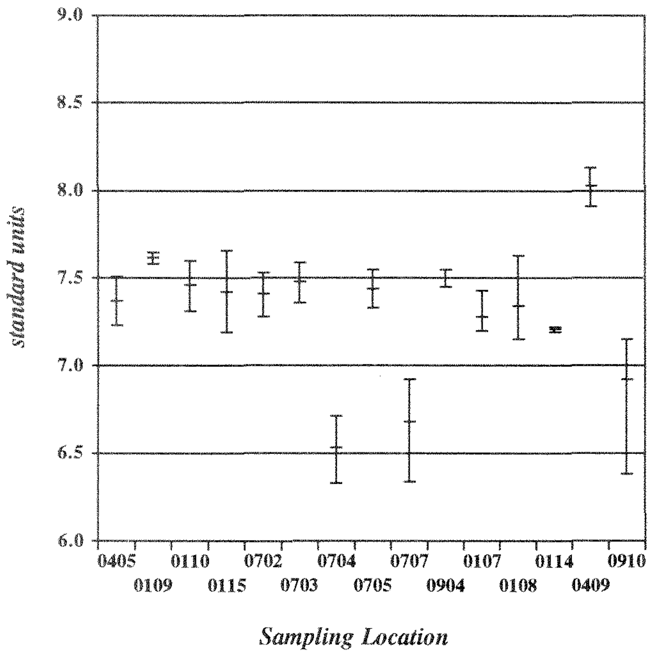


Figure 3-27. pH of Groundwater Samples from the Unweathered Lavery Till Unit

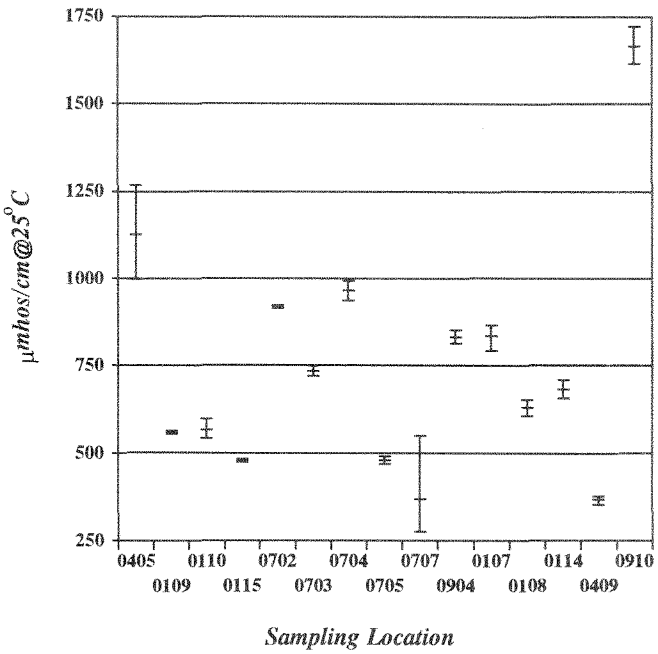


Figure 3-28. Conductivity (μmhos/cm@25°C) of Groundwater Samples from the Unweathered Lavery Till Unit

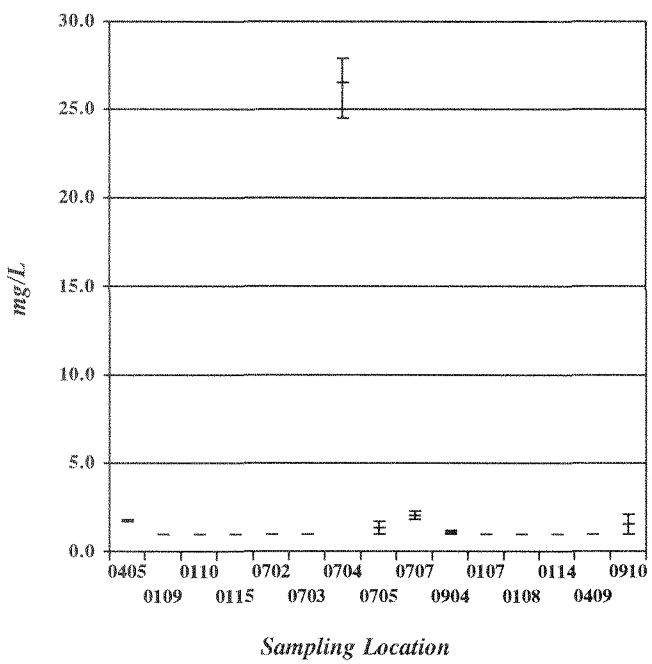


Figure 3-29. Total Organic Carbon (mg/L) in Groundwater Samples from the Unweathered Lavery Till Unit

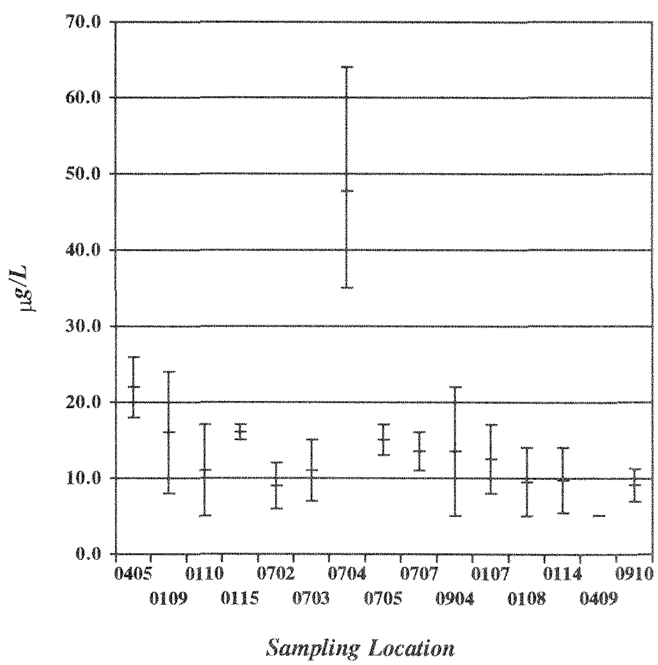


Figure 3-30. Total Organic Halogens (μg/L) in Groundwater Samples from the Unweathered Lavery Till Unit

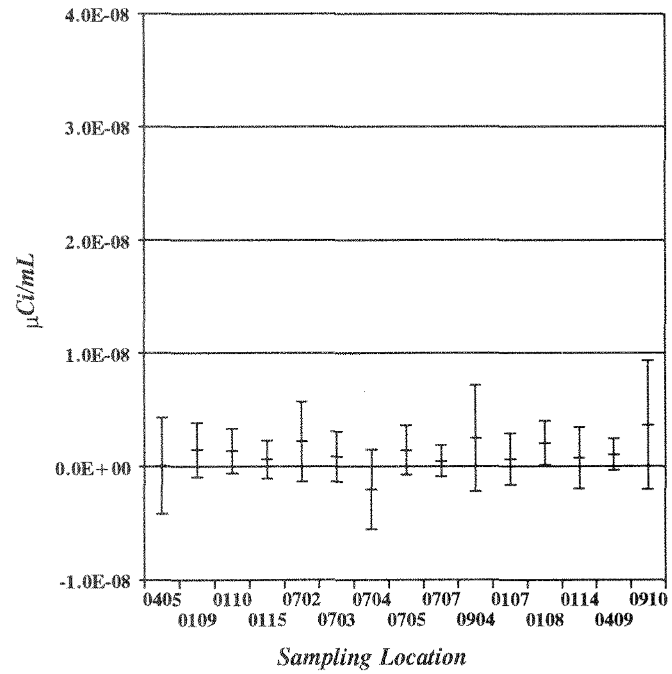


Figure 3-31. Gross Alpha (μCi/mL) in Groundwater Samples from the Unweathered Lavery Till Unit

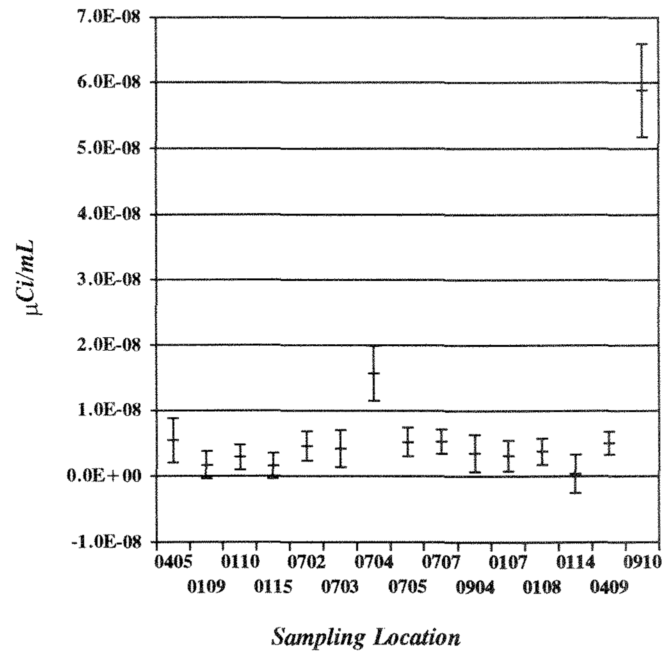


Figure 3-32. Gross Beta (μCi/mL) in Groundwater Samples from the Unweathered Lavery Till Unit

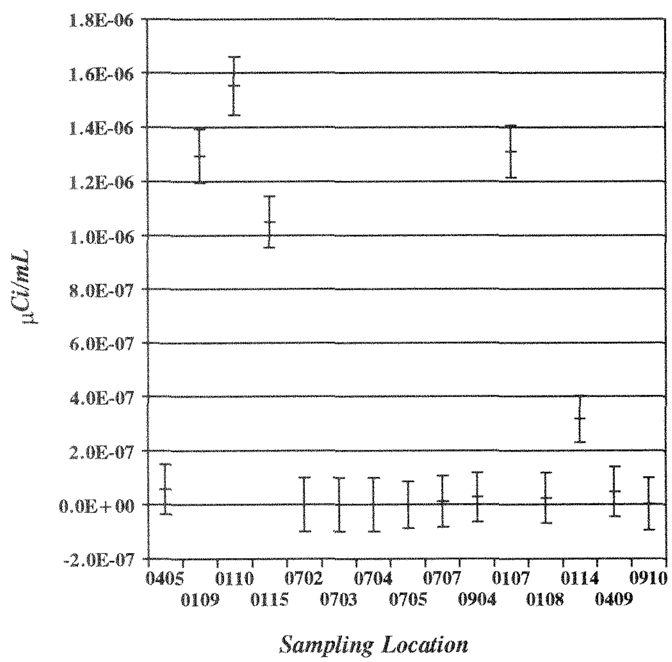


Figure 3-33. Tritium Activity (μCi/mL) in Groundwater Samples from the Unweathered Lavery Till Unit

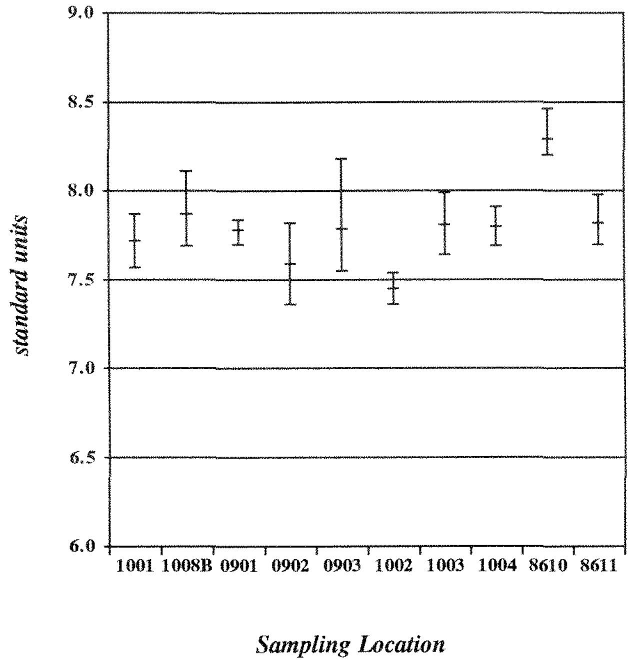


Figure 3-34. pH of Groundwater Samples from the Kent Recessional Sequence

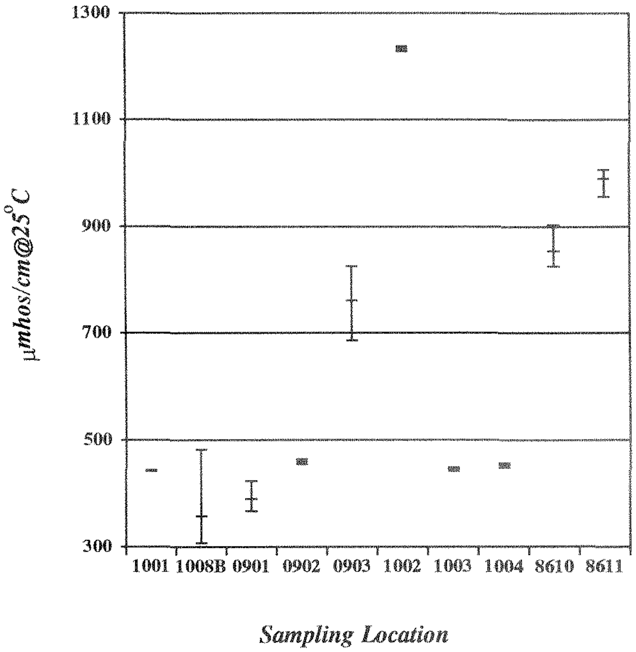


Figure 3-35. Conductivity (µmhos/cm@25°C) of Groundwater Samples from the Kent Recessional Sequence

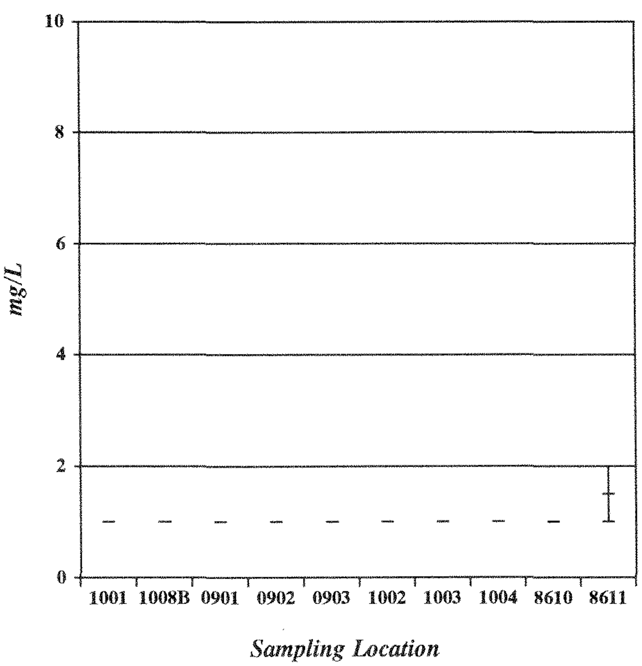


Figure 3-36. Total Organic Carbon (mg/L) in Groundwater Samples from the Kent Recessional Sequence

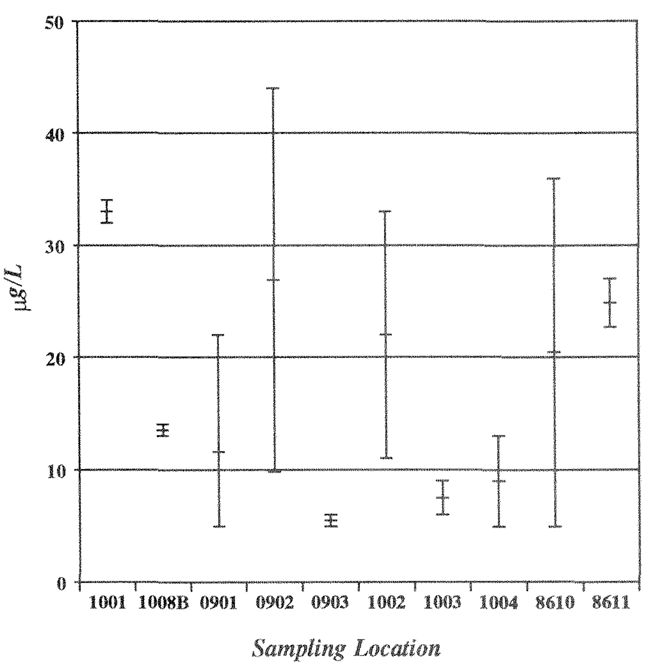


Figure 3-37. Total Organic Halogens (µg/L) in Groundwater Samples from the Kent Recessional Sequence

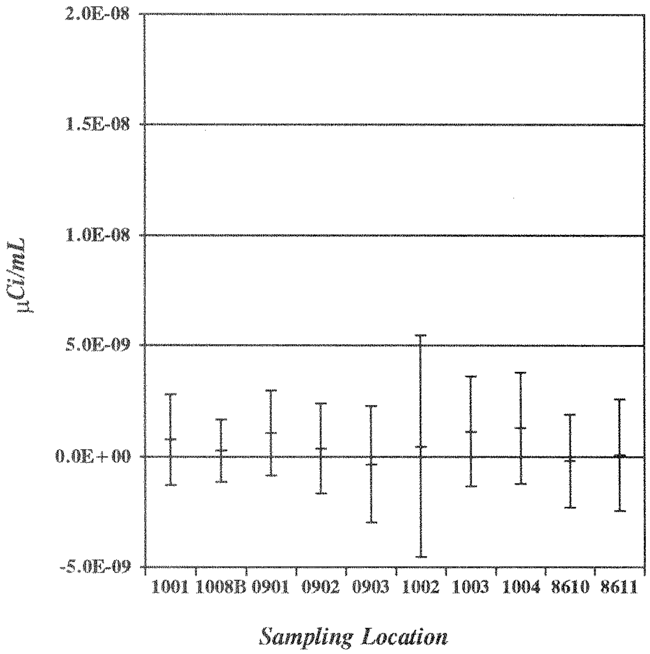


Figure 3-38. Gross Alpha (μCi/mL) in Groundwater Samples from the Kent Recessional Sequence

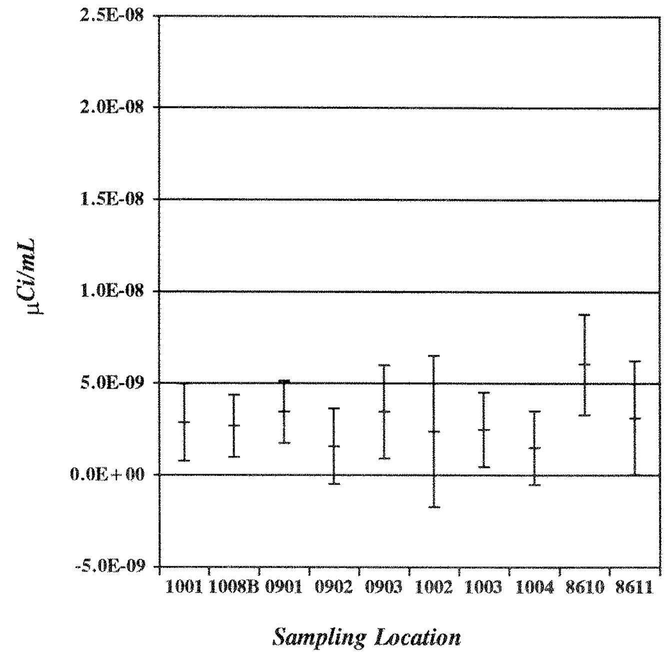


Figure 3-39. Gross Beta (μCi/mL) in Groundwater Samples from the Kent Recessional Sequence

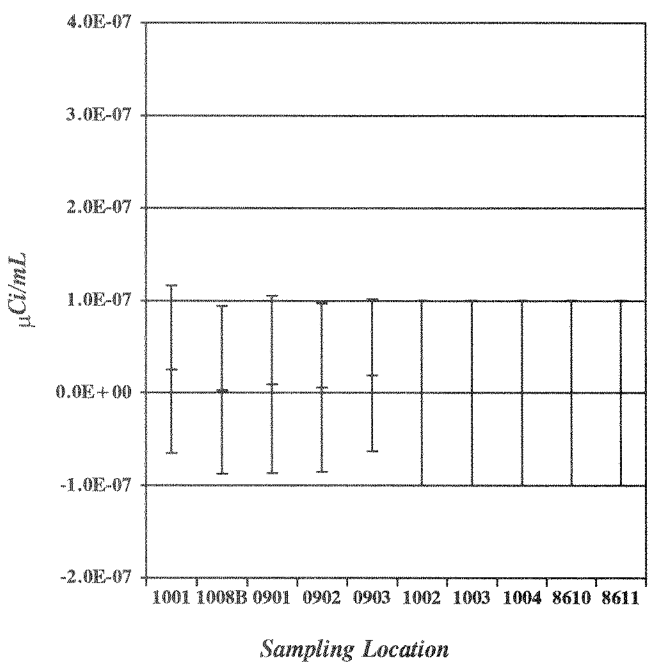


Figure 3-40. Tritium Activity (μCi/mL) in Groundwater Samples from the Kent Recessional Sequence

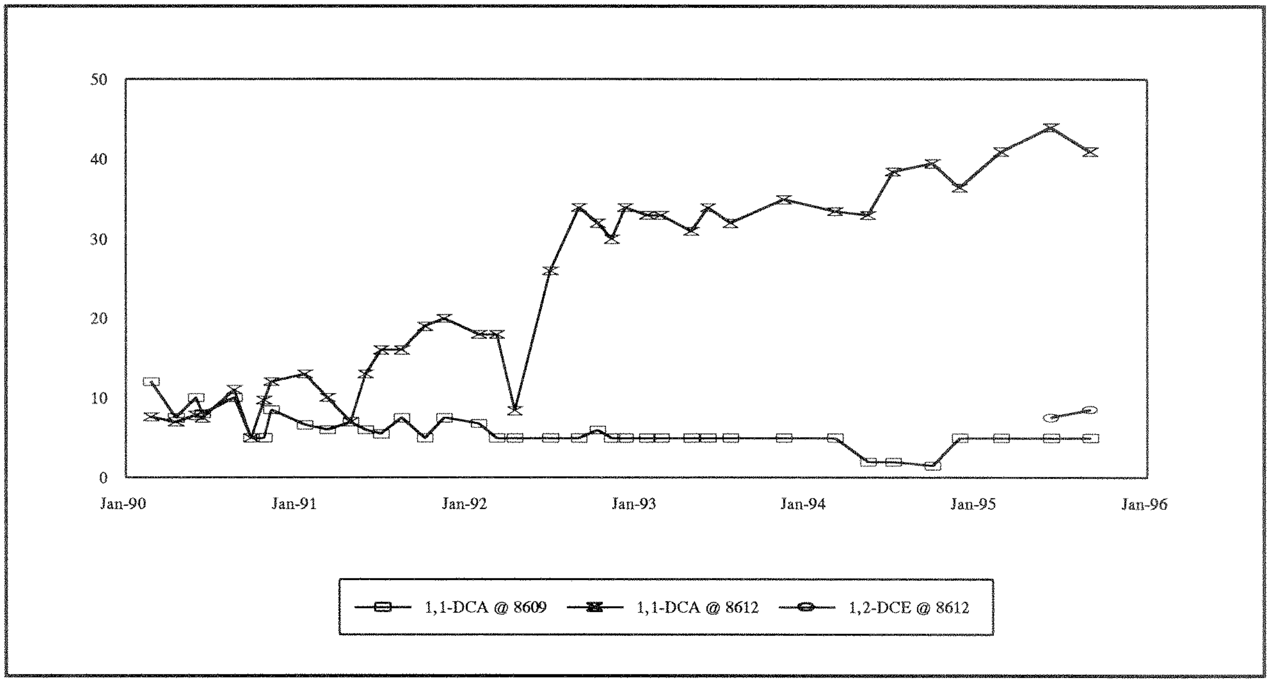


Figure 3-41. Six-Year Trends (1990 through 1995) of 1,1-DCA and 1,2-DCE (μg/L) at Selected Groundwater Locations

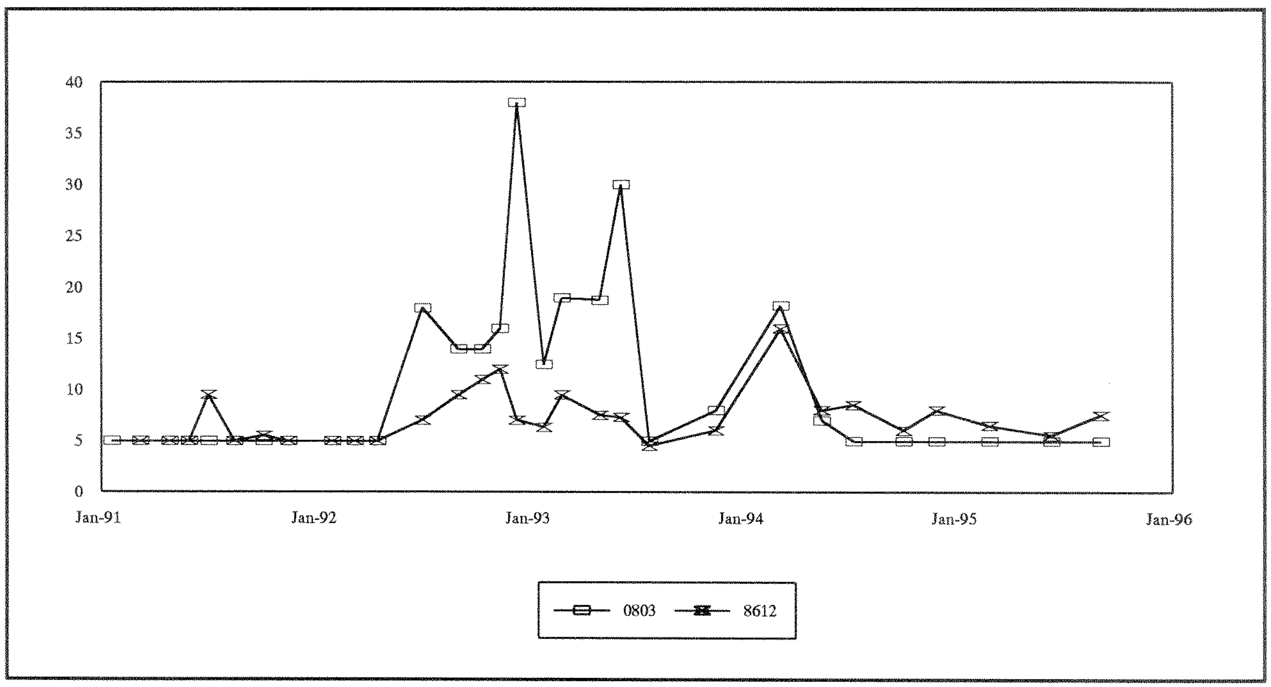


Figure 3-41a. Five-Year Trends (1991 through 1995) of Dichlorodifluoromethane (DCDFMeth) (μg/L) at Selected Groundwater Locations

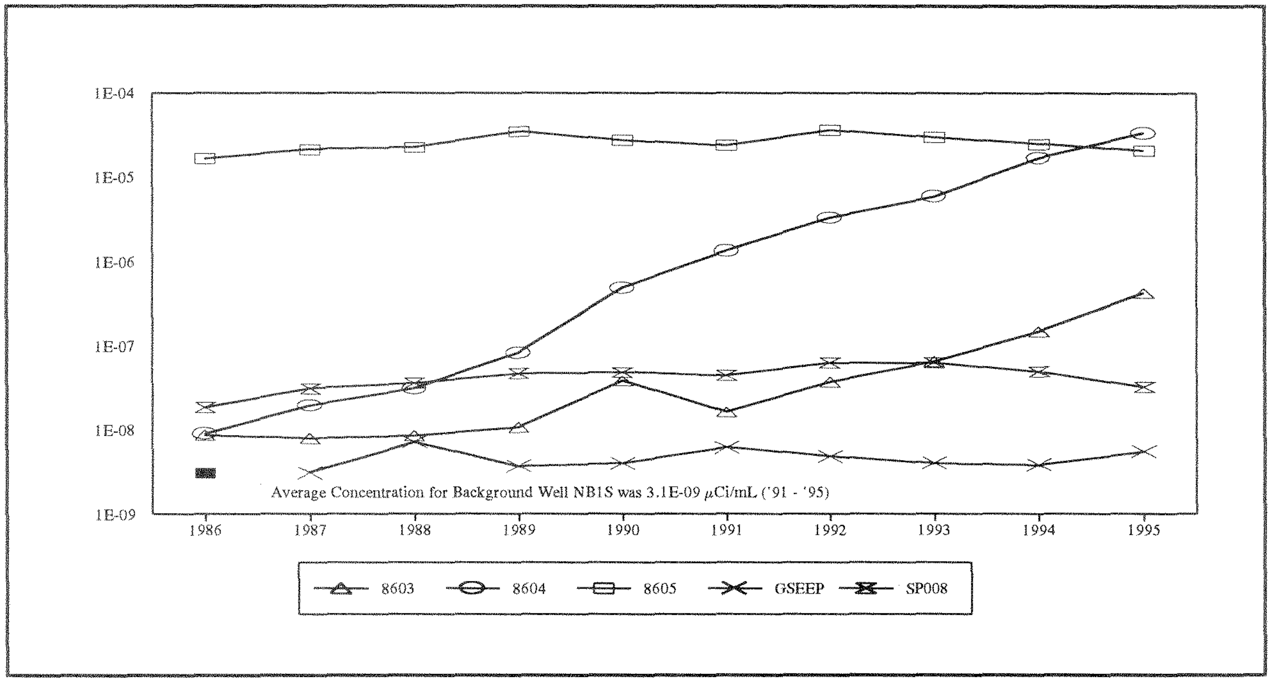


Figure 3-42. Ten-Year Trends of Averaged Gross Beta Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

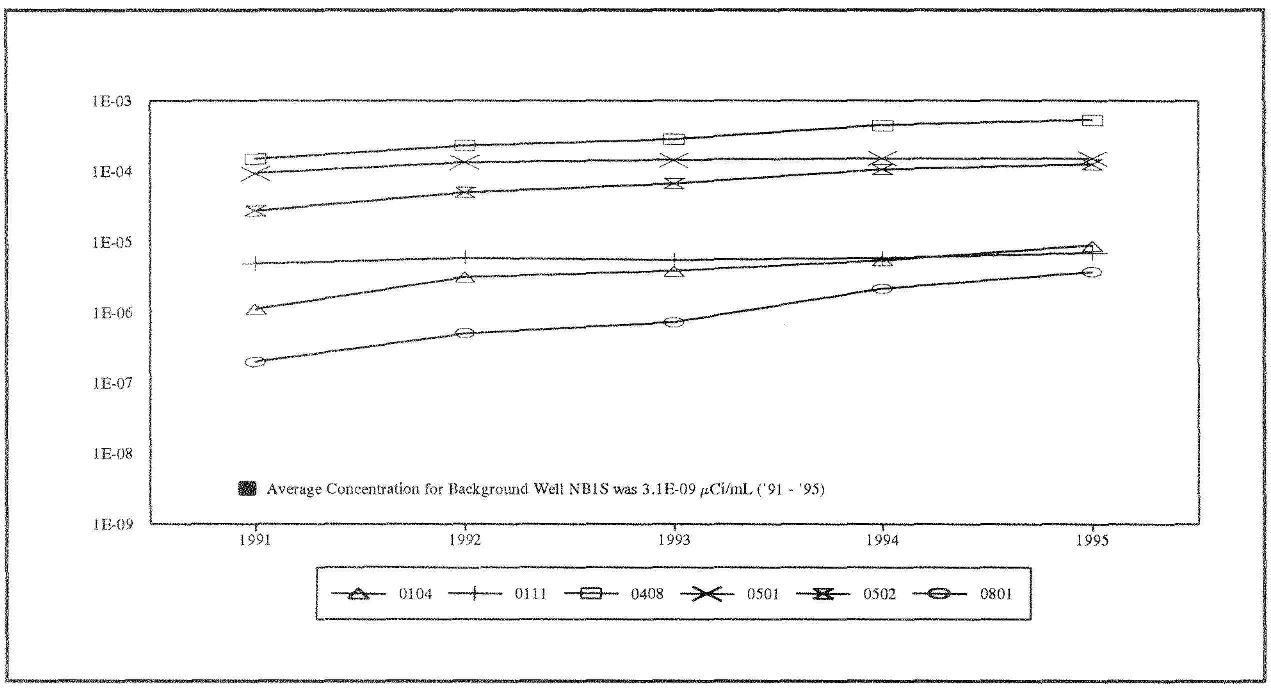


Figure 3-42a. Five-Year Trends of Gross Beta Activity (µCi/mL) at Selected Locations in the Sand and Gravel Unit

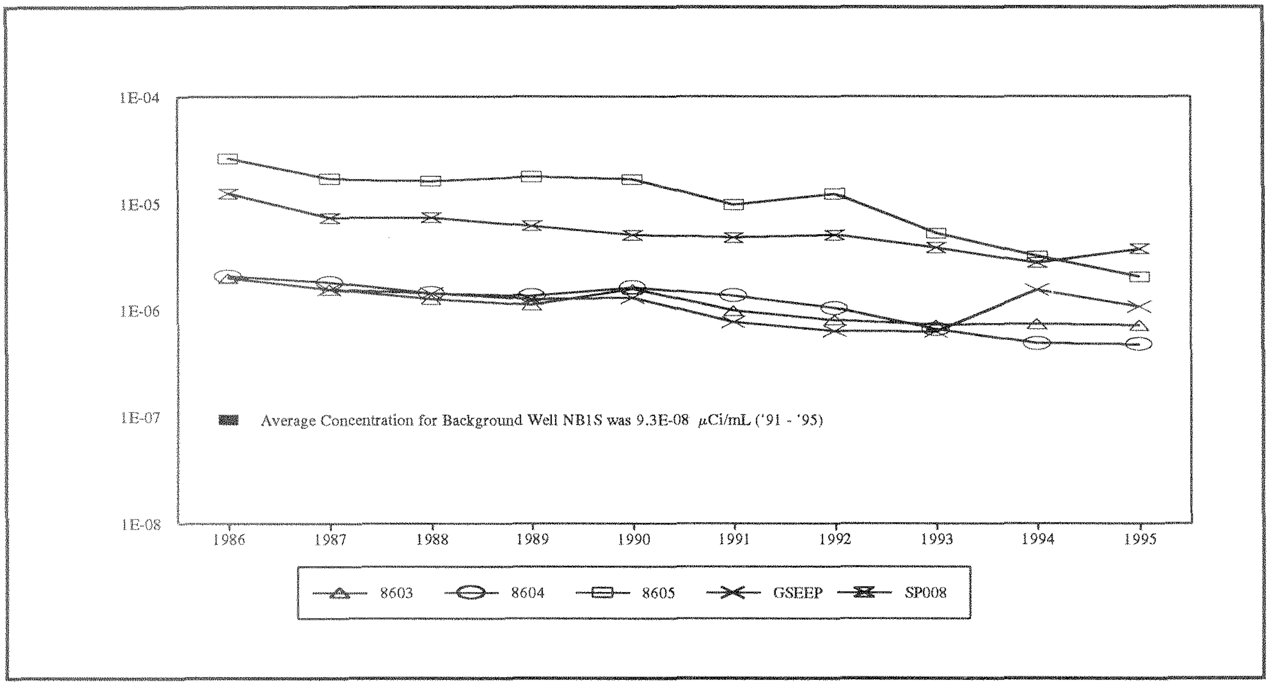


Figure 3-43. Ten-Year Trends of Averaged Tritium Activity (μCi/mL) at Selected Locations in the Sand and Gravel Unit

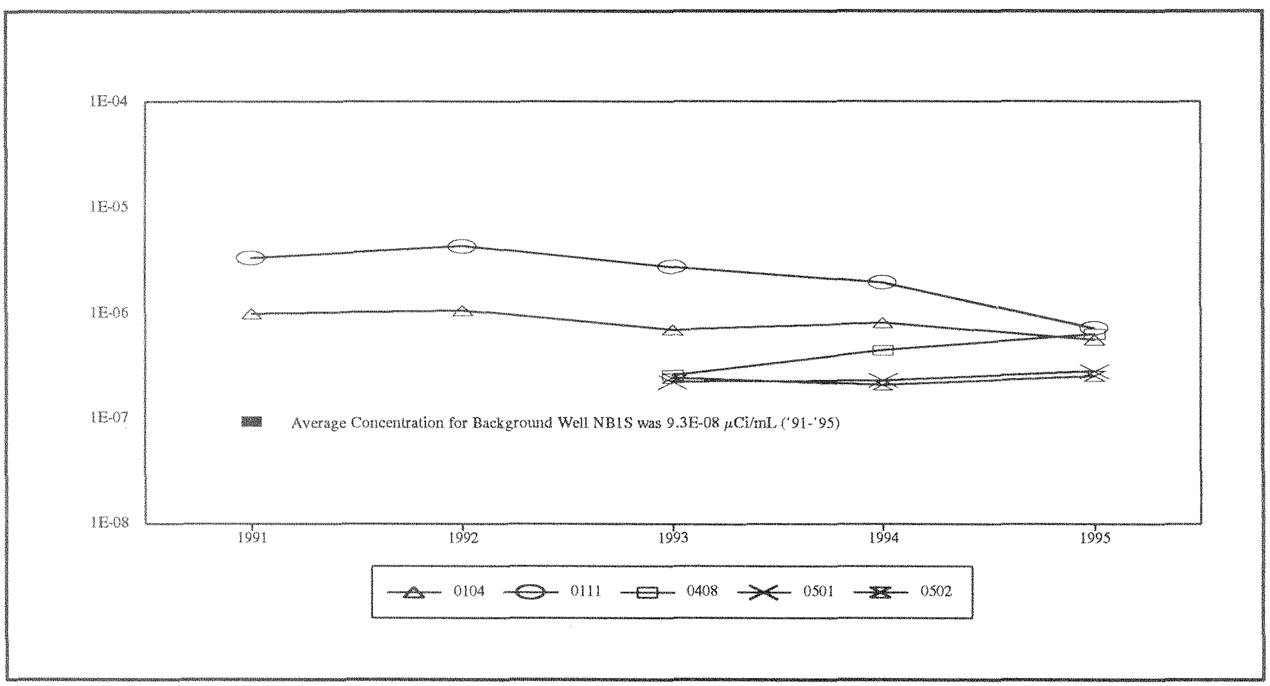


Figure 3-43a. Five-Year Trends of Tritium Activity (μCi/mL) at Selected Locations in the Sand and Gravel Unit

RADIOLOGICAL DOSE ASSESSMENT

Each year the potential radiological dose to the public that is attributable to operations and effluents from the West Valley Demonstration Project (the WVDP or Project) 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.

Introduction

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 1995.

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 1995 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.

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 lead-207 isotope remains. Radionuclides with lower atomic numbers most often have no more than one daughter. For example, strontium-90 has one radioactive daughter, yttrium-90, which finally decays into stable zirconium, and cobalt-60 decays directly to stable nickel.

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: a 1.0-millicurie source of cesium-137 measured in 1995 was 2.0 millicuries in 1965 and will be 0.5 millicuries in 2025.

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 skin layer of the body from the outside to deliver a whole body dose or expose 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 risk. 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.

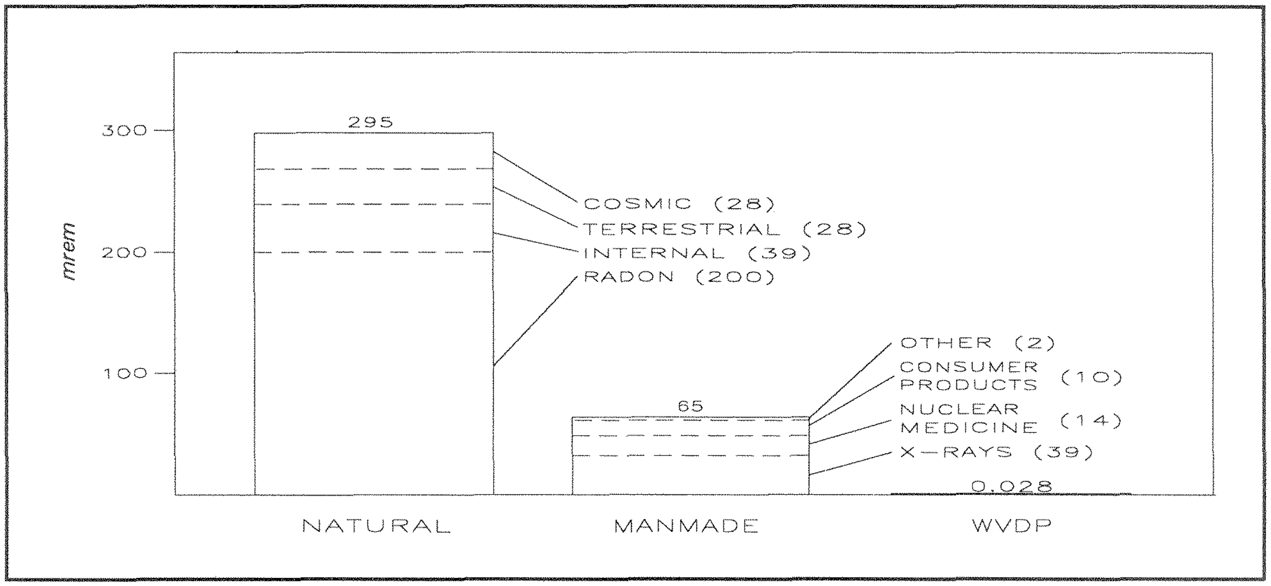


Figure 4-1. Comparison of Annual Background Radiation Dose to the Dose from 1995 WVDP Effluents

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 is calculated by adding the dose equivalent from external, penetrating radiation to the CEDE. 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 shows the relative contribution to the annual dose in millirem from these sources in comparison to the estimated 1995 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 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. The WVDP contributes a very small amount (0.028 mrem [0.00028 mSv] per year) 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 insignificantly small compared to the federal 100 mrem standard or the approximately 300 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, 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 annually 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 based on surveys of drinking water usage by the local population surrounding and residing downstream of the WVDP site. Table 4-1 summarizes the potential exposure pathways for the general off-site population.

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 air and liquid discharges from the Project. (See *Appendix C-1 and C-2.*) 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 local population. 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. Although these measurements of environmental media are relatively imprecise (because the concentrations of radioactivity are so small and usually are near the analytical detection limits), they can provide

Table 4 - 1

Potential Exposure Pathways under Existing WVDP Conditions

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

additional assurance that operations at the WVDP are not adversely affecting the public.

Predictive Computer Modeling

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 were 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 were calculated using models that have been approved by the DOE and the EPA to demonstrate compliance with radiation standards.

Radiological dose was 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 were then summed to obtain the total dose estimates reported in Table 4-2.

Because these calculated doses already include contributions from all environmental pathways and media, estimates of potential doses from ingestion of specific environmental media (e.g., fish, milk) that contain statistically valid net concentrations of radionuclides are not added to the reported estimates.

Environmental Media Concentrations

Near-site and control samples of fish, milk, beef, venison, and local produce were collected and analyzed for various radionuclides, including tritium, cobalt-60, strontium-90, iodine-129, cesium-134, and cesium-137. The measured radionuclide concentrations reported in *Appendix C-3*, Tables C-3.1 through C-3.4 (pp. C3-3 through C3-8) are the basis for comparing near-site and background concentrations.

If statistically significant differences were found between near-site and background sample concentrations, the portion of the near-site sample concentration above background was used to calculate a potential maximum individual dose for comparison with dose limit standards and background. If no significant differences in concentrations were found, then no further assessment was conducted.

The maximum potential dose to nearby residents from the consumption of foods with radionuclide concentrations above background concentrations was 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 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 1988).

Airborne Releases

Releases of airborne radioactive materials from nominal 10-meter stacks and from the main 60-meter stack were 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 were used as input parameters. Resulting output from the CAP88-PC code was then used to determine the total EDE to a maximally exposed individual and the collective dose to the local population within an 80-kilometer (50-mi) radius of the WVDP.

Table 4 - 2

Summary of Annual Effective Dose Equivalents to an Individual and Population from WVDP Releases in 1995

Exposure Pathway	*Annual Effective Dose Equivalent*	
	Maximally Exposed Off-Site Individual [1] *mrem (mSv)*	*Collective Effective Dose Equivalent* [2] *person-rem (person-Sv)*
Airborne Releases [3]	***4.3E-04 (4.3E-06)***	***8.6E-03 (8.6E-05)***
% EPA Standard (10 mrem)	*4.3E-03%*	*N/A*
Waterborne Releases [4]		
Effluents Only	*7.3E-03 (7.3E-05)*	*1.3E-02 (1.3E-04)*
Effluents plus North Plateau Drainage	*2.8E-02 (2.8E-04)*	*9.4E-02 (9.4E-04)*
Total from All Pathways	***2.8E-02 (2.8E-04)***	***1.0E-01 (1.0E-03)***
% DOE Standard (100 mrem) – Air and Water Combined	*2.8E-02%*	*N/A*
% Natural Background (300 mrem; 390,000 person-rem) – Air and Water Combined	*9.3E-03%*	*2.6E-05%*

[1] *Maximum exposure to air discharges occurs at a residence 1.9 kilometers north-northwest from the main plant.*

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

[3] *From permanent point sources. Calculated using AIRDOS-EPA (CAP88-PC for individual and population).*

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

Exponents are expressed as "E" in this report; a value given as $1.2x10^{-4}$ in scientific notation is reported as 1.2E-04 in the text and tables.

N/A - Not applicable. Numerical regulatory standards are not set for the collective EDE to the population.

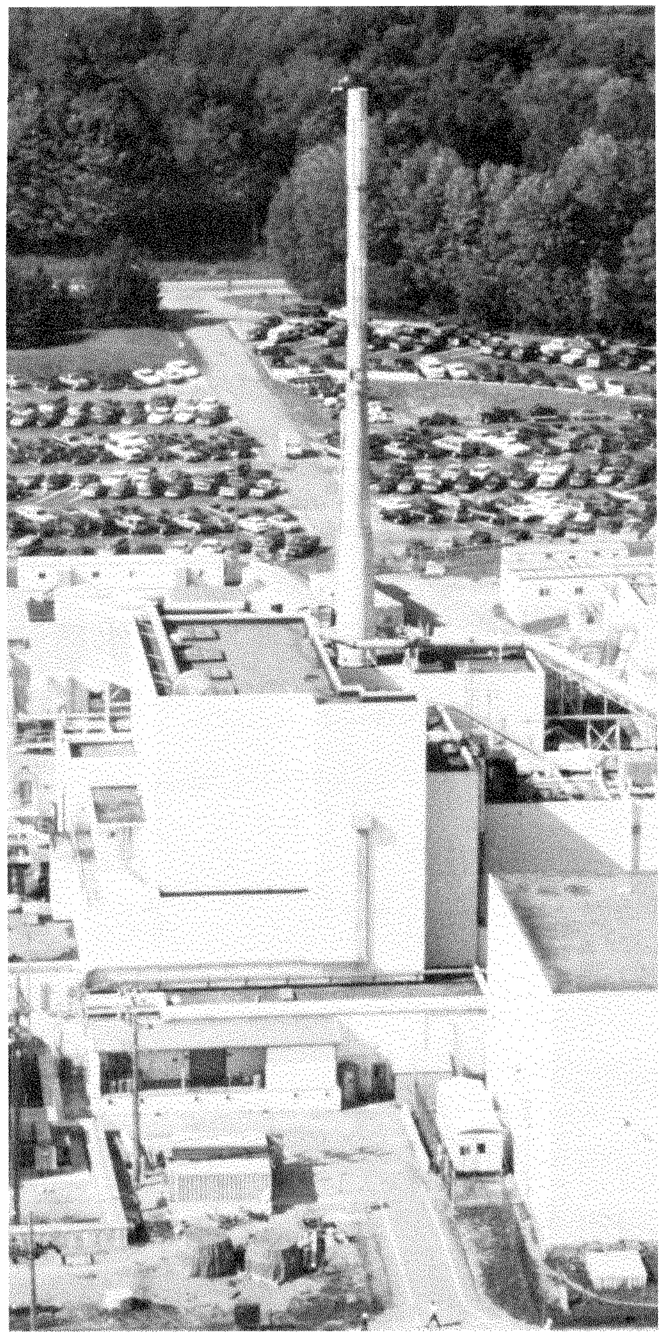
As reported in *Chapter 2, Environmental Monitoring*, four 10-meter stacks were monitored for radioactive air emissions during 1995. The main plant stack, which vents to the atmosphere at a height of 63 meters (208 ft), was considered an elevated release; all other releases were considered ground-level releases. The activity that was released to the atmosphere from these stacks is listed in Tables C-2.1 through C-2.8 in *Appendix C-2* (pp. C2-3 through C2-9) and was used as input to the CAP88-PC code.

Wind data collected from the on-site meteorological tower during 1995 were used as input to the CAP88-PC code. Data collected at the 60-meter and 10-meter heights were used in combination with elevated and ground-level effluent release data, respectively.

Waterborne Releases

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 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 annually consume 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).

Five planned batch releases of liquid radioactive effluents from lagoon 3 occurred during 1995.



The Main Plant Ventilation Stack at the West Valley Demonstration Project

The radioactivity that was discharged in these effluents is listed in *Appendix C-1*, Table C-1.1 (p. C1-3) 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 radioactivities from the sewage treatment facility and french drain are presented in *Appendix C-1*, Tables C-1.5 and C-1.6 (p. C1-7).

In addition to the above discharges there are two natural drainage channels originating on the Project premises for which there are measurable amounts of radioactivity. These are drainages from the north swamp (WNSW74A) and northeast swamp (WNSWAMP). The measured radioactivity from these points is reported in *Appendix C-1* (Tables C-1.7 and C-1.8 [pp. C1-8 and C1-9]). These release points are included in the EDE calculations for the maximally exposed off-site individual and the collective population.

Environmental Media Concentrations

Radionuclide concentrations in samples of fish, milk, beef, venison, and local crops were assessed to determine if near-site concentrations were statistically above concentrations for corresponding background (control) samples.

Fish

Muscle tissue from fish collected from June 1995 through November 1995 in Cattaraugus Creek upstream (background samples) and downstream of the site above and below the Springville dam was analyzed. Twenty tissue samples were collected both at background locations upstream of the site and at locations downstream of the site above the Springville dam. Ten tissue samples were collected at points downstream of the site below the dam. All samples were analyzed for strontium-90 and gamma-emitting radionuclides and the values compared to background. (See Table C-3.4 [p. C3-6].)

Values for cesium-134 were below detection limits or were statistically the same as background concentrations for all fish samples downstream of the site. Median strontium-90 and cesium-137 concentrations in fish collected at the first point of public access downstream of the WVDP and above the Springville dam appeared to be slightly above strontium-90 and cesium-137 concentrations in upstream background fish. The hypothetical maximum dose to an individual from eating 21 kilograms (46 lbs) of fish from this downstream point is only 1.3E-02 mrem. This is roughly equivalent to the dose received every hour from natural background radiation.

Although concentrations in fish samples downstream of the WVDP are marginally different from background samples collected in 1995, there is no evidence of an upward trend. To determine if this difference in downstream fish observed in 1995 is a result of normal statistical variation, these data are being subjected to a more comprehensive long-term statistical evaluation.

Milk

Milk samples were collected from various nearby dairy farms throughout 1995. Control samples were collected from farms 25-30 kilometers (15-20 mi) to the south and north of the WVDP. Milk samples were measured for tritium, strontium-90, iodine-129, cesium-134, cesium-137, and potassium-40. (See Table C-3.1 [p. C3-3].) Ten near-site milk samples were collected and compared with eight background samples. Radionuclide concentrations in routine milk samples from near-site locations were all below detection limits or statistically the same as background concentrations.

Beef

Near-site and control samples of locally raised beef were collected in 1995. These samples were measured for tritium, strontium-90, and gamma-emitting radionuclides such as cesium-134 and cesium-137. Two samples of beef muscle tissue were collected from background locations and two from near-site locations. Individual concentrations of strontium-90, cesium-137, and cesium-134 were below detection limits in near-site samples. (See Table C-3.2 [p. C3-4].) Strontium-90 concentrations in one near-site sample were above detection limits but were not statistically different from background.

Venison

Meat samples from three near-site and three control deer were collected in 1995. (See Table C-3.2 [p. C3-4].) These samples were measured for tritium, strontium-90, cesium-134, cesium-137, and other gamma-emitting radionuclides. Tritium, strontium-90, cesium-137, and cesium-134 concentrations for background and near-site samples were statistically identical.

Produce (hay, corn, beans, and apples)

Near-site and background samples of hay, corn, beans, and apples were collected during 1995 and analyzed for tritium, cobalt-60, strontium-90, potassium-40, and cesium-137. (See Table C-3.3 [p. C3-5].) Single samples of each type of produce were collected and compared with single background sample results. All radionuclides were below detection limits, statistically the same as historical background concentrations, or within the range of values observed at other biological media background locations. See *Appendix A* (pp. A-39 through A-42) for the locations from which background biological samples are collected.

Predicted Dose from Airborne Emissions

Applicable Standards

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 (0.01 mSv) EDE to any member of the public in any year.

Maximum Dose to an Off-site Resident

Based on the airborne radioactivity released from the permitted point sources at the site during 1995, it was estimated that a person living in the vicinity of the WVDP could have received a total EDE of 4.3E-04 mrem (4.3E-06 mSv). This maximally exposed off-site individual is located at 1.9 kilometers north-northwest of the site and eats only locally produced foods.

The maximum potential total dose to an off-site resident was also assessed by individual exposure pathways.

The maximum total EDE of 4.3E-04 mrem (4.3E-06 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 less than one minute of natural background radiation received by an average member of the U.S. population and is well below the 10 mrem (0.01 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 popu-

Collecting Baseline Air Effluent Samples from the Vitrification Facility

lation. According to census projections for 1995, an estimated 1.3 million people resided within 80 kilometers (50 mi) of the WVDP. This population received an estimated 8.6E-03 person-rem (8.6E-05 person-Sv) total EDE from radioactive airborne effluents released from the permitted WVDP point sources during 1995. The resulting average EDE per individual was 6.6E-06 mrem (6.6E-08 mSv).

Predicted Dose from Waterborne Releases

Applicable Standards

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 radiation exposure 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 relevant (although the values in creek samples are well below the EPA drinking water limits). The estimated radiation dose was compared with the applicable guidelines provided in DOE Order 5400.5.

Maximum Dose to an Off-site Individual

Based on the radioactivity in effluents released from the WVDP (lagoon 3, sewage treatment plant, and french drain) during 1995, an off-site individual could have received a potential maximum EDE of 7.3E-03 mrem (7.3E-05 mSv). Approximately 72% of this dose is from cesium-

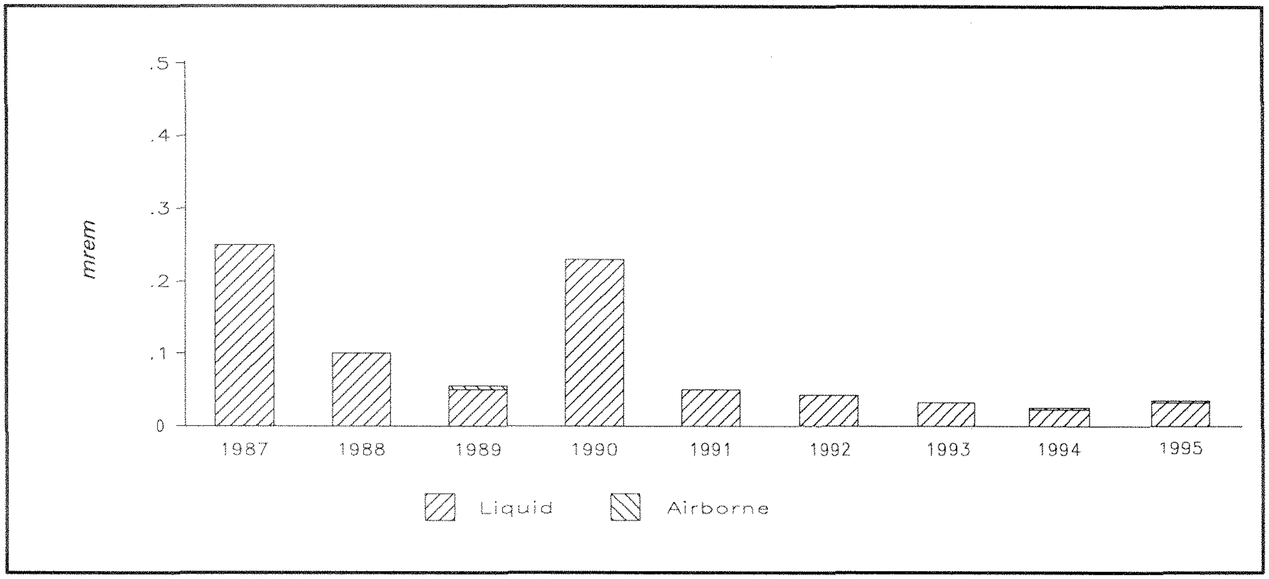


Figure 4-2. Effective Dose Equivalent from Liquid and Airborne Effluents to a Maximally Exposed Individual Residing near the WVDP

137 and 21% from strontium-90. This dose of 0.0073 mrem (0.000073 mSv) is negligible in comparison to the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation. The maximum individual EDE due to natural drainage from the north plateau (north swamp and northeast swamp) is 2.1E-02 mrem (2.1E-04 mSv). (See Table C-1.7 [p. C1-8].) The combined EDE to the maximally exposed individual from liquid effluents is 2.8E-02 mrem (2.8E-04 mSv). This dose of 0.028 mrem (0.000028 mSv) is negligible in comparison to the 300 mrem (3 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 treatment plant, and french drain) during 1995, the population living within 80 kilometers (50 mi) of the site received a collective EDE of 1.3E-02 person-rem (1.3E-04 person-Sv). The collective dose to the population from the natural outfalls (north swamp and northeast swamp) is 8.1E-02 person-rem (8.1E-04 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 7.2E-05 mrem (7.2E-07 mSv). This dose of 0.000072 mrem (0.00000072 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 1995 is the sum of the individual dose contributions. The hypothetical maximum EDE from all pathways to a nearby resident was 2.8E-02 mrem (2.8E-04 mSv). This dose is 0.03% of the 100 mrem (1 mSv) annual limit in DOE Order 5400.5.

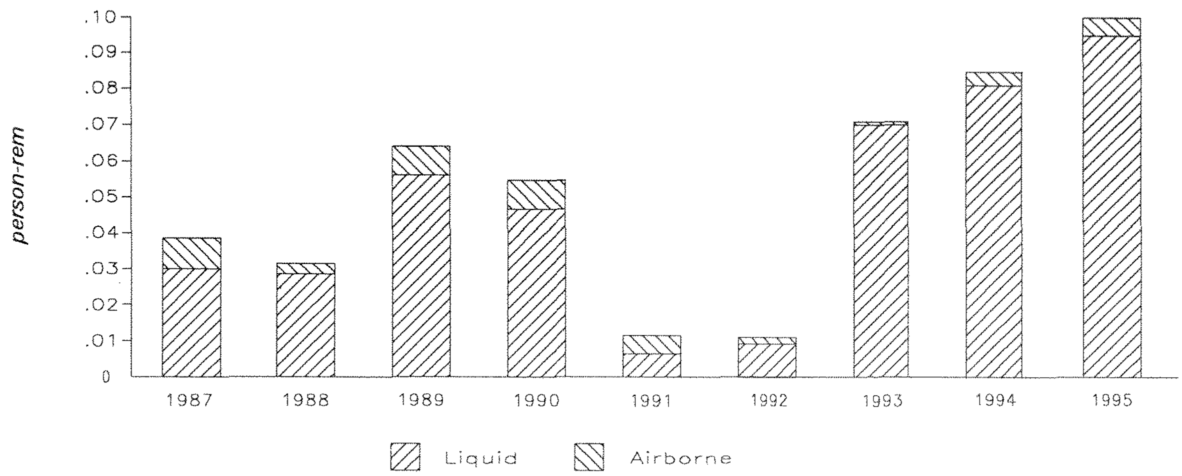


Figure 4-3. Collective Effective Dose Equivalent from Liquid and Airborne Effluents to the Population Residing within 80 Kilometers of the WVDP

The total collective EDE to the population within 80 kilometers (50 mi) of the site was 1.0E-01 person-rem (1.0E-03 person-Sv), with an average EDE of 7.9E-05 mrem (7.9E-07 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 shows the dose to the maximally exposed individual over the last nine years. The estimated dose for 1995 is about the same as the dose reported in previous years.

Figure 4-3 shows the collective dose to the population over the last nine years. Although an upward trend results from increased project liquid releases over the last several years, the dose for 1995 is about the same as the dose for 1994.

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 unplanned releases (as defined by DOE Order 5400.1) of air or liquid effluent in 1995.

Risk Assessment

Estimates of cancer risk from ionizing radiation have been presented recently 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 1.0E-04 to 5.0E-04 cancer fatalities/rem. The most recent risk coefficient of 5.0E-04 (International Commission on Radiological Protection) 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 1.4E-08 probability of a cancer fatality (1 chance in 70 million). This risk is well below the range of 1E-06 to 1E-05 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 was performed for airborne and waterborne releases. This analysis resulted in estimated doses to the hypothetical maximally exposed individual that were orders of magnitude below all applicable EPA standards and DOE Orders, which limit the release of radioactive materials and dose to individual members of the public. The collective population dose was also 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 radiological guidelines and standards during 1995.

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 Co., Inc. (WVNS) Quality Assurance is responsible for monitoring the quality of site activities, including the environmental monitoring program. 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 program for environmental monitoring activities at the Western New York Nuclear Service Center (WNYNSC) is consistent with 10 CFR 830.120, Quality Assurance, and the WVDP's Environmental Quality Assurance Plan (West Valley Nuclear Services 1994) and is based directly upon the eighteen-element program outlined in Quality Assurance Program Requirements for Nuclear Facilities (American Society of Mechanical Engineers 1989), which describes the major aspects of a good quality assurance program. The program focuses upon assigning responsibilities and upon thorough planning, specification, control, and documentation of all aspects of an activity:

√ *Responsibility.* Responsibilities involved in overseeing, managing, and conducting an activity must be clearly defined. Personnel who check and 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. Any 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 must be kept of all activities 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 self-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 WVNS requirements with respect to the above elements.

Procedures

Activities affecting 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 is consistent and repeatable; it is a means of tracking down possible sources of error. For example, 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 ensure sample integrity.

Samples are collected into appropriate containers and labeled immediately with 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. If necessary, samples are preserved as soon as possible after collection.

In order to monitor 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 from the containers, coolers, or from handling during collection, storage, or shipping. Trip blanks are collected 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. Samples that are clearly outside site influence show natural 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 12,000 samples were handled as part of site monitoring in 1995. 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 between WVNS and the subcontract laboratories. 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. Laboratory quality control consists of proper training of analysts, maintenance and calibration of measuring equipment and instrumentation, and specific methods of processing samples 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 a known concentration of an analyte of interest such as a pH buffer or a plutonium-239 counting standard. Standards 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, or one per day. 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 deemed usable.

Laboratory 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.

Laboratory 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, serves 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:

1) to determine if contamination is present in the counting instrument

2) to determine if the instrument is responding in an acceptable manner

3) to determine the background correction that should be applied in calculations of radiological activity.

An instrument background count is taken before each day's counting. Background counts are recorded on control charts with defined acceptance limits. An unacceptable count requires corrective action before analyses can proceed.

Laboratory 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 Characterization Research Division (NERL-CRD), formerly the Environmental Monitoring Systems Laboratory (EMSL). Crosscheck samples for radiological analyses are analyzed by both the Environmental Laboratory on-site and by the subcontract laboratories.

Results from radiological crosschecks are summarized in *Appendix D*, Tables D-1 through D-3 (pp. D-1 through D-6). A total of 141 radiological crosscheck analyses were performed by or for WVNS and reported in 1995. One hundred thirty-five results (95.7%) were within control limits. Forty-six of the results were produced by the on-site Environmental Laboratory; 97.8% were within control limits. Out-of-control results were followed up through formal corrective action procedures.

No nonradiological crosschecks were performed by WVNS in 1995.

By contract, 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.

WVDP environmental thermoluminescent dosimeters (TLDs) were analyzed by WVNS for the first three quarters of 1995. Analysis was transferred to the independent off-site subcontractor for the final three quarters of 1995, allowing two quarters of overlap. Table D-4 (p. D-7) summarizes environmental TLD analytical results from WVNS and the off-site subcontractor compared to results from U.S. Nuclear Regulatory Commission (NRC) TLDs placed in the same locations but collected and analyzed by the NRC. Although not a formal crosscheck, the agreement of these sets of results demonstrates the precision of these measurements and substantiates confidence in results from the remainder of the environmental TLD locations.

Personnel Training

Anyone performing environmental monitoring program activities must be 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 lock-up before analysis or shipping.

Samples sent off-site for analysis are accompanied by an additional chain-of-custody/analytical request form. Signature control must be maintained by the agent transporting the samples. Subcontract laboratories are required by contract to maintain internal chain-of-custody records and to store the samples under secure conditions.

Audits and Appraisals

WVNS Quality Assurance conducted several surveillances in 1995 of various aspects of specific environmental programs at the WVDP, comparing them with requirements of the WVDP Environmental Quality Assurance Plan (WVDP-099). The environmental monitoring program, which was included in the scope of the surveillances, met the requirements of WVDP-099.

The NRC visited the WVDP site in June 1995 in order to assess the status of WVNS' program for the operation of the vitrification facility. As a result of this review it was determined that a viable program for protecting public health and safety was in place. The NRC included five recommendations for program enhancement in their report.

Later in 1995 WVNS Project Appraisals assessed environmental monitoring program compliance with DOE Orders. This assessment was part of the line-management self-assessment supporting the operational readiness review and included environmental monitoring. Project Appraisals reported one observation and one noteworthy practice. (For more information on site audits and assessments see the *Environmental Compliance Summary: Calendar Year 1995* [p. lviii].)

Self-Assessments

Areas of inquiry from two prescheduled self-assessments were combined into one self-assessment of the environmental monitoring program, conducted in calendar year 1995. In the course of the self-assessment, three observations were noted. Deficiencies have been 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 the self-assessment that would compromise data in this report or in the program in general.

Data Management and Data Validation

Information on environmental monitoring program samples is maintained and tracked in the LIMS and includes collection, chain-of-custody transfer, shipping information, analytical results, and final validation status.

All analytical data produced in the Environmental Laboratory at the bench level must be 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.

All software used to generate data is subjected to verification and validation before use.

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.

The data are then evaluated and reports are prepared. Before each technical report can be issued it must undergo a peer review in which the document, including the data, is comprehensively reviewed by one or more persons who are knowledgeable in the necessary field of work.

The multiple levels of scrutiny built into data generation, validation, and reporting ensure that reliable and accurate data are reported from the environmental monitoring program.

Data Reporting

Radiological measurements require that analytical or instrumental background counts be subtracted from sample counts to obtain net values. If background counts are equal to or greater than the sample count, an individual sample result can be zero or negative. Therefore, sometimes a result will be lower than the minimum detection limit of an analytical technique.

Although a negative value does not represent a physical reality, a reliable long-term average of many measurements can be obtained only if the very small and negative values are included in the population calculations.

For individual measurements, uncertainties are reported as two times the standard deviation, which approximates a 95% confidence level or interval around the measurement. (See also "confidence coefficient" in the *Glossary*.) Positive means for which the 95% confidence interval does not include zero may be assumed to indicate detectable amounts of activity.

Averages from measurements from a particular sampling location are calculated by taking a simple arithmetic mean. What is not so clear, even as a professional consensus, is how to represent the uncertainty associated with an average from data collected from a given sample point throughout a set period of time, such as weekly samples collected over a year.

One method in use by other facilities is to represent an average of a set of samples by using an arithmetic mean of the central values and then using the standard error of the mean to represent the range of variation in the sample values alone. This method does not consider the relative value of the uncertainties associated with the measurements.

Thus, in situations where the analytical results of a group of samples are near the minimum detectable concentration and may all include zero within their confidence interval, the 95% confidence interval for the mean may not include zero; therefore, the average may appear to be statistically greater than zero even though it is doubtful that any individual sample contained detectable radioactivity.

In this report we have opted to express the confidence interval of the average of repeated independent samples collected at a sample location periodically over the year by pooling the error terms from the individual measurements going into the average, given that the standard deviations of the samples are relatively comparable. In this manner, we are expressing a reasonable and representative estimate of the uncertainty term for the (annual, monthly) average value, as follows:

$$e_m = \frac{\sqrt{e_1^2 + e_2^2 + \ldots + e_n^2}}{\sqrt{n}}$$

where e_1 through e_n represent the confidence interval or error terms for each of *n* measurements, and e_m equals the confidence interval for the mean.

In previous years samples for which the confidence interval was larger than the result were reported with "less than" values. This year, to allow the readers to perform similar calculations with data groups, as has been the past practice of the report preparers, the actual calculated value, whether positive, negative, or zero, is being reported. The associated confidence interval will be expressed as e_m, above.

Appendix A

1995 Environmental Monitoring Program

The WVDP Supports a Bluebird and Wood Duck Nesting-box Program
Sponsored by the Springville Field and Stream Club

1995 Environmental Monitoring Program

The following schedule represents the West Valley Demonstration Project (WVDP) routine environmental monitoring program for 1995. This schedule met or exceeded the minimum program specifications needed to satisfy the requirements of DOE Order 5400.1. It also met requirements of DOE 5400.5 and DOE/EH-0173T. Specific methods and recommended monitoring program elements are found in DOE/EP-0096, *Effluent Monitoring*, and DOE/EP-0023, *Environmental Surveillance*, which were the bases for selecting most of the schedule specifics. Additional monitoring was mandated by operational safety requirements (OSRs) and air and water discharge permits (40 CFR 61 and SPDES), which also required formal reports. Specifics are identified in the schedule under MONITORING/REPORTING REQUIREMENTS.

Beginning in 1995, results from all locations except groundwater monitoring points were summarized in the Quarterly Environmental Monitoring Data Reports (QEMDRs). Groundwater monitoring data are summarized in quarterly groundwater monitoring results reports. A computerized environmental data-screening system implemented in 1995 identifies analytical data exceeding pre-set trigger limits. All locations were checked monthly for trends or noticeable results in accordance with criteria established in *Documentation* and *Reporting of Environmental Monitoring Data* (West Valley Nuclear Services Co., Inc. April 13, 1995). Reportable results were then described in the Monthly Trend Analysis Report (MTAR) together with possible causes and corrective actions, if indicated. A WVDP Effluent Summary Report (WESR) is transmitted with each MTAR.

Schedule of Environmental Sampling

The following table is a schedule of environmental sampling at the WVDP. Locations of the sampling points are shown in Figures A-1 through A-9. The index on pp. A-vi through A-ix is a list of the codes for various sample locations. Table headings in the schedule are as follows:

- ***Sample Location Code*** - The physical location where the sample is collected is described. The code consists of seven characters: The first character identifies the sample medium as **A**ir, **W**ater, **S**oil/Sediment, **B**iological, or **D**irect Measurement. The second character specifies o**N**-site or o**F**f-site. The remaining characters describe the specific location (e.g., **AFGRVAL** is **A**ir **OF**f-site at **GR**eat **VAL**ley).

- ***Monitoring/Reporting Requirements*** - The bases for monitoring that location, any additional references to permits or OSRs, and the reports generated from sample data are noted. Routine reports cited in Appendix A are the WVDP Effluent Summary Report (WESR), the Monthly Trend Analysis Report (MTAR), the Quarterly Environmental Monitoring Data Report (QEMDR), the On-site Discharge Report (ODIS), and the annual Site Environmental Report (SER).

- ***Sampling Type/Medium*** - Describes the collection method and the physical characteristics of the medium.

- ***Collection Frequency*** - Indicates how often the samples are collected or retrieved.

- ***Total Annual Sample Collections*** - Specifies the number of discrete physical samples collected annually for each group of analytes.

- ***Analyses Performed/Composite Frequency*** - Type of analyses of the samples taken at each collection event, the frequency of composite, and the analytes determined for the composite samples are noted.

Summary of Monitoring Program Changes for 1995

Location Code	*Description of Changes*
ANVITSK **ANSEISK**	Vitrification stack sampler and seismic sampler. Brought on-line November 1, 1995.
ANCSSTK	System formerly monitoring the cement solidification system ventilation stack was reinstalled at a different area in the same building for monitoring 01-14 building ventilation at the same stack location.
ANLAUNV	Monitoring frequency changed from weekly to monthly.
ANLAGAM **ANNDAAM**	Ambient diffuse-source air samplers added to the monitoring program in 1995.
ANSDAT9	Analytes and sampling frequency as specified by NYSERDA.
AFDNKRK **AFNASHV** **SFNASHV**	**AFDNKRK** background sampler removed from program because of siting-access restrictions. New background sampler **AFNASHV** brought on-line in July 1995.
DFTLD #37	Off-site background TLD location, formerly at Dunkirk air sampler, relocated to new Nashville location.
WNSP001	Total manganese and dissolved sulfide added to monitoring program per SPDES permit modification effective November 1, 1994.
WNSP006	Technetium-99 (Tc-99) added to assess concentrations at the point where liquid streams leave the site.
WFBCTCB **WFBCBKG**	Sampling frequency upgraded from biweekly to weekly for comparability with other surface water monitoring locations. Conductivity and Tc-99 added at **WFBCBKG** for comparison to liquid effluent discharge points. Conductivity added at **WFBCTCB** to reflect sampling protocol at other surface water points.
BFMHAUR **BFMSCHT**	Milk collection dropped from **BFMHAUR** because the dairy is no longer a commercial source of milk. This monitoring location was replaced by **BFMSCHT**, another near-site farm.

Summary of Monitoring Program Changes for 1995

Location Code	*Description of Changes*
Groundwater Monitoring Points	Program reviewed and sampling frequency and analytes tailored to address constituents of concern.
SF Soil Series and On-site Soils	Gross alpha/beta analysis added.
Sediments	Collection frequency changed from semiannual to annual.

Index of Environmental Monitoring Program Sample Points

* *Not detailed on map.*

Index of Environmental Monitoring Program Sample Points (continued)

** Not detailed on map.*

Index of Environmental Monitoring Program Sample Points (concluded)

1995 Monitoring Program
On-site Effluent Monitoring:

Air Effluents

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
ANSTACK Main Plant Ventilation Exhaust Stack **ANSTSTK** Supernatant Treatment System (STS) Ventilation Exhaust **ANCSSTK** 01-14 Building (Formerly Cement Solidification System (CSS)) Ventilation Exhaust **ANCSRFK** Contact Size-reduction Facility Exhaust **ANVITSK**** Vitrification HVAC Exhaust	Airborne radioactive effluent points, including LWTS and vitrification off-gas <u>Required by</u>: • OSR-GP-1 • 40 CFR 61 <u>Reported in</u>: • WESR • MTAR • QEMDR • ODIS • SER • Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate monitors →	Continuous measurement of fixed filter, replaced weekly →	N/A →	Real-time alpha and beta monitoring
		Continuous off-line air particulate filters →	Weekly →	52 each location →	Gross alpha/beta, gamma isotopic*
				Weekly filters composited to 4 each location →	Quarterly composite for Sr-90, Pu/U isotopic, total U, Am-241, gamma isotopic
		Continuous off-line desiccant columns for water vapor collection →	Weekly →	52 each at two locations →	H-3 (**ANSTACK** and **ANSTSTK** only)
		Continuous off-line charcoal cartridges →	Weekly →	Weekly cartridges composited to 4 each location →	Quarterly composite for I-129
ANSEISK** Seismic Sampler, Vitrification Backup	Airborne radioactive effluent point <u>Required by</u>: • OSR-GP-1 • 40 CFR 61 <u>Reported in</u>: • WESR • MTAR • QEMDR • ODIS • SER • Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate filter →	Weekly →	52 →	Filters for gross alpha/beta, gamma isotopic* upon collection

* Weekly gamma isotopic only if gross activity rises significantly.
** Samplers brought on line with cold operations in 1995.

	Sampling Rationale
ANSTACK	DOE/EH-0173T, 3.0; OSR-GP-1, 1.A, 2.B; and DOE/EP-0096, 3.3. Monitors and samples HEPA-filtered ventilation from most process areas, including cell ventilation, vessel off-gas, FRS and head end ventilation, analytical area. Requires continuous effluent monitoring per Subpart H, Section 61.93(b) because potential emissions may exceed 0.1 mrem limit.
ANSTSTK	DOE/EH-0173T, 3.0; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3. Monitors and samples HEPA-filtered ventilation from building areas involved in treatment of high-level waste supernatant. Requires continuous effluent monitoring per Subpart H, Section 61.93(b) because potential emissions may exceed 0.1 mrem limit.
ANCSSTK	DOE/EH-0173T, 3.0; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3. Monitors and samples HEPA-filtered ventilation from 01-14 building, which houses equipment used to treat ceramic melter off-gas. Requires continuous effluent monitoring per Subpart H, Section 61.93(b) because potential emissions may exceed 0.1 mrem limit.
ANCSRFK	DOE/EH-0173T, 3.0; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3. Monitors and samples HEPA-filtered ventilation from process area where radioactive tanks, pipes, and other equipment are reduced in volume by cutting with a plasma torch.
ANVITSK	DOE/EH-0173T, 3.0; OSR-GP-1; DOE/EP-0096, 3.3. Vitrification facility heating, ventilation, and air conditioning effluent exhaust stack. Sampler expected to be brought on-line in late 1995 when cold operations began. Interim approval; permit pending.
ANSEISK	DOE/EH-0173T, 3.0; OSR-GP-1; and DOE/EP-0096, 3.3. Vitrification system back-up filter for catastrophic-event monitoring in case of primary vitrification HVAC stack failure.

1995 Monitoring Program
On-site Effluent Monitoring:

Air Effluents

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
ANSUPCV Supercompactor Exhaust	Airborne radioactive effluent point Required by: • OSR-GP-1 • 40 CFR 61 Reported in: • WESR • MTAR • QEMDR • ODIS • SER • Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate monitor during operation	→ Continuous measurement of fixed filter	→ N/A	→ Real-time beta monitoring
		Continuous off-line air particulate filter	→ Weekly	→ 52	→ Filters for gross alpha/beta, gamma isotopic* upon collection
				Collected filters composited to 4	→ Quarterly composites for Sr-90, Pu/U isotopic, total U, Am-241, gamma isotopic
OVEs/PVUs Outdoor Ventilated Enclosures/ Portable Ventilation Units	Airborne radioactive effluent points Required by: • OSR-GP-1 • 40 CFR 61 Reported in: • WESR • MTAR • QEMDR • ODIS • SER • Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate filter	→ As required	→ 1 each location	→ Filters for gross alpha/beta, gamma isotopic* upon collection
				Collected filters** composited to 4	→ Quarterly composites for Sr-90, Pu/U isotopic, total U, Am-241, gamma isotopic

* Gamma isotopic only if gross activity rises significantly.

** If, upon gross determination, individual filter is significantly higher than background, individual sample would be submitted immediately for isotopic analysis.

Sampling Rationale	
ANSUPCV	DOE/EH-0173T, 3.0; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3. Monitors and samples HEPA-filtered ventilation from area where low-level radioactive waste volume is reduced by compaction.
OVEs/PVUs	DOE/EH-0173T, 3.0; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3. Outdoor ventilated enclosures; portable ventilation units used for handling of radioactive materials or for decontamination in areas without containment ventilation.

1995 Monitoring Program
Environmental Surveillance:

Air Effluents and On-site Ambient Air

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
ANLLWTVC Low-level Waste Treatment Ventilation, "Cold" Side **ANLLWTVH** Low-level Waste Treatment Ventilation, "Hot" Side **ANLAUNV** Laundry Change Room Ventilation	Airborne radioactive effluent point Required by: • 40 CFR 61 Reported in: • WESR • MTAR • QEMDR • ODIS • SER • Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate filter →	Weekly (monthly at ANLAUNV) →	52 each location (12 at ANLAUNV) →	Filters for gross alpha/beta, gamma isotopic* upon collection
ANLAGAM** Lag Storage Area Ambient Air **ANNDAAM**** NDA Area Ambient Air	Ambient diffuse source air emissions Reported in: • MTAR • QEMDR • SER	Continuous air particulate filter →	Weekly →	52 each location →	Gross alpha/beta
				Weekly filter composited to 4 each location →	Quarterly composite for Sr-90, gamma isotopic, Pu/U isotopic, total U, Am-241
ANSDAT9*** SDA Trench 9 Ambient Air	Ambient diffuse source air emissions Reported in: • Quarterly reports to NYSDEC • MTAR • QEMDR • SER	Continuous air particulate filter →	Weekly →	52 →	Gross alpha/beta
				Weekly filter composited to 4 →	Quarterly composite for gamma isotopic
		Continuous off-line desiccant column for water vapor collection →	Weekly →	52 →	H-3
		Continuous off-line charcoal cartridges →	Monthly →	Monthly cartridges composited to 4 →	Quarterly composite for I-129

* Gamma isotopic only if gross activity rises significantly.
** Added to the monitoring program in 1995.
*** Sampling frequency and analytical parameters as directed by NYSERDA.

Sampling Rationale	
ANLLWTVC **ANLLWTVH**	DOE/EH-0173T, 3.0; and DOE/EP-0096, 3.3. Sample "cold" and "hot" sides of ventilation exhaust from low-level waste treatment facility.
ANLAUNV	DOE/EH-0173T, 3.0; and DOE/EP-0096, 3.3. Samples ventilation from contaminated clothing laundry.
ANLAGAM	DOE/EH-0173T, 3.3.2. Monitors ambient air in lag storage area, a possible diffuse source of air emissions.
ANNDAAM	DOE/EH-0173T, 3.3.2. Monitors ambient air in NDA area, a possible diffuse source of air emissions.
ANSDAT9	DOE/EH-0173T, 3.3.2. Monitors ambient air by SDA trench 9, a possible diffuse source of air emissions. WVDP support of NYSERDA.

1995 Monitoring Program
On-site Effluent Monitoring:

Liquid Effluents

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNSP001 Lagoon 3 Discharge Weir	Primary point of liquid effluent batch release Required by: • OSR-GP-2 • SPDES Permit Reported in: • Monthly SPDES DMR • WESR • MTAR • QEMDR • SER	Grab liquid →	Daily, during lagoon 3 discharge* →	40-80 →	Daily for gross beta, conductivity, flow
				7-12 →	Every 6 days a sample is analyzed for gross alpha/beta, H-3, Sr-90, gamma isotopic
				Composite of daily samples for each discharge, 4-8 →	Weighted composite for gross alpha/beta, H-3, C-14, Tc-99, Sr-90, I-129, gamma isotopic, Pu/U isotopic, total U, Am-241 for each month of discharge
		Composite liquid →	Twice during discharge, near start and near end →	8-16 →	Two 24-hour composites for BOD-5, suspended solids, SO_4, NO_3, NO_2, NH_3, total Al, Fe, and Mn, total recoverable Cd, Cr, Cu, Ni, Pb, and Zn, dissolved As and Cu, dissolved sulfide
		Grab liquid →	Twice during discharge, near start and near end →	8-16 →	Settleable solids, total dissolved solids, pH, cyanide amenable to chlorination, oil & grease, surfactant (as LAS), total recoverable Co, Cr^{+6}, Se, and V, dichlorodifluoromethane, trichlorofluoromethane, 3,3-dichlorobenzidine, tributyl phosphate, hexachlorobenzene, alpha-BHC, heptachlor, xylene, 2-butanone
		Composite liquid →	Semiannual →	2 →	A 24-hour composite for titanium
		Composite liquid →	Annual →	1 →	A 24-hour composite for Ba and Sb
		Grab liquid →	Semiannual →	2 →	Bis(2-ethylhexyl) phthalate, 4-dodecene
		Grab liquid →	Annual →	1 →	Chloroform

* Lagoon 3 is discharged between four and eight times per year, as necessary, averaging ten days per discharge.

Sampling Rationale

WNSP001 DOE 5400.5 and DOE/EH-0173T, 2.3.3.

By DOE Order all liquid effluent streams from DOE facilities shall be evaluated and their potential for release of radionuclides addressed.

New York State SPDES permit no. NY0000973.

These regulations are met for radiological parameters by daily grab sampling during periods of lagoon 3 discharge. Sampling for chemical constituents is performed near the beginning and end of each discharge period to meet the site SPDES permit. Both grab samples and 24-hour composite samples are collected.

1995 Monitoring Program
On-site Effluent Monitoring:

Liquid Effluents

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNSP006 Frank's Creek at Security Fence	Combined facility liquid discharge Required by: • OSR-GP-2 Reported in: • MTAR • QEMDR • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH, conductivity
				Weekly samples composited to 12	→ Monthly composite for gamma isotopic and Sr-90 (monthly composite shared with NYSDOH)
				Weekly samples composited to 4	→ Quarterly composite for C-14, I-129, Pu/U isotopic, total U, Am-241, Tc-99
		Grab liquid	→ Semiannual	→ 2	→ NPOC, TOX, Ca, Mg, Na, K, Ba, Mn, Fe, Cl, SO_4, NO_3+NO_2-N, F, HCO_3, CO_3
WNSP007 Sanitary Waste Discharge	Liquid effluent point for sanitary and utility plant combined discharge Required by: • SPDES Permit Reported in: • Monthly SPDES DMR • WESR • MTAR • QEMDR • ODIS • SER	24-hour composite liquid	→ 3 each month	→ 36	→ Gross alpha/beta, H-3, pH, suspended solids, NH_3, NO_2-N, BOD-5, total Fe
				Monthly samples composited to 4 quarterly samples	→ Gamma isotopic
		Grab liquid	→ 3 each month	→ 36	→ Oil & grease
		Grab liquid	→ Weekly	→ 52	→ pH, settleable solids, total residual chlorine
		Grab liquid	→ Annual	→ 1	→ Chloroform
WNSDADR SDA Trench Run-off	Surface water run-off point from SDA trench 14 cover Required by: • Interim Measures Compliance Reported in: • Quarterly reports to NYSDEC • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ pH, total suspended solids, oil & grease, flow, gross alpha/beta, H-3, gamma isotopic

Sampling Rationale

WNSP006 DOE/EH-0173T, 5.10.1.1.

By DOE Order all liquid effluent streams from DOE facilities shall be evaluated and their potential for release of radionuclides addressed.

Per WVDP SPDES Permit NY0000973, outfall 116 (pseudo monitoring point) uses flow data from WNSP006. Monitoring for flow augmentation parameters (flow and total dissolved solids [TDS]) is performed at location WNSP006; calculated TDS and flow data related to sample point WNSP006 are reported for pseudo monitoring point 116 on the monthly SPDES DMR.

WNSP007 DOE 5400.5 and DOE/EH-0173T, 2.3.3.

Sampling rationale is based on New York State SPDES permit no. NY0000973 and DOE 5400.5 criteria for discharge of radioactivity to and from the sewage treatment plant.

WNSDADR NYSERDA interim measures compliance.

WVDP support of NYSERDA.

Grab sample monitoring surface water runoff from SDA trench 14 membrane cover.

1995 Monitoring Program
Environmental Surveillance:

On-site Surface Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNSWAMP NE Swamp Drainage	Site surface drainage Reported in: • WESR • MTAR • QEMDR • ODIS • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH, conductivity
				Weekly samples composited to 12	→ Monthly composite for gamma isotopic and Sr-90 (monthly composite shared with NYSDOH)
				Weekly samples composited to 4	→ Quarterly composite for C-14, I-129, Pu/U isotopic, total U, Am-241
		Grab liquid	→ Semiannual	→ 2	→ NPOC, TOX, Ca, Mg, Na, K, Ba, Mn, Fe, Cl, SO_4, NO_3+NO_2-N, F, HCO_3, CO_3
WNSW74A North Swamp Drainage	Site surface drainage Reported in: • WESR • MTAR • QEMDR • ODIS • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH, conductivity
				Weekly samples composited to 12	→ Monthly composite for gamma isotopic, Sr-90
				Weekly samples composited to 4	→ Quarterly composite for C-14, I-129, Pu/U isotopic, total U, Am-241
		Grab liquid	→ Semiannual	→ 2	→ NPOC, TOX, Ca, Mg, Na, K, Ba, Mn, Fe, Cl, SO_4, NO_3+NO_2-N, F, HCO_3, CO_3
WN8D1DR High-level Waste Farm Underdrain	Drains subsurface water from HLW storage tank area Reported in: • MTAR	Grab liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH
				Weekly samples composited to 12	→ Monthly composite for gamma isotopic, Sr-90

Sampling Rationale

WNSWAMP DOE/EH-0173T, 5.10.1.1.

NE site surface water drainage; provides for the sampling of this discrete drainage path for uncontrolled surface waters just before they leave the site's controlled boundary. Waters represent surface and subsurface drainages from the construction and demolition debris landfill (CDDL), old hardstand areas, and other possible north plateau sources of radiological or nonradiological contamination.

WNSW74A DOE/EH-0173T, 5.10.1.1.

N site surface water drainage; provides for the sampling of this discrete drainage path for uncontrolled surface waters just before they leave the site's controlled boundary. Waters represent surface and subsurface drainages from lag storage areas and other possible north plateau sources of radiological or nonradiological contamination.

WN8D1DR DOE/EH-0173T, 5.10.1.3.

Monitors the potential influence on subsurface drainage surrounding the high-level waste tank farm.

1995 Monitoring Program
Environmental Surveillance:

On-site Surface Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNSP008 French Drain	Drains subsurface water from LLWTF lagoon area Required by: • SPDES permit Reported in: • Monthly SPDES DMR • WESR • MTAR • QEMDR • ODIS • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3
		Grab liquid	→ 3 each month	→ 36	→ Conductivity, pH, BOD-5, total Fe, total recoverable Cd and Pb
		Grab liquid	→ Annual	→ 1	→ As, Cr, total Ag, and Zn
WNSP005 Facility Yard Drainage	Combined drainage from facility yard area Reported in: • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3, pH
WNCOOLW Cooling Tower Basin	Cools plant utility steam system water Reported in: • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3, pH
				Monthly samples composited to 4	→ Quarterly composite for gamma isotopic

Sampling Rationale

WNSP008	DOE/EH-0173T, 5.10.1.3. French drain of subsurface water from lagoon (LLWTF) area. NYSDEC SPDES permit no. NY0000973 also provides for the sampling of this discrete drainage path for uncontrolled subsurface waters before they flow into Erdman Brook. Waters represent subsurface drainages from downward infiltration around the LLWTF and lagoon systems. This point would also monitor any subsurface spillover from the overfilling of lagoons 2 and 3. Sampling of significance for both radiological and nonradiological contamination. This site is also monitored as part of the groundwater program. (See SSWMU #1.)
WNSP005	Facility yard surface water drainage; generally in accordance with DOE/EH-0173T, 5.10.1.1. Formerly in accordance with NYSDEC SPDES permit no. NY0000973. Provides for the sampling of this discrete drainage path for uncontrolled surface waters just after outfall 007 discharge into the drainage and before these surface waters flow to Erdman Brook. Waters represent surface and subsurface drainages primarily from the main plant yard area. Historically this point was used to monitor sludge pond(s) and utility room discharges to the drainage. These two sources have been rerouted. Migration of residual site contamination around the main plant dictates surveillance of this point primarily for radiological parameters.
WNCOOLW	Facility cooling tower circulation water; generally in accordance with DOE/EH-0173T, 5.10.1.1. Operational sampling carried out to confirm no migration of radiological contamination into the primary coolant loop of the HLWTF and/or plant utility steam systems. Migration from either source might indicate radiological control failure.

1995 Monitoring Program
Environmental Surveillance:

On-site Surface Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNFRC67* Frank's Creek E of SDA	Drains NYS Low-level Waste Disposal Area Reported in: • Reported to NYSERDA • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3, pH
WNERB53* Erdman Brook N of Disposal Areas	Drains NYS and WVDP disposal areas Reported in: • Reported to NYSERDA • MTAR • QEMDR • SER	Grab liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH
WNNDADR Drainage between NDA and SDA	Drains WVDP disposal and storage area Reported in: • MTAR • QEMDR • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ pH
				Weekly samples composited to 12	→ Monthly composite for gross alpha/beta, gamma isotopic, H-3
				Weekly samples composited to 4	→ Quarterly composite for Sr-90, I-129
		Grab liquid	→ Semiannual	→ 2	→ NPOC, TOX
WNDCELD Drainage S of Drum Cell	Drains WVDP storage area Reported in: • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ pH, gross alpha/beta
				Monthly samples composited to 4	→ Quarterly composite for Sr-90, I-129, gamma isotopic, H-3
WNNDATR** NDA Trench Interceptor Project	On-site groundwater interception Reported in: • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3, gamma isotopic, NPOC, TOX
				Monthly samples composited to 4	→ Quarterly composite for I-129

* Monthly sample collected by NYSDOH
** Coordinated with Waste Management Operations

Sampling Rationale	
WNFRC67	DOE/EH-0173T, 5.10.1.1. Monitors the potential influence of both the SDA and drum cell drainage into Frank's Creek east of the SDA and upstream of the confluence with Erdman Brook.
WNERB53	DOE/EH-0173T, 5.10.1.1. Monitors the potential influence of the drainages from the SDA and the WVDP disposal area into Erdman Brook upstream of the confluence with Frank's Creek.
WNNDADR	DOE/EH-0173T, 5.10.1.1. Monitors the potential influence of the WVDP storage and disposal area drainage into Lagoon Road Creek upstream from confluence with Erdman Brook.
WNDCELD	DOE/EH-0173T, 5.10.1.1. Monitors potential influence of drum cell drainage into Frank's Creek south of the SDA and upstream of WNFRC67.
WNNDATR	DOE Order 5400.1, IV.9. Monitors groundwater in vicinity of the NDA interceptor trench project. The grab sample is taken directly from the trench collection system.

1995 Monitoring Program
Environmental Surveillance:

On-site Surface Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNSTAW Series On-site standing water ponds not receiving effluent includes: **WNSTAW4** Border pond SW of AFRT240 **WNSTAW5** Border pond SW of DFTLD13 **WNSTAW6** Borrow pit NE of Project facilities **WNSTAW9** North reservoir near intake **WNSTAWB** Background pond at Sprague Brook maintenance building	Water within vicinity of plant airborne or water effluent Reported in: • MTAR • QEMDR • SER	Grab liquid →	Annual →	1 each location* →	Gross alpha/beta, H-3, pH, conductivity, Cl, Fe, Mn, Na, NO_3+NO_2-N, SO_4

*Sampling depends upon on-site ponding conditions during the year.

Sampling Rationale

WNSTAW Series	DOE/EH-0173T, 5.10.1.1. Monitoring of on- and off-site standing waters at locations listed below. Although none receive effluent directly, the potential for contamination is present except at the background location. Former collecting sites 1, 2, 3, 7, and 8 were deleted from the monitoring program because they were built over or are now dry.
WNSTAW4	Border pond located south of AFRT240. Chosen to be a location for obtaining high potential concentration based on meteorological data. Perimeter location adjacent to a working farm. Drainage extends through private property and is accessible by the public.
WNSTAW5	Border pond located west of Project facilities near the perimeter fence and DFTLD13. Chosen to be a location for obtaining high potential concentration based on meteorological data. Location is adjacent to private residence and potentially accessible by the general public.
WNSTAW6	Borrow pit northeast of Project facilities just outside of inner security fence. Considered to be the closest standing water to the main plant and high-level waste facilities (in lieu of the availability of WNSTAW1).
WNSTAW9	North reservoir near intake. Chosen to provide data in the event of potentially contaminated site potable water supply. Location is south of main plant facilities.
WNSTAWB	Pond located near the Sprague Brook maintenance building. Considered a background location approximately 14 kilometers north of the WVDP.

1995 Monitoring Program
Environmental Surveillance:

On-site Potable Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WNDNK Series Site Potable Water includes: **WNDNKMS** Maintenance Shop Drinking Water **WNDNKMP** Main Plant Drinking Water **WNDNKEL** Environmental Lab Drinking Water	Sources of potable water within site perimeter <u>Reported in</u>: • Cattaraugus County • MTAR • QEMDR • QEMER	Grab liquid	→ Monthly	→ 12 per location	→ Gross alpha/beta, H-3, pH, conductivity
WNDNKUR Utility Room (EP-1) Potable Water Storage Tank		Grab liquid	→ Annual*	→ 1	→ As, Ba, Cd, Cr, Hg, Se, fluoride, NO_3

* **WNDNKUR** only. Sample for NO_3 to be collected in March. Pb and Cu will also be sampled at this site based upon Cattaraugus County Health Department guidance.

Sampling Rationale

WNDNK Series	Site drinking water; generally according to DOE/EH-0173T, 5.10.1.2. Potable water sampling carried out to confirm no migration of radiological and/or nonradiological contamination into the site's drinking water supply.
WNDNKMS	Site drinking water; generally according to DOE/EH-0173T, 5.10.1.2. Potable water sampled at the maintenance shop in order to monitor a point that is at an intermediate distance from the point of potable water generation and that is used heavily by site personnel.
WNDNKMP	Site drinking water; generally according to DOE/EH-0173T, 5.10.1.2. Same rationale as WNDNKMS but sampled at the main plant water fountain.
WNDNKEL	Site drinking water; generally according to DOE/EH-0173T, 5.10.1.2. Potable water sampled at the Environmental Laboratory in order to monitor the point farthest away from the point of potable water generation.
WNDNKUR	Site drinking water; generally according to DOE/EH-0173T, 5.10.1.2. Sampled at the utility room potable water storage tank before the site drinking water distribution system. Sample location is entry point EP-1.

1995 Monitoring Program
Environmental Surveillance:

On-site Groundwater

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
Low-level Waste Treatment Facility (SSWMU #1) **WNW** **0103** **0104** U **0105** **0106** **0107** **0108** **0109** **0110** **0111** **0114** **0115** U **0116** U **8603** **8604** U **8605** Surface: **WNSP008** Miscellaneous Small Units (SSWMU #2) **WNW** **0201** U **0202** U **0203** **0204** U **0205** **0206** **0207** **0208** **8606**	Groundwater monitoring wells around site super solid waste management units (SSWMUs)* Reported in: • SER • Quarterly Groundwater Reports	Grab liquid Direct field measurement of sample water	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3

NOTE: "U" designates upgradient, "B" designates background, and "C" designates crossgradient wells; the remainder are downgradient.

* The groundwater monitoring program was revised in May 1995 after a review of results from previous years of sampling. The program in place at the end of 1995 is presented in the "Groundwater Monitoring Plan" (WVDP-239).

Sampling Rationale	
On-site Groundwater	DOE Order 5400.1, IV.9; DOE/EH-0173T, 5.10.1.3; RCRA 3008(h) Order on Consent. The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive super solid waste management units (SSWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SSWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SSWMUs. Groundwater protection is addressed in WVDP-091, "Groundwater Protection Management Program." Groundwater monitoring as detailed in WVDP-239, "Groundwater Monitoring Plan," is applicable to the 1996 program.
SSWMU #1	Low-level waste treatment facilities, including four active lagoons, lagoons 2, 3, 4 and 5, and an inactive, filled-in lagoon, lagoon 1.
SSWMU #2	Miscellaneous small units, including the sludge pond, the solvent dike, the paper incinerator, and the kerosene tank.

1995 Monitoring Program
Environmental Surveillance:

On-site Groundwater

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
Liquid Waste Treatment System (SSWMU #3) **WNW** **0301** U **0302** U **0305** xx**0306** **0307** **NB1S** B HLW Storage and Processing Tank (SSWMU #4) **WNW** **0401** U **0402** U **0403** U **0404** U **0405 C** **0406** **0407** **0408** **0409** xx**0410** U xx**0411** U	Groundwater monitoring wells around site super solid waste management units (SSWMUs)* Reported in: • SER • Quarterly Groundwater Reports	Grab liquid Direct field measurement of sample discharge water	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3

NOTE: "U" designates upgradient, "B" designates background, and "C" designates crossgradient wells; the remainder are downgradient.

xx- Wells that are dry and not used for groundwater monitoring.

* The groundwater monitoring program was revised in May 1995 after a review of results from previous years of sampling. The program in place at the end of 1995 is presented in the "Groundwater Monitoring Plan" (WVDP-239).

Sampling Rationale	
On-site Groundwater	DOE Order 5400.1, IV.9; DOE/EH-0173T, 5.10.1.3; RCRA 3008(h) Order on Consent. The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive super solid waste management units (SSWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SSWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SSWMUs. Groundwater protection is addressed in WVDP-091, "Groundwater Protection Management Program." Groundwater monitoring as detailed in WVDP-239, "Groundwater Monitoring Plan," is applicable to the 1996 program.
SSWMU #3	Liquid waste treatment system containing effluent from the supernatant treatment system.
SSWMU #4	High-level waste storage and processing area, including the high-level radioactive waste tanks, the supernatant treatment system, and the vitrification facility.

1995 Monitoring Program
Environmental Surveillance:

On-site Groundwater

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
Maintenance Shop Leach Fields (SSWMU #5) **WNW** **0501** U **0502** Low-level Waste Storage Area (SSWMU #6) **WNW** **0601** **0602** **0603** U **0604** **0605** **8607** U **8608** U **8609** U Chemical Process Cell Waste Storage Area (SSWMU #7) **WNW** **0701** U **0702** C **0703** **0704** **0705** C **0706** U **0707**	Groundwater monitoring wells around site super solid waste management units (SSWMUs)* Reported in: • SER • Quarterly Groundwater Reports	Grab liquid Direct field measurement of sample discharge water	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3

NOTE: "U" designates upgradient, "B" designates background, and "C" designates crossgradient wells; the remainder are downgradient.

* The groundwater monitoring program was revised in May 1995 after a review of results from previous years of sampling. The program in place at the end of 1995 is presented in the "Groundwater Monitoring Plan" (WVDP-239).

Sampling Rationale	
On-site Groundwater	DOE Order 5400.1, IV.9; DOE/EH-0173T, 5.10.1.3; RCRA 3008(h) Order on Consent. The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive super solid waste management units (SSWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SSWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SSWMUs. Groundwater protection is addressed in WVDP-091, "Groundwater Protection Management Program." Groundwater monitoring as detailed in WVDP-239, "Groundwater Monitoring Plan," is applicable to the 1996 program.
SSWMU #5	Maintenance shop sanitary leach field, formerly used by NFS and WVNS to process domestic sewage generated by the maintenance shop.
SSWMU #6	The low-level waste storage area includes metal and fabric structures housing low-level radioactive wastes being stored for future disposal.
SSWMU #7	The chemical process cell (CPC) waste storage area contains packages of pipes, vessels, and debris from decontamination and cleanup of the chemical process cell in the former reprocessing plant.

1995 Monitoring Program
Environmental Surveillance:

On-site Groundwater

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
Construction and Demolition Debris Landfill (CDDL) (SSWMU #8) WNW **0801** U **0802** **0803** **0804** **8603** U **8612** **WNGSEEP** **WNDMPNE** NRC-licensed Disposal Area (NDA) (SSWMU #9) WNW **0901** U **0902** U **0903** **0904** **0905** **0906** **0907** **0908** U **0909** **0910** **8610** **8611** **WNNDATR** IRTS Drum Cell (SSWMU #10) WNW **1001** U **1002** **1003** **1004** **1005** U **1006** **1007** **1008b** B **1008c** B	Groundwater monitoring wells around site super solid waste management units (SSWMUs)* Reported in: • SER • Quarterly Groundwater Reports	Grab liquid Direct field measurement of sample discharge water	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3

NOTE: "U" designates upgradient, "B" designates background, and "C" designates crossgradient wells; the remainder are downgradient.

* The groundwater monitoring program was revised in May 1995 after a review of results from previous years of sampling. The program in place at the end of 1995 is presented in the "Groundwater Monitoring Plan" (WVDP-239).

Sampling Rationale	
On-site Groundwater	DOE Order 5400.1, IV.9; DOE/EH-0173T, 5.10.1.3; RCRA 3008(h) Order on Consent. The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive super solid waste management units (SSWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SSWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SSWMUs. Groundwater protection is addressed in WVDP-091, "Groundwater Protection Management Program." Groundwater monitoring as detailed in WVDP-239, "Groundwater Monitoring Plan," is applicable to the 1996 program.
SSWMU #8	Construction and demolition debris landfill (CDDL), used by NFS and the WVDP to dispose of nonhazardous and nonradioactive materials.
SSWMU #9	The NRC-licensed disposal area (NDA) contains radioactive wastes generated by NFS and the WVDP.
SSWMU #10	The integrated radioactive waste system (IRTS) treatment drum cell stores cement-stabilized low-level radioactive waste.

1995 Monitoring Program
Environmental Surveillance:

On-site Groundwater

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
State-licensed Disposal Area (SSWMU #11) **WNW** **1101a** U **1101b** U **1101c** U **1102a** **1102b** **1103a** **1103b** **1103c** **1104a** **1104b** **1104c** **1105a** **1105b** **1106a** U **1106b** U **1107a** **1108a** U **1109a** U **1109b** U **1110a** **1111a**	Groundwater monitoring points around site super solid waste management units (SSWMUs) Reported in: • SER	Grab liquid	Per NYSERDA*	Per NYSERDA*	Per NYSERDA*
Fuel Storage Area (Not a SSWMU) **WNW** **8613A** C **8613B** C **8613C**	Reported in: • SER • Quarterly Groundwater Reports	Grab liquid Direct field measurement of sample discharge water	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3
Well Points (Not in a SSWMU) **WP-A** **WP-C** **WP-D** **WP-E** **WP-F** **WP-G** **WP-H**	Well points downgradient of main plant Reported in: • SER	Grab liquid	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and Appendix E	See Tables 3-1, 3-2, and 3-3

NOTE: "U" designates upgradient, "B" designates background, and "C" designates crossgradient wells; the remainder are downgradient.

* SDA wells are sampled by NYSERDA; therefore, frequencies and analyses are not included in this summary of the WVDP program. Data are presented in Appendix F.

Sampling Rationale

On-site Groundwater	DOE Order 5400.1, IV.9; DOE/EH-0173T, 5.10.1.3; RCRA 3008(h) Order on Consent. The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive super solid waste management units (SSWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SSWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SSWMUs. Groundwater protection is addressed in WVDP-091, "Groundwater Protection Management Program." Groundwater monitoring as detailed in WVDP-239, "Groundwater Monitoring Plan," is applicable to the 1996 program.
SSWMU #11	The state-licensed disposal area (SDA) was operated by NFS as a commercial low-level disposal facility; it also received wastes from NFS reprocessing operations.
Fuel Storage Area	Monitors groundwater in the vicinity of the underground fuel storage tanks; this is not included in any of the SSWMUs.
Well Points	Monitor groundwater of known contamination in the north plateau area. All well points are downgradient of the main plant.

1995 Monitoring Program
Environmental Surveillance:

Off-site Surface Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WFBCTCB Buttermilk Creek, upstream of Cattaraugus Creek confluence at Thomas Corners Road	Restricted surface waters receiving plant effluents Reported in: • MTAR • QEMDR • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ pH, conductivity
				Weekly samples composited to 12	→ Monthly composite for gross alpha/beta, H-3
				Weekly samples composited to 4	→ Quarterly composite for gamma isotopic and Sr-90
WFFELBR Cattaraugus Creek at Felton Bridge	Unrestricted surface waters receiving plant effluents Reported in: • MTAR • QEMDR • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ Gross alpha/beta, H-3, pH
				Weekly samples composited to 12	→ Flow-weighted monthly composite for gamma isotopic and Sr-90, gross alpha/beta, H-3
WFBCBKG Buttermilk Creek near Fox Valley (background)	Unrestricted surface water background Reported in: • MTAR • QEMDR • SER	Timed continuous composite liquid	→ Weekly	→ 52	→ pH, conductivity
				Weekly samples composited to 12	→ Monthly composite for gross alpha/beta, H-3
				Weekly samples composited to 4	→ Quarterly composite for gamma isotopic, Sr-90, C-14, I-129, Pu/U isotopic, total U, Am-241, Tc-99
		Grab liquid	→ Semiannual	→ 2	→ NPOC, TOX, Ca, Mg, Na, K, Ba, Mn, Fe, Cl, SO_4, NO_3-NO_2-N, F, HCO_3, CO_3
WFBIGBR Cattaraugus Creek at Bigelow Bridge (background)	Unrestricted surface water background Reported in: • MTAR • QEMDR • SER	Grab liquid	→ Monthly	→ 12	→ Gross alpha/beta, H-3, Sr-90, and gamma isotopic

Monthly composite at **WFBCTCB, WFBCBKG,** and **WFFELBR** is also sent to NYSDOH.

Sampling Rationale

WFBCTCB DOE/EH-0173T, 5.10.1.1.

Buttermilk Creek is the surface water receiving all WVDP effluents. **WFBCTCB** monitors the potential influence of WVDP drainage into Buttermilk Creek upstream of confluence with Cattaraugus Creek.

WFFELBR DOE/EH-0173T, 5.10.1.1.

Because Buttermilk Creek is the surface water that receives all WVDP effluents and empties into Cattaraugus Creek, **WFFELBR** monitors the potential influence of WVDP drainage into Cattaraugus Creek directly downstream of the confluence with Buttermilk Creek.

WFBCBKG DOE/EH-0173T, 5.10.1.1.

Monitors background conditions of Buttermilk Creek upstream of the WVDP. Allows comparison to downstream conditions.

WFBIGBR DOE/EH-0173T, 5.10.1.1.

Monitors background conditions of Cattaraugus Creek at Bigelow Bridge, upstream of the WVDP. Allows comparison to downstream conditions.

1995 Monitoring Program
Environmental Surveillance:

Off-site Drinking Water

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
WFWEL series wells near the WVDP outside the WNYNSC perimeter **WFWEL01** 3.0 km WNW **WFWEL02** 1.5 km NW **WFWEL03** 4.0 km NW **WFWEL04** 3.0 km NW **WFWEL05** 2.5 km SW **WFWEL06** (background) 29 km S **WFWEL07** 4.0 km NNE **WFWEL08** 2.5 km ENE **WFWEL09** 3.0 km SE **WFWEL10** 7.0 km N	Drinking water supply; groundwater near facility* Reported in: • MTAR • QEMDR • SER	→ Grab liquid	→ Annual	→ 1 each location	→ Gross alpha/beta, H-3, gamma isotopic, pH, conductivity

* Off-site drinking water wells are not affected by the potential migration of contaminants in the subsurface at the WVDP.

Sampling Rationale

Off-site Drinking Water **WFWEL** Series	DOE 5400.1, IV.9; DOE/EH-0173T, 5.10.1.2. Eight of the ten listed off-site private residential drinking water wells represent the nearest unrestricted uses of groundwater close to the WVDP. The ninth sample (**WFWEL10**) is from a public water supply from deep wells. The tenth drinking water well, **WFWEL06**, is located 29 kilometers south of the Project and is considered a background drinking water source.

1995 Monitoring Program
Environmental Surveillance:

Off-site Air

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
AFFXVRD 3.0 km SSE at Fox Valley	Particulate air samples around the WNYNSC perimeter <u>Reported in</u>: • MTAR • QEMDR • SER	Continuous air particulate filter	→ Weekly	→ 52 each location Weekly filters composited to 4 each location	→ Gross alpha/beta → Quarterly composite for Sr-90, gamma isotopic Total U, U/Pu isotopic, and Am-241 for **AFRSPRD** and **AFGRVAL** only
AFTCORD 3.7 km NNW at Thomas Corners Road					
AFRT240* 2.0 km NE on Route 240					
AFSPRVL 7 km N at Springville					
AFWEVAL 6 km SSE at West Valley					
AFDNKRK** 50 km W at Dunkirk (background)					
AFNASHV** 37 km W at village of Nashville, town of Hanover (background)					
AFBOEHN 2.3 km SW on Dutch Hill Road					
AFRSPRD 1.5 km NW on Rock Springs Road		Continuous desiccant column for water vapor collection	→ Weekly	→ 52 each location (**AFRSPRD** and **AFGRVAL** only)	→ H-3
AFGRVAL 29 km S at Great Valley (background)		Continuous charcoal cartridge	→ Monthly	→ 12 composited to 4 each location (**AFRSPRD** and **AFGRVAL** only)	→ Quarterly composite for I-129
AFBLKST Bulk Storage Warehouse 2.2 km ESE at Buttermilk Road					

* Filter from duplicate sampler sent to NYSDOH.
** AFNASHV replaced AFDNKRK in 1995.

Sampling Rationale	
AFFXVRD	DOE/EH-0173T, 5.7.4.
AFTCORD	
AFRT240	Air samplers put into service by NFS as part of the site's original monitoring program. Perimeter locations chosen to obtain data from places most likely to provide highest concentrations, based on meteorological data.
AFSPRVL	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Off-site (remote) sampler located on private property in nearby community within 15 kilometers of the site (north).
AFWEVAL	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Off-site (remote) sampler located on private property in nearby community within 15 kilometers of the site (southeast).
AFDNKRK	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Off-site (remote) sampler considered to be representative of natural background radiation. Located 50 kilometers west of the site (upwind) on privately owned property. Location discontinued in 1995.
AFNASHV	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Off-site (remote) sampler considered to be representative of natural background radiation. Located 37 kilometers west of the site (upwind) on privately owned property. Location replaced AFDNKRK in 1995.
AFBOEHN	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Perimeter location chosen to obtain data from the place most likely to provide highest elevated release concentrations based on meteorological data. AFBOEHN is located on NYSERDA property at the perimeter.
AFRSPRD	DOE/EH-0173T, 5.7.4. Perimeter location chosen to obtain data from the place most likely to provide highest ground-level release concentrations based on meteorological data. AFRSPRD is on WVDP property but outside the main plant operations fence line. I-129 and H-3 are sampled here because the sampling trains were easy to incorporate and the location was most likely to receive effluent releases.
AFGRVAL	DOE/EH-0173T, 5.7.4; DOE/EP-0023, 4.2.3. Off-site (remote) sampler considered to be representative of natural background radiation. Located on privately owned property 29 kilometers south of the site (typically upwind). I-129 and H-3 sampled here also.
AFBLKST	DOE/EH-0173T, 5.7.4. Off-site monitoring of bulk storage warehouse, near site perimeter.

1995 Monitoring Program
Environmental Surveillance:

Fallout, Sediment, and Soil

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
AFDHFOP 2.3 km SW **AFFXFOP** 3.0 km SSE **AFTCFOP** 3.7 km NNW **AF24FOP** 2.0 km NE **ANRGFOP** Met tower on-site	Collection of fallout particulate and precipitation around WNYNSC perimeter Reported in: • MTAR • QEMDR • SER	Integrated precipitation	→ Monthly	→ 12 each location	→ Gross alpha/beta, H-3, pH, gamma isotopic
SF Soil Series Surface Soil (at each of ten air samplers)	Long-term fallout accumulation Reported in: • MTAR • QEMDR • SER	Surface plug composite soil	→ Annual	→ 1 each location	→ Gross alpha/beta, gamma isotopic, Sr-90, Pu-239, Am-241, plus U-isotopic and total U at **SFRSPRD**, **SFBOEHN**, and **SFGRVAL**
SFCCSED Cattaraugus Creek at Felton Bridge **SFSDSED** Cattaraugus Creek at Springville Dam **SFBISED** Cattaraugus Creek at Bigelow Bridge (background) **SFTCSED** Buttermilk Creek at Thomas Corners Road **SFBCSED** Buttermilk Creek at Fox Valley Road (background)	Deposition in sediment downstream of facility effluents Reported in: • MTAR • QEMDR • SER	Grab stream sediment	→ Annual (Split of **SFSDSED and SFBCSED** to **NYSDOH**)	→ 1 each location	→ Gross alpha/beta, gamma isotopic, Sr-90, U/Pu isotopic, total U, Am-241
SN On-site Soil Series: **SNSW74A** (Near WNSW74A) **SNSWAMP** (Near WNSWAMP) **SNSP006** (Near WNSP006)	Reported in: • MTAR • QEMDR • SER	Surface plug or grab	→ Annual	→ 1 each location	→ Gross alpha/beta, gamma isotopic, Sr-90, Pu-239, Am-241, U-isotopic, total U, Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn

Sampling Rationale

AFDHFOP **AFFXFOP** **AFTCFOP** **AF24FOP**	DOE/EP-0023, 4.7. Collection of fallout particles and precipitation around the site perimeter at established air sampling locations. AFDHFOP (Dutch Hill at Boehn road), AFFXFOP (Fox Valley Road), AFTCFOP (Thomas Corners), AF24FOP (Route 240). Indicates short-term effects.
ANRGFOP	Collection of fallout particles and precipitation on-site at the meteorological tower. Indicates short-term effects.
SF Soil Series	DOE/EH-0173T, 5.9.1. Off-site soils collected at air sampling locations. **SFWEVAL** (West Valley), **SFFXVRD** (Fox Valley Road), **SFSPRVL** (Springville), **SFTCORD** (Thomas Corners), **SFRT240** (Route 240), **SFNASHV** (Nashville), **SFBOEHN** (Boehn Road-Dutch Hill), **SFGRVAL** (Great Valley), **SFRSPRD** (Rock Springs Road), **SFBLKST** (bulk storage warehouse): Collection of long-term fallout data at established air sampler locations via soil sampling.
SFCCSED	DOE/EH-0173T, 5.12.1. Sediment deposition in Cattaraugus Creek at Felton Bridge. Location is first access point of Cattaraugus Creek downstream of the confluence with Buttermilk Creek.
SFSDSED	DOE/EH-0173T, 5.12.1. Sediment deposition in Cattaraugus Creek at Springville Dam. Reservoir provides ideal settling and collection location for sediments downstream of Buttermilk Creek confluence. Located downstream of **SFCCSED**.
SFBISED	DOE/EH-0173T, 5.12.1. Sediment deposition in Cattaraugus Creek at Bigelow Bridge. Location is upstream of the Buttermilk Creek confluence and serves as a Cattaraugus Creek background location.
SFTCSED	DOE/EH-0173T, 5.12.1. Sediment deposition in Buttermilk Creek at Thomas Corners immediately downstream of all facility liquid effluents.
SFBCSED	DOE/EH-0173T, 5.12.1. Sediment deposition in Buttermilk Creek upstream of facility effluents (background).
SN Soil Series	DOE/EH-0173T, 5.9.1. On-site soil. (Samples may be partially composed of sediments.)
SNSW74A	Surface soil near **WNSW74A**. Location to be specifically defined by geographic coordinates. Corresponds to site drainage pattern flow (i.e., most likely area of radiological deposition/accumulation).
SNSWAMP	Surface soil near **WNSWAMP**. Location to be specifically defined by geographic coordinates. Corresponds to site drainage pattern flow (i.e., most likely area of radiological deposition/accumulation).
SNSP006	Surface soil near **WNSP006**. Location to be specifically defined by geographic coordinates. Corresponds to site drainage pattern flow (i.e., most likely area of radiological deposition/accumulation).

1995 Monitoring Program
Environmental Surveillance:

Off-site Biological

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
BFFCATC Cattaraugus Creek downstream of the Buttermilk Creek confluence **BFFCTRL** Control sample from nearby stream not affected by the WVDP (7 km or more upstream of site effluent point; background)	Fish in waters up- and downstream of facility effluents Reported in: • MTAR • QEMDR • SER	Individual collection, biological	Semiannual (Samples at **BFFCATC** and **BFFCTRL** shared with NYSDOH) →	20 fish each location →	Gamma isotopic and Sr-90 in edible portions of each individual fish
BFFCATD Cattaraugus Creek downstream of Springville Dam			Annual (**BFFCATD** only) →	10 fish →	Gamma isotopic and Sr-90 in edible portions of each individual fish
BFMREED Dairy farm, 3.8 km NNW **BFMCOBO** Dairy farm, 9 km WNW **BFMCTLS** Control location 25 km S (background) **BFMCTLN** Control location 30 km N (background)	Milk from animals foraging around facility perimeter and at background sites Reported in: • MTAR • QEMDR • SER	Grab biological →	Monthly (**BFMREED, BFMCOBO, BFMCTLS, BFMCTLN.** Samples at **BFMREED** and **BFMCOBO** shared with NYSDOH) →	12 monthly samples composited to 4 each location →	Quarterly composite for gamma isotopic, Sr-90, H-3, and I-129
BFMWIDR Dairy farm, 3.5 km SE of site **BFMSCHT*** Dairy farm 4.8 km S			Annual (**BFMWIDR, BFMSCHT**) →	1 each location →	Gamma isotopic, Sr-90, H-3, and I-129

* BFMSCHT replaces former location (BFMHAUR), which no longer provides milk commercially.

Sampling Rationale	
BFFCATC **BFFCATD**	DOE/EH-0173T, 5.11.1.1. Radioactivity may enter a food chain in which fish are a major component and are consumed by the local population.
BFFCTRL	Control fish sample to provide background data for comparison with fish caught downstream of facility effluents.
BFMREED **BFMCOBO** **BFMWIDR** **BFMSCHT**	DOE/EH-0173T, 5.8.2.1. Milk from animals foraging around facility perimeter. Milk is consumed by all age groups and is frequently the most important food that could contribute to the radiation dose. Dairy animals pastured near the site and at two background locations allow adequate monitoring.
BFMCTLS **BFMCTLN**	Control milk samples collected far from site to provide background data for comparison with near-site milk.

1995 Monitoring Program
Environmental Surveillance:

Off-site Biological

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
BFVNEAR* Nearby locations **BFVCTRL*** Remote locations (16 km or more from facility; background) **BFHNEAR** Beef cattle/milk cow forage from near-site location	Fruit and vegetables grown near facility perimeter, downwind if possible <u>Reported in</u>: • MTAR • QEMDR • SER	Grab biological (fruits and vegetables)	→ Annual, at harvest (**BFVNEAR** and **BFVCTRL**)	→ 3 each (split with NYSDOH)	→ Gamma isotopic and Sr-90 analysis of edible portions, H-3 in free moisture
BFHCTLS or **BFHCTLN** Beef cattle/milk cow forage from control location south or north (background)		Grab biological	→ Annual (**BFHNEAR**, **BFHCTLS**, or **BFHCTLN**)	→ 1 each location	→ Gamma isotopic, Sr-90
BFBNEAR Beef animal from nearby farm in downwind direction **BFBCTRL** Beef animal from control location 16 km or more from facility (background)	Meat (beef foraging near facility perimeter, downwind if possible) <u>Reported in</u>: • MTAR • QEMDR • SER	Grab biological	→ Semiannual	→ 2 each location	→ Gamma isotopic and Sr-90 analysis of meat, H-3 in free moisture
BFDNEAR Deer in vicinity of the site	Meat (deer foraging near facility perimeter) <u>Reported in</u>: • MTAR • QEMDR • SER	Individual collection biological	→ Annual, during hunting season (**BFDNEAR** sample split with NYSDOH)	→ 3	→ Gamma isotopic and Sr-90 analysis of meat, H-3 in free moisture
BFDCTRL Control deer 16 km or more from facility (background)			During year as available (**BFDCTRL** sample split with NYSDOH)	→ 3	→ Gamma isotopic and Sr-90 analysis of meat, H-3 in free moisture

* Corn, apple, and bean samples are identified specifically as follows: corn = BFVNEAC and BFVCTRC; apples = BFVNEAA and BFCTRA; beans = BFVNEAB and BFVCTRB.

Sampling Rationale

BFVNEAR DOE/EH-0173T, 5.8.2.2.

Fruits and vegetables (corn, apples, and beans) collected from areas near the site. Collected, if possible, from areas near the site predicted to have worst case downwind concentrations of radionuclides in air and soil. Sample analysis reflects steady state/chronic uptake or contamination of foodstuffs as a result of site activities. Possible pathway to humans or indirectly through animals.

BFVCTRL DOE/EH-0173T, 5.8.2.2.

Fruits and vegetables collected from area remote from the site. Background fruits and vegetables collected for comparison with near-site samples. Collected in area(s) of no possible site impact.

BFHNEAR DOE/EH-0173T, 5.8.2.2.

Hay collected from areas near the site. Same as for near-site fruits and vegetables (**BFVNEAR**). Indirect pathway to humans through animals. Collected with either beef or milk sample location.

BFHCTLS
BFHCTLN DOE/EH-0173T, 5.8.2.2.

Hay collected from areas remote from the site. Background hay collected for comparison with near-site samples. Collected in area(s) of no possible site impact.

BFBNEAR DOE/EH-0173T, 5.8.2.3.

Beef collected from animals raised near the site. Following the rationale for vegetable matter collected near site (**BFVNEAR** and **BFHNEAR**), edible flesh portion of beef animals is analyzed to determine possible radionuclide content passable directly to humans. For animals foraging downwind in areas of maximum probable site impact.

BFBCTRL DOE/EH-0173T, 5.8.2.3.

Beef collected from animals raised far from the site. Background beef collected for comparison with near-site samples. Collected in area(s) of no possible site impact.

BFDNEAR DOE/EH-0173T, 5.8.3.

Venison from deer herd found living near the site. Same as for beef (**BFBNEAR**).

BFDCTRL DOE/EH-0173T, 5.8.3.

Venison from deer herd living far from the site. Background deer meat collected for comparison with near-site samples. Collected in area(s) of no possible site impact.

1995 Monitoring Program
Environmental Surveillance:

Off-site Direct Radiation

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
DFTLD Series Thermoluminescent Dosimetry (TLD) Off-site: **#1-16** At each of 16 compass sectors, at nearest accessible perimeter point **#17** "5 Points" landfill, 19 km SW (background) **#20** 1,500 m NW (downwind receptor) **#21** Springville 6 km N **#22** West Valley 6 km SSE **#23** Great Valley 29 km S (background) **#37** Dunkirk 50 km NW - early 1995 (background) Nashville 37 km NW - late 1995 (background) **#41** Sardinia-Savage Road 24 km NE (background)	Direct radiation around facility Reported in: • QEMDR • SER	Integrating LiF TLD	→ Quarterly	→ 5 TLDs at each of 23 locations collected 4 times per year	→ Quarterly gamma radiation exposure

Sampling Rationale	
DOSIMETRY Off-site	DOE/EH-0173T, 5.5 and DOE/EP-0023, 4.6.3. TLDs offer continuous integrated environmental gamma-ray monitoring and have been deployed systematically about the site. Off-site TLDs are used to verify that site activities have not adversely affected the surrounding environs. In addition to general NRC crosschecks at selected sites, a biennial HPIC gamma radiation measurement is completed at all TLD locations.

1995 Monitoring Program
Environmental Surveillance:

On-site Direct Radiation

Sample Location Code	Monitoring/Reporting Requirements	Sampling Type/Medium	Collection Frequency	Total Annual Sample Collections	Analyses Performed/ Composite Frequency
DNTLD Series Thermoluminescent Dosimetry (TLD) On-site: **#18, #19, #33** At three corners of SDA **#24, #26-32, #34** (9) At security fence around site **#35, #36, #38-40** (5) On-site near operational areas **#25** Rock Springs Road 500 m NNW of plant **#42** SDA T-1 Building **#43** SDA West Perimeter Fence	Direct radiation on facility grounds Reported in: • QEMDR • SER	Integrating LiF TLD	→ Quarterly	→ 5 TLDs at each of 20 sites collected 4 times per year	→ Quarterly gamma radiation exposure

Sampling Rationale	
DOSIMETRY On-site	DOE/EH-0173T, 5.4 and 5.5. On-site TLDs monitor waste management units and verify that the potential dose rate to the general public (i.e., Rock Springs Road) is below 100 mrem/annum (1 mSv/annum) from site activities. In addition to general NRC crosschecks at selected sites, a biennial HPIC gamma radiation measurement is completed at all locations. Potential TLD sampling locations are continually evaluated with respect to site activities.

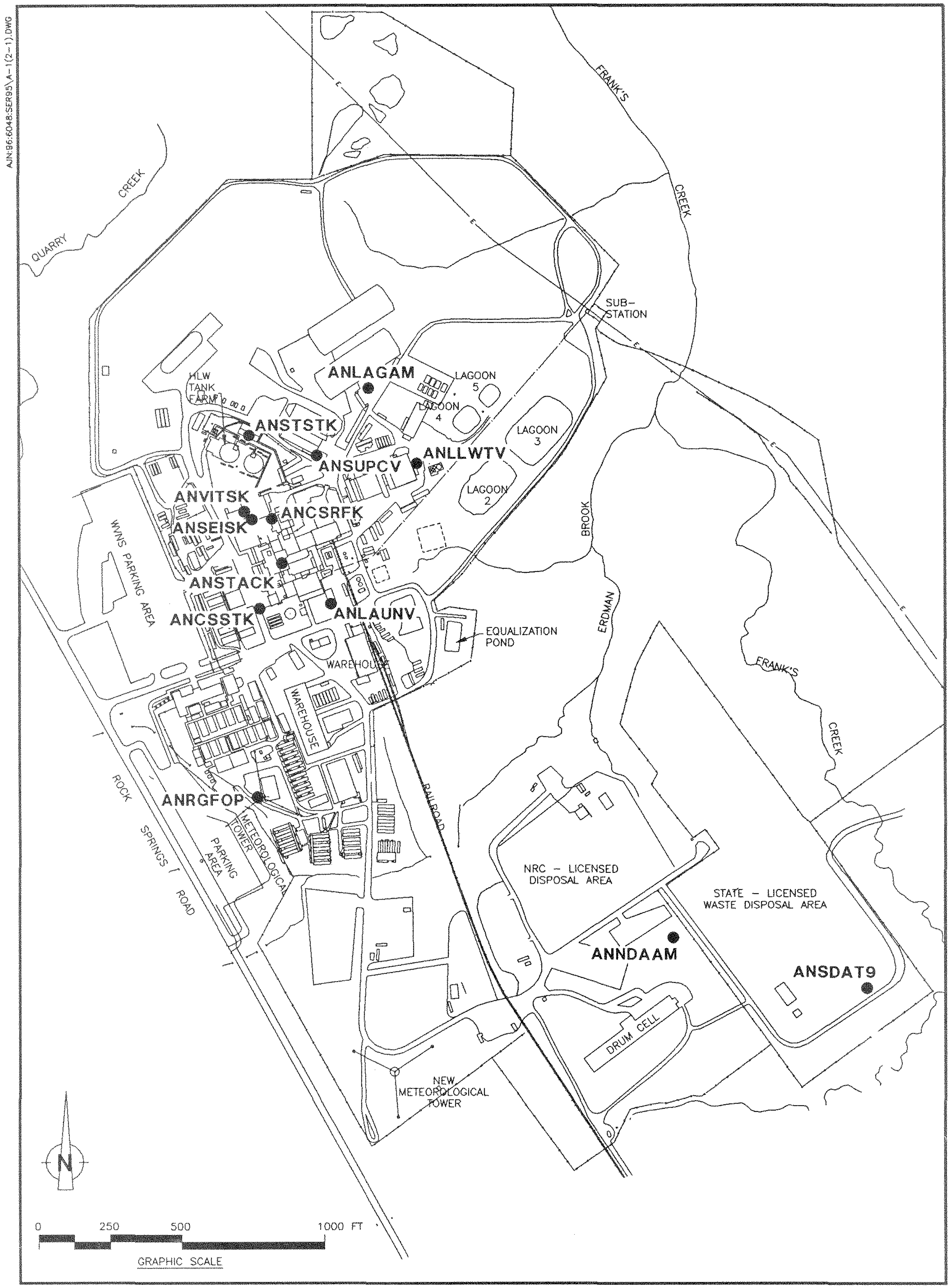


Figure A-1. On-site Air Monitoring and Sampling Points.

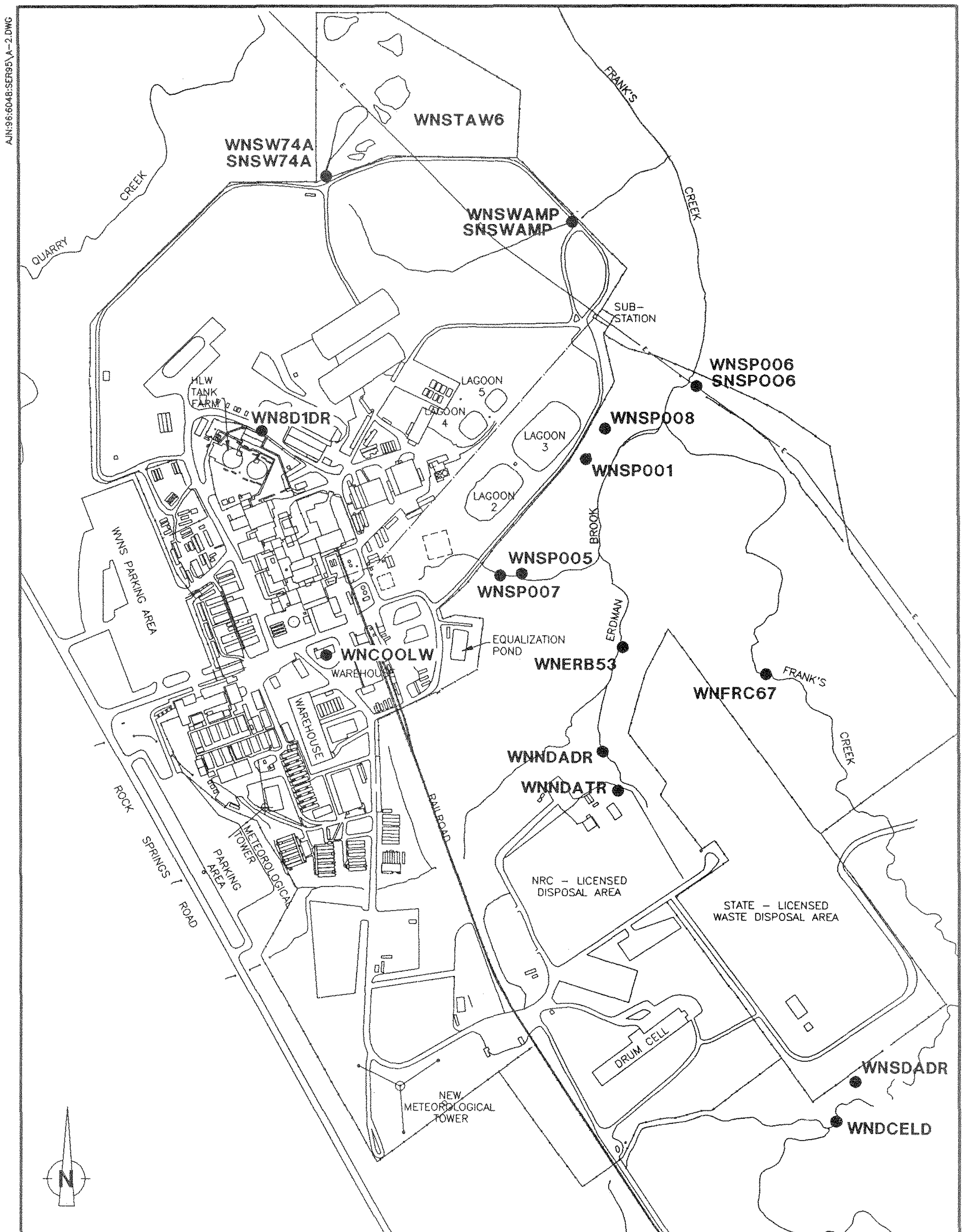


Figure A-2. Sampling Locations for On-site Surface Water and Soil.

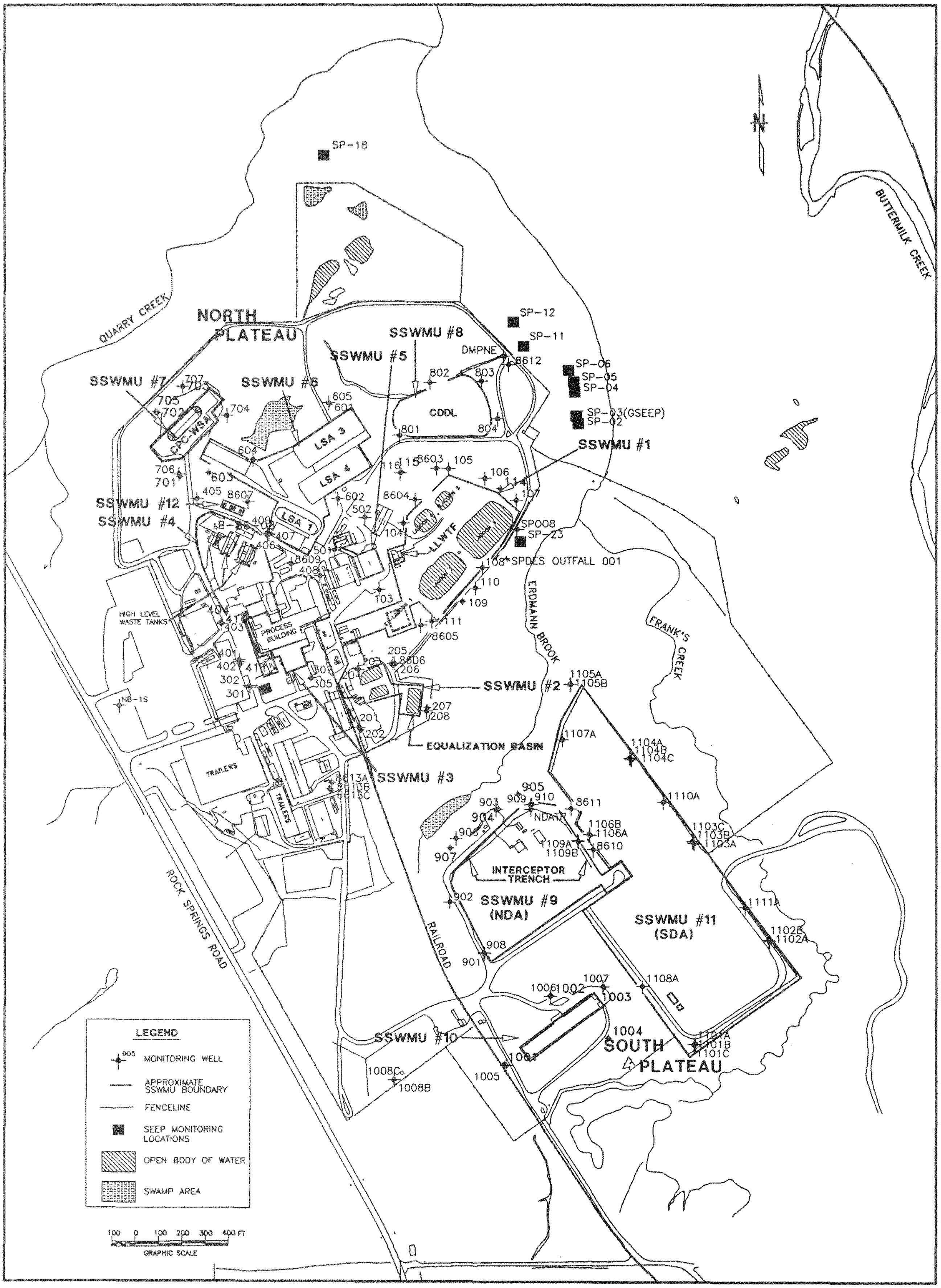


Figure A-3. On-Site Groundwater Monitoring Network *(Includes wells not actively monitored following May 1995 but retained for water level measurements).*

AJN:96:6048:SER95\2-4(A-4).DWG

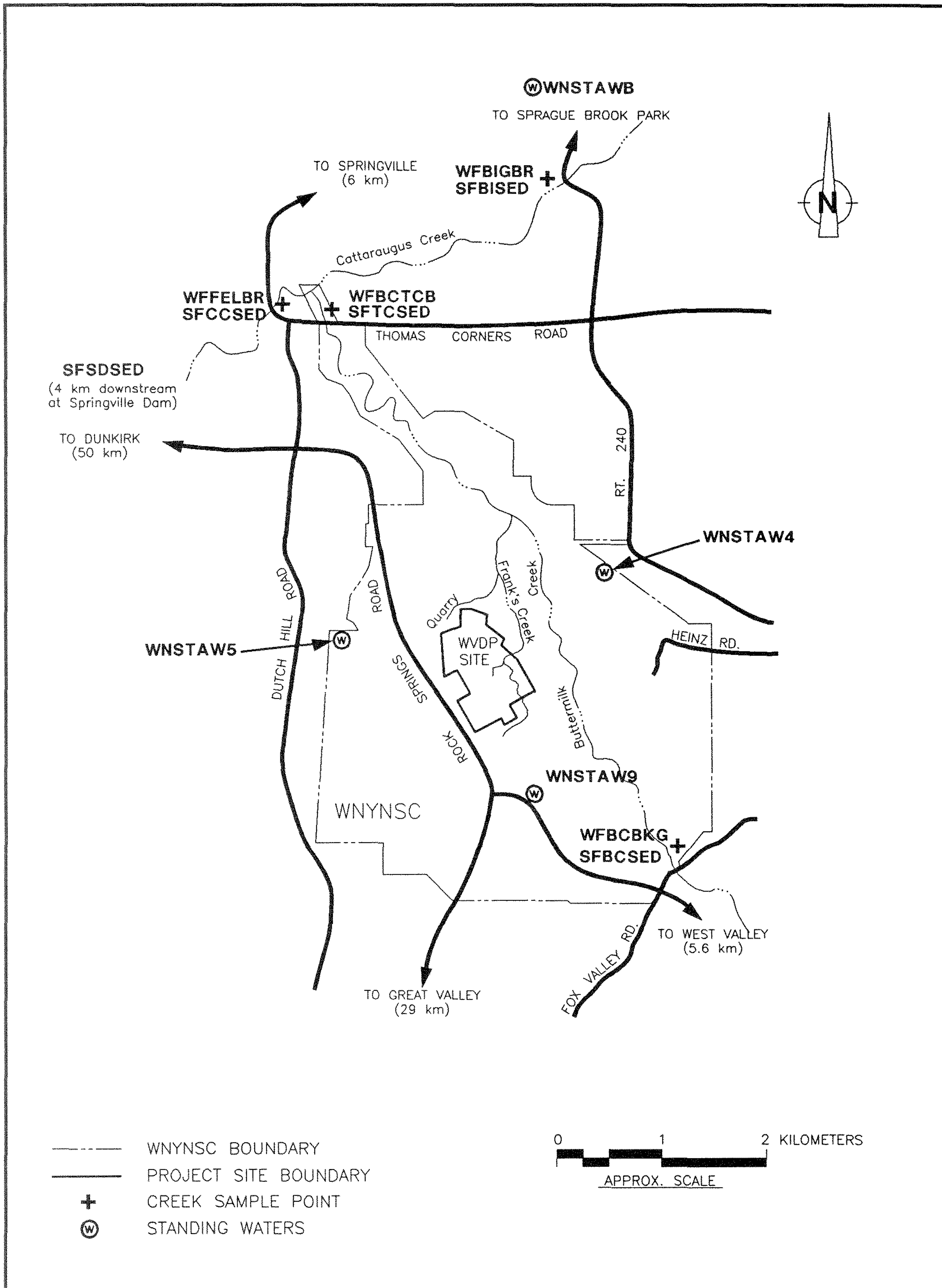


Figure A-4. Location of Off–site Surface Water and Sediment Samples.

AJN:96:6048:SER95\A-5.DWG

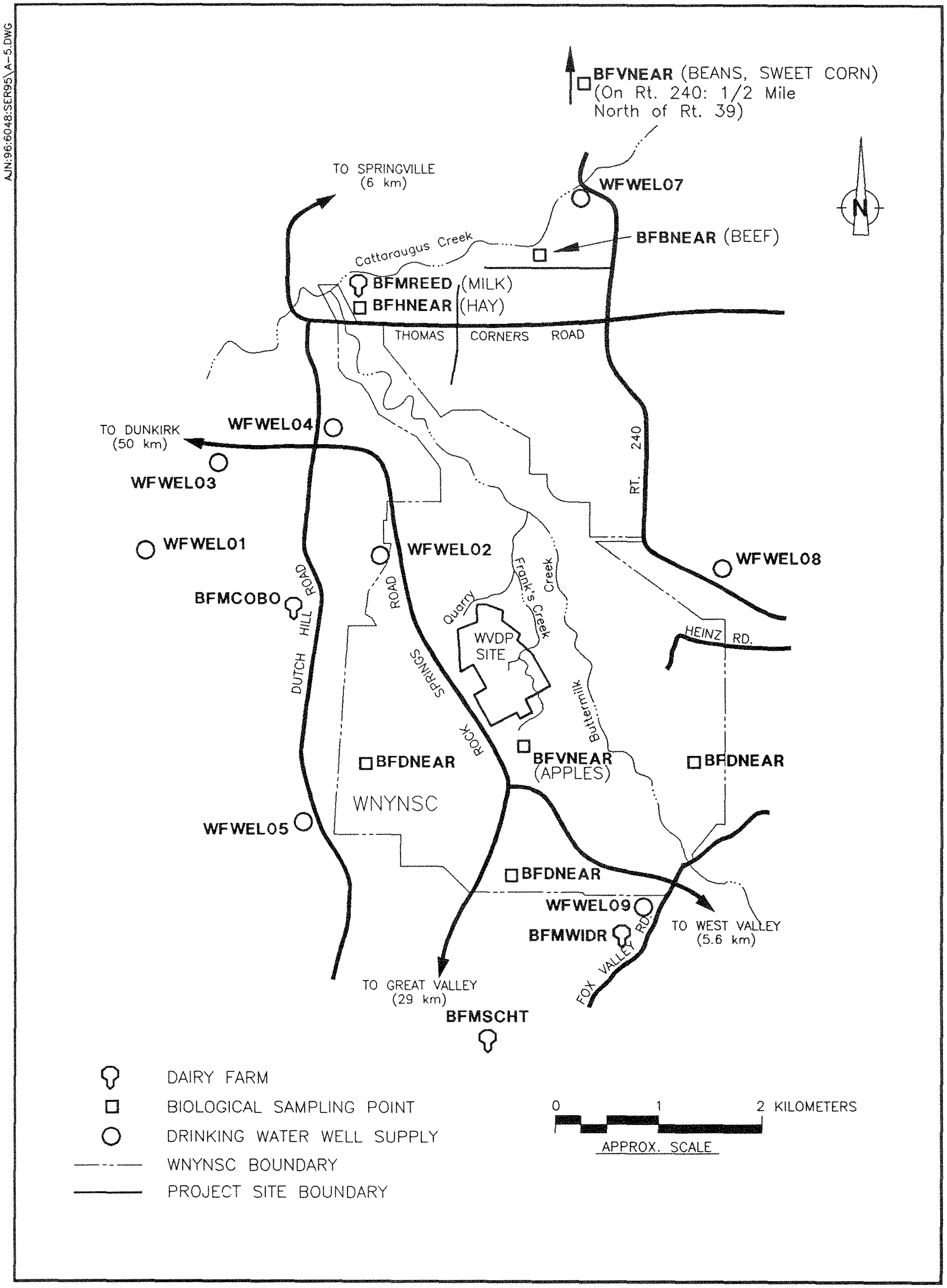


Figure A-5. Near–site Drinking Water and Biological Sample Points.

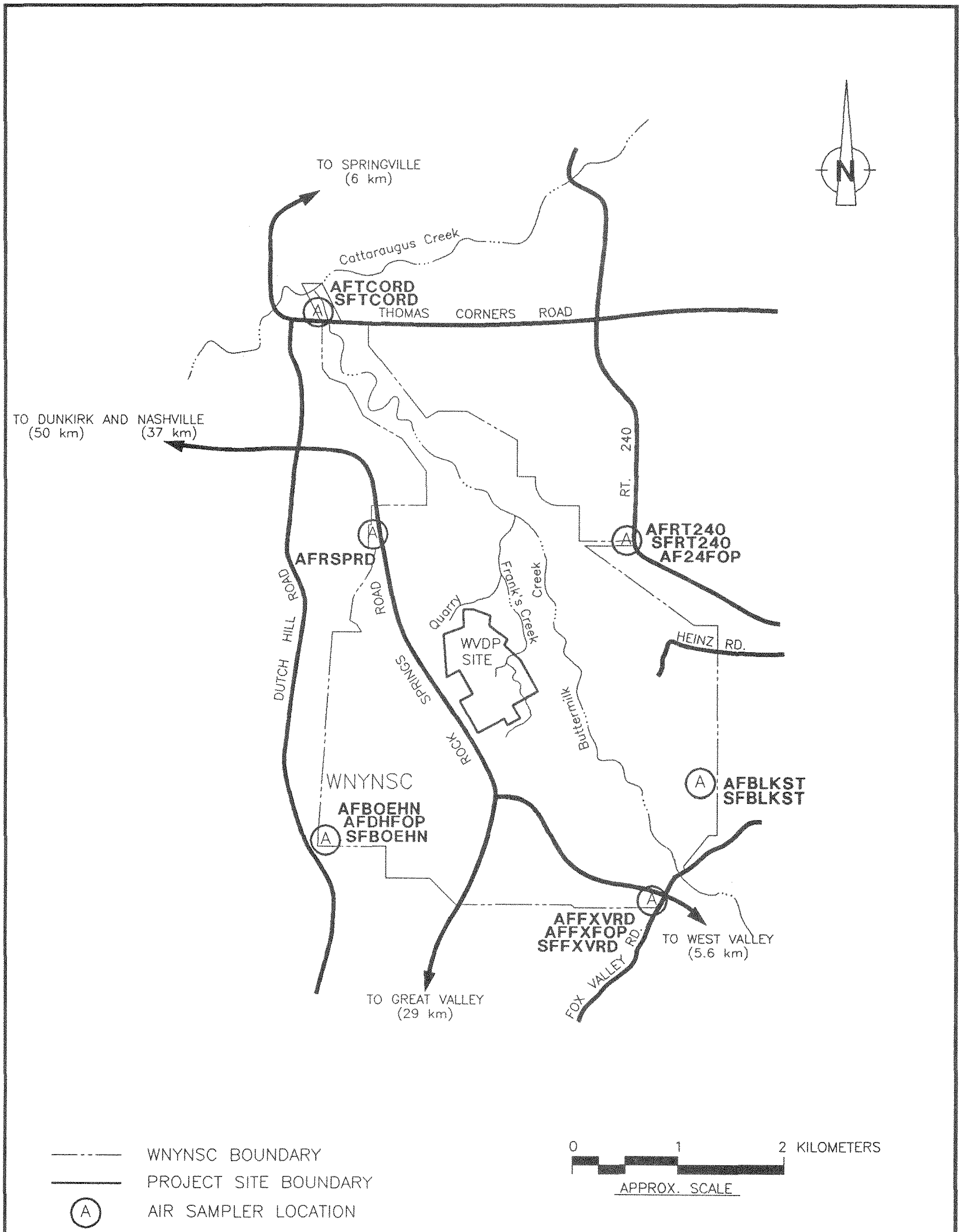


Figure A-6. Location of Perimeter Air, Soil, and Fallout Sampling Points.

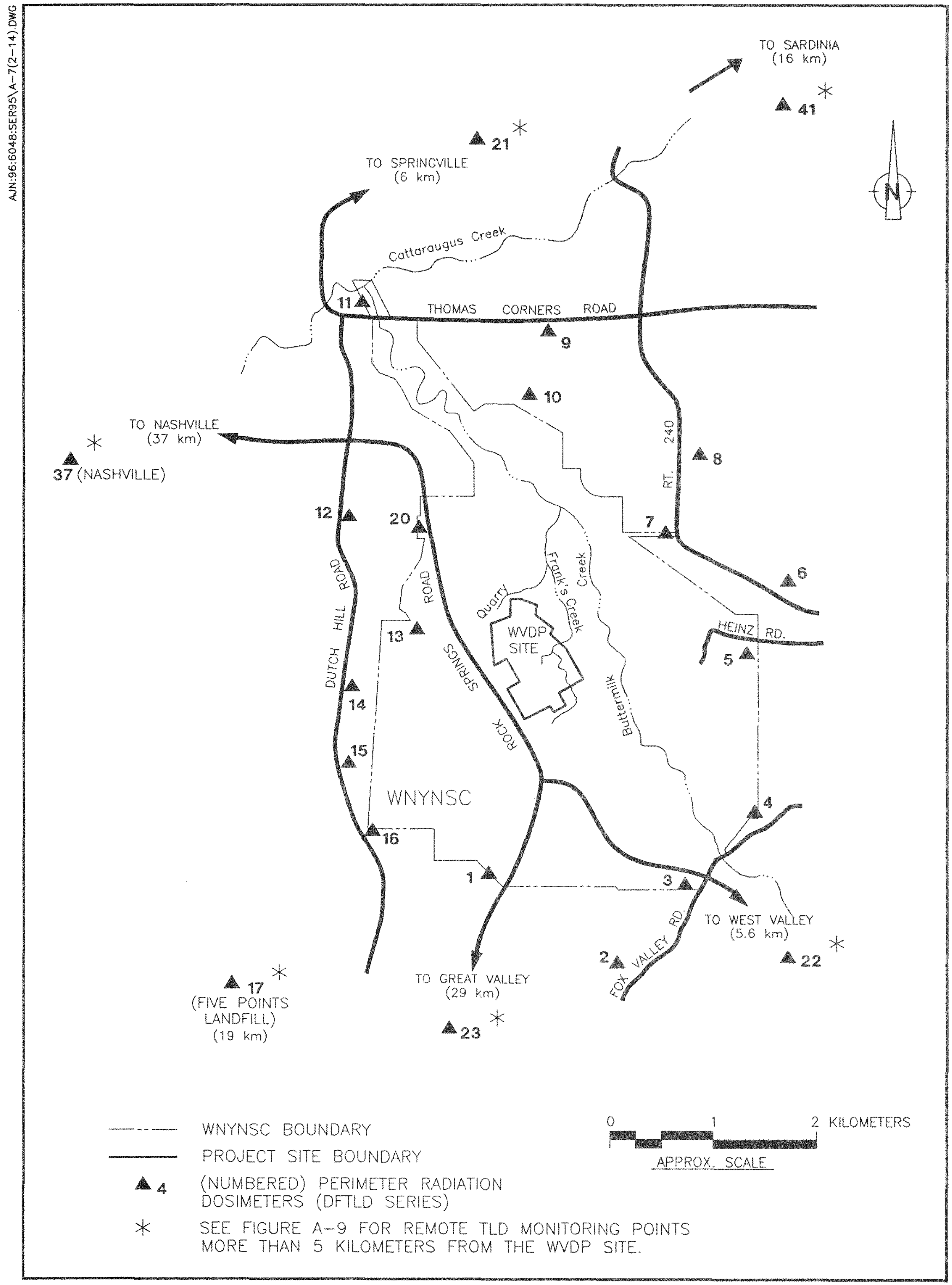


Figure A-7. Location of Off-site Thermoluminescent Dosimeters (TLDs).

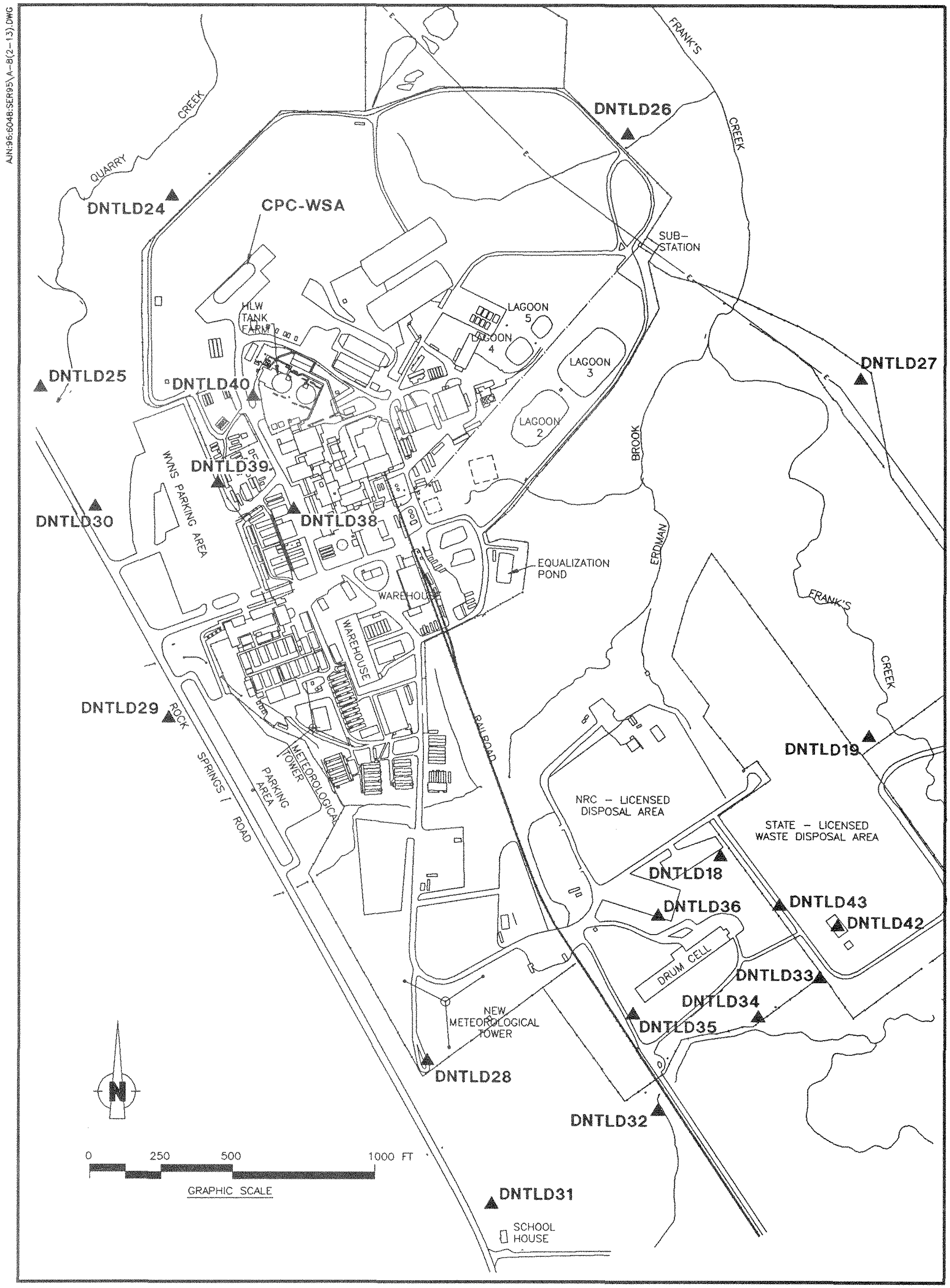
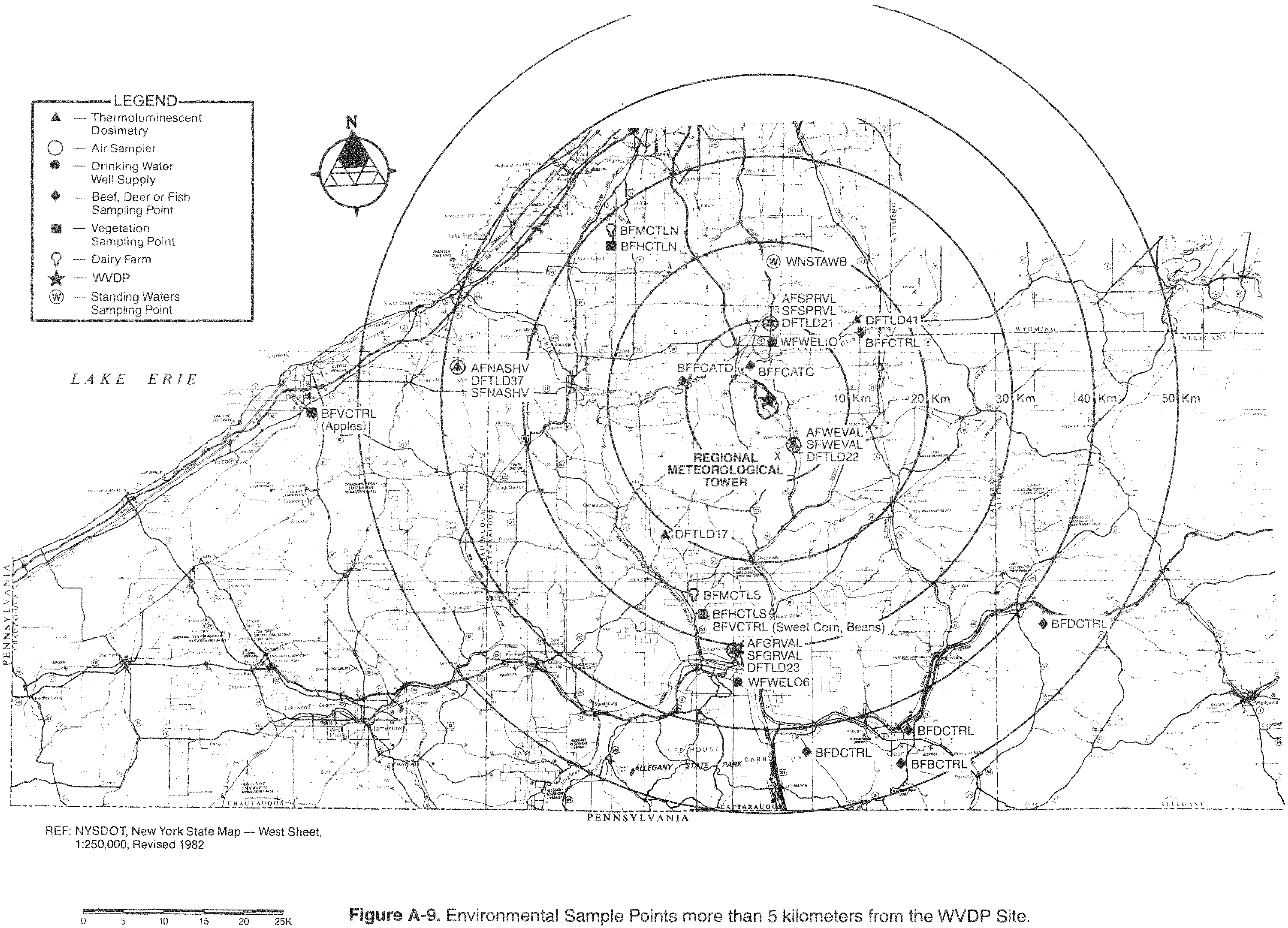


Figure A-8. Location of On-site Thermoluminescent Dosimeters (TLDs).



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

Figure A-9. Environmental Sample Points more than 5 kilometers from the WVDP Site.

Appendix B

Environmental Regulations, Orders, Standards, and Permits

Table B - 1

*Department of Energy Radiation Protection Standards and Derived Concentration Guides**

Effective Dose Equivalent Radiation Standard for Protection of the Public

Continuous exposure of any member of the public from routine activities:
100 mrem/year (1 mSv/yr) effective dose equivalent from all exposure pathways

Department of Energy Derived Concentration Guides (DCGs) for Drinking Water and Air (μCi/mL)

Radionuclide	Half-Life (years)	In Air	In Water	Radionuclide	Half-Life (years)	In Air	In Water
H-3**	1.2E+01	1E-07	2E-03	**Eu-152**	1.4E+01	5E-11	2E-05
C-14**	5.7E+03	6E-09	7E-05	**Eu-154****	8.8E+00	5E-11	2E-05
Fe-55	2.7E+00	5E-09	2E-04	**Eu-155**	5.0E+00	3E-10	1E-04
Ni-59	7.5E+04	4E-09	7E-04	**Th-232**	1.4E+10	7E-15	5E-08
Co-60**	5.3E+00	8E-11	5E-06	**U-232****	7.2E+01	2E-14	1E-07
Ni-63	1.0E+02	2E-09	3E-04	**U-233****	1.6E+05	9E-14	5E-07
Sr-90**	2.9E+01	9E-12	1E-06	**U-234****	2.4E+05	9E-14	5E-07
Y-90	7.3E-03	1E-09	1E-05	**U-235****	7.0E+08	1E-13	6E-07
Zr-93	1.5E+06	4E-11	9E-05	**U-236****	3.4E+06	1E-13	5E-07
Nb-93m	1.5E+01	4E-10	3E-04	**U-238****	4.5E+09	1E-13	6E-07
Tc-99**	2.1E+05	2E-09	1E-04	**Np-239**	6.5E-03	5E-09	5E-05
Ru-106	1.0E+00	3E-11	6E-06	**Pu-238****	8.8E+01	3E-14	4E-08
Cd-113m	1.4E+01	8E-12	9E-07	**Pu-239****	2.4E+04	2E-14	3E-08
Sb-125	2.8E+00	1E-09	5E-05	**Pu-240****	6.5E+03	2E-14	3E-08
Te-125m	1.6E-01	2E-09	4E-05	**Pu-241**	1.4E+01	1E-12	2E-06
Sn-126	1.0E+05	1E-10	8E-06	**Am-241****	4.3E+02	2E-14	3E-08
I-129**	1.6E+07	7E-11	5E-07	**Am-242m**	1.5E+02	2E-14	3E-08
Cs-134**	2.1E+00	2E-10	2E-06	**Am-243**	7.4E+03	2E-14	3E-08
Cs-135	2.3E+06	3E-09	2E-05	**Cm-243**	2.8E+01	3E-14	5E-08
Cs-137**	3.0E+01	4E-10	3E-06	**Cm-244**	1.8E+01	4E-14	6E-08
Pm-147	2.6E+00	3E-10	1E-04	**Gross Alpha (as Am-241)**	N/A	2E-14	3E-08
Sm-151	9.0E+01	4E-10	4E-04	**Gross Beta (as Sr-90)**	N/A	9E-12	1E-06

* *Ref: DOE Order 5400.5 (February 8, 1990). Effective May 8, 1990.*
** *Analysis for these radionuclides in WVDP effluent are performed routinely.*
N/A = Not applicable.

Table B - 2

Environmental Regulations, Orders, and Standards

The following environmental standards and laws are applicable, in whole or in part, to the West Valley Demonstration Project:

Atomic Energy Act of 1954, 42 USC 2011 et seq.

DOE Order 5400.1. November 9, 1988. *General Environmental Protection Program*, including Change 1 (June 29, 1990).

DOE Order 5480.1B. September 23, 1986. *Environment, Safety, and Health Program for DOE Operations*, including Change 5 (May 10, 1993).

DOE Order 5484.1. February 24, 1981. *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, including Change 7 (October 17, 1990).

Clean Air Act (CAA). 42 USC 7401 et seq., as amended, and implementing regulations.

Federal Water Pollution Control Act [Clean Water Act (CWA)]. 33 USC 1251 et seq., as amended, and implementing regulations.

Resource Conservation and Recovery Act (RCRA). 42 USC 6901 et seq., as amended, and implementing regulations.

National Environmental Policy Act (NEPA) of 1969. 42 USC 4321 et seq., as amended, and implementing regulations.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). 42 USC 9601 et seq. (including Superfund Amendments and Reauthorization Act of 1986), and implementing regulations.

Toxic Substances Control Act (TSCA). 15 USC 2601 et seq., as amended, and implementing regulations.

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, 42 USC 1001 et seq., and implementing regulations.

Safe Drinking Water Act (SDWA). 42 USC 300*f* et seq., as ammended, and implementing regulations.

Environmental Conservation Law of New York State, and implementing regulations (NYCRR).

The standards and guidelines applicable to releases of radionuclides from the West Valley Demonstration Project are found in DOE Order 5400.5 (February 8, 1990), including Change 2 (January 7, 1993).

Ambient water quality standards contained in the State Pollutant Discharge Elimination System (SPDES) permit issued for the facility are listed in Table C-5.1. Airborne discharges are also regulated by the Environmental Protection Agency under the National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61 Subpart H (December 15, 1989).

The above list covers the major activities at the West Valley Demonstration Project but does not constitute a comprehensive enumeration.

Table B - 3

West Valley Demonstration Project Environmental Permits

Permit Name and Number	Agency/Permit Type	Description	1995 Changes	Status
Boilers (042200-0114-00002 and 042200-0114-00003)	NYSDEC/Certificate to Operate an Air Emission Source (CO)	Boilers located in the utility room	A new CO was issued.	COs expire 8/01/99.
Cement storage silo ventilation system (042200-0114-CSS01)	NYSDEC/CO	Exhaust from the cement storage silo baghouse	A new CO was issued.	CO expires 8/01/99.
Analytical & Process Chemistry Laboratory (042200-0114-15F-1)	NYSDEC/CO	Analytical & Process Chemistry Laboratory equipment from various laboratories in the main plant	A new CO was issued.	CO expires 8/01/99.
Tank #35157 vent (042200-0114-35157)	NYSDEC/CO	Vent from 3,000-gallon sulfuric acid tank #35157	A new CO was issued.	CO expires 8/01/99.
Source-capture welding system (042200-0114-MS001)	NYSDEC/CO	Maintenance shop welding ventilation using "elephant trunk" ducts to vent welding fumes at the source of generation	A new CO was issued.	CO expires 8/01/99.
Blueprint machine (042200-0114-00012)	NYSDEC/CO	Blueprint machine vent for ammonia emissions	A new CO was issued.	CO expires 8/01/99.
Blower exhaust, welding only (042200-0114-00013) Welding/painting (042200-0114-00014) Painting only (042200-0114-00015)	NYSDEC/CO	Portable blowers (some with and some without filters) for venting emissions from typical painting and welding operations occurring at the site	None	COs expire in 1998/1999.

Table B - 3 (continued)

West Valley Demonstration Project Environmental Permits

Permit Name and Number	Agency/Permit Type	Description	1995 Changes	Status
Analytical cell mock-up unit (042200-0114-00027)	NYSDEC/CO	Analytical cell mock-up unit (located in the vitrification test facility) emissions from use of laboratory chemicals	None	CO expires 12/01/98.
Scale vitrification system (SVS) solids transfer system (042200-0114-SVS01) SVS vessel vent system (042200-0114-SVS02) SVS mini-melter off-gas system (042200-0114-SVS04)	NYSDEC/CO	Scale vitrification system vac-u-max solids transfer system vent, feed mix tank vent, and melter off-gas treatment system emissions.	NYSDEC inspected on 10/03/95.	The SVS is not currently operating. Extensions of the COs are forthcoming.
SVS ammonia vent system-emission point system SVS07 (04220-0114-SVS07)	NYSDEC/CO	Scale vitrification system ammonia vent system for relieving pressure before cylinder change-outs	None	CO expires 8/01/99.
Environmental Analytical Annex laboratory hoods (042200-0114-00016 through 042200-0114-00026)	NYSDEC/CO	Eleven separate blowers for laboratory hoods and analytical equipment in the Environmental Analytical Annex (EAA) [i.e., vitrification cold operations laboratory]	None	COs expire 8/01/99.

Table B - 3 (continued)

West Valley Demonstration Project Environmental Permits

Permit Name and Number	Agency/Permit Type	Description	1995 Changes	Status
Cold chemical solids transfer system (042200-0114-CTS02) Cold chemical vessel vent system (042200-0114-CTS03) Cold chemical vessel dust collection hood (042200-0114-CTS04)	NYSDEC/CO	Cold chemical facility. Dry or solid chemical emissions from solids transfer system, dust collection hood, and from mix tank vent for vitrification operations	A conversion from a PC to a CO was requested in 9/95. NYSDEC inspected on 10/03/95. COs were issued.	COs expire 8/01/99.
Vitrification facility heating, ventilation, and air conditioning (HVAC) system (042200-0114-15F-2)	NYSDEC/CO	Canister-welding emissions vented through vitrification facility HVAC system. [i.e., canister welding ventilation]	A conversion from a PC to a CO was requested in 9/95. NYSDEC inspected on 10/03/95. COs were issued.	CO expires 8/01/99.
Vitrification off-gas treatment system (042200-0114-15F-1)	NYSDEC/Permit to Construct (PC) an Air Emission Source	Vitrification facility off-gas treatment system emissions	The PC was extended.	PC extended to 7/31/96. Will convert to a CO after NOx stack testing, scheduled for 5/96.
Slurry-fed ceramic melter (modification to WVDP-687-01)	EPA/Interim NESHAP	Slurry-fed ceramic melter radionuclide emissions	A conditional NESHAP permit was issued.	Issued 5/08/95. No expiration date.
Vitrification facility HVAC system	EPA/Interim NESHAP	Vitrification facility HVAC system radionuclide emissions	None	Issued 5/08/95. No expiration date.
01-14 building ventilation system (WVDP-187-01)	EPA/NESHAP	Liquid waste treatment system ventilation of radionuclides in the 01-14 building	None	Issued 10/05/87. Modified 5/25/89. No expiration date.
Contact size-reduction facility (WVDP-287-01)	EPA/NESHAP	Contact size-reduction and decontamination facility radionuclide emissions	None	Issued 10/05/87. No expiration date.

Table B - 3 (continued)

West Valley Demonstration Project Environmental Permits

Permit Name and Number	Agency/Permit Type	Description	1995 Changes	Status
Supernatant treatment system (WVDP-387-01)	EPA/NESHAP	Supernatant treatment system ventilation for radionuclide emissions	None	Issued 10/05/87. No expiration date.
Low-level waste supercompactor (WVDP-487-01)	EPA/NESHAP	Low-level waste supercompactor ventilation system for radionuclide emissions	None	Issued 10/05/87. No expiration date.
Outdoor ventilated enclosures (WVDP-587-01)	EPA/NESHAP	Ten portable ventilation units for removal of radionuclides	None	Issued 12/22/87. No expiration date.
Process building ventilation system (WVDP-687-01)	EPA/NESHAP	Original main plant ventilation of radionuclides	None	Issued 12/22/87. No expiration date.
State Pollutant Discharge Elimination System (SPDES [NY-0000973])	NYSDEC/Water discharge	Covers discharges to surface waters from various sources on-site	The permit was modified in June 1995 to include additional water-treatment chemicals. Construction of a flow augmentation system was completed.	Expires 2/01/99.
Buffalo Pollutant Discharge Elimination System (95-05-TR096)	Buffalo Sewer Authority/Sanitary sewage and sludge	Permit issued to hauler of waste from the wastewater treatment facility	None	Expires 6/30/96. Currently pursuing auxiliary disposal alternatives.
Chemical bulk storage	NYSDEC/Chemical bulk storage tank registration	Registration of bulk storage tanks used for listed hazardous chemicals	None	Expires 7/97. Will renew before expiration.
Petroleum bulk storage	NYSDEC/Petroleum bulk storage tank registration	Registration of bulk storage tanks used for petroleum	None	Expires 9/96. Will renew before expiration.

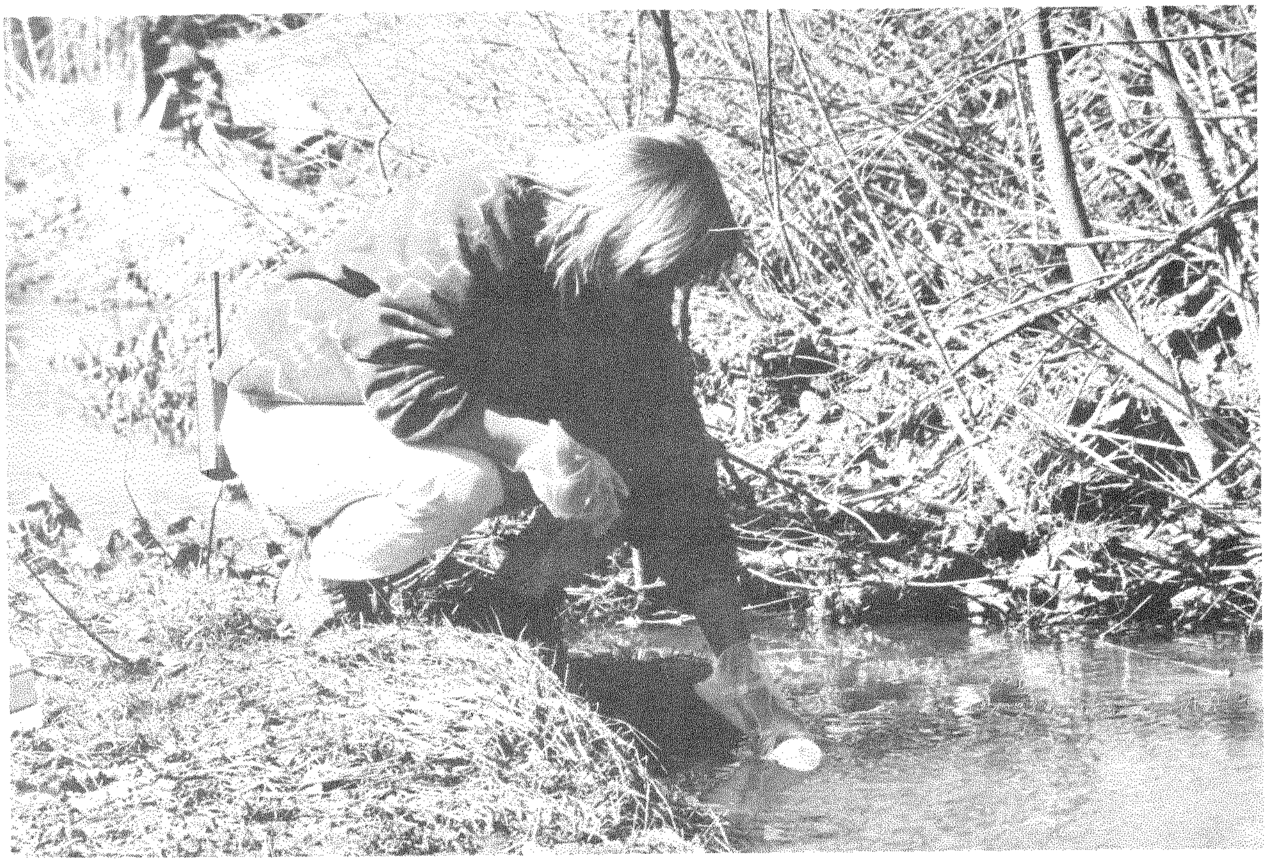
Table B - 3 (concluded)

West Valley Demonstration Project Environmental Permits

Permit Name and Number	Agency/Permit Type	Description	1995 Changes	Status
Bird depredation permit	U.S. Fish & Wildlife Service/New York State Division of Fish and Wildlife	Licenses for the removal of nests of migratory birds	The permit was renewed.	Two-year license and annual report. Revised to adhere to Inactive Nest Standard Conditions. Expires 12/31/97. Annual report due to U.S. Fish and Wildlife Service by 1/31/97.

Appendix C - 1

Summary of Water and Sediment Monitoring Data



Collecting a Sample at a WVDP Stream Sampling Location

Table C - 1.1

Total Radioactivity of Liquid Effluents Released from Lagoon 3 in 1995 (curies)*

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Alpha	6.07±1.51E-04	1.43±0.60E-04	2.78±1.09E-04	2.38±1.32E-04	1.27±0.24E-03
Beta	8.71±0.34E-03	2.42±0.11E-03	3.89±0.23E-03	5.24±0.29E-03	2.03±0.05E-02
H-3	3.14±0.07E-01	3.58±0.11E-01	5.34±0.16E-01	2.18±0.07E-01	1.42±0.02E+00
Sr-90	1.89±0.09E-03	6.64±0.45E-04	1.33±0.07E-03	1.66±0.09E-03	5.54±0.15E-03
Cs-137	3.44±0.59E-04	9.44±2.65E-05	1.20±0.31E-04	3.05±0.44E-04	8.63±0.84E-04
Co-60	0.00±6.14E-05	0.00±3.10E-05	0.00±4.35E-05	0.00±4.36E-05	0.00±9.23E-05
K-40	1.24±0.51E-03	0.00±3.76E-04	0.00±5.33E-04	0.00±5.58E-04	1.24±1.00E-03
U-232	4.20±0.29E-04	7.12±0.66E-05	1.06±0.08E-04	1.25±0.08E-04	7.22±0.32E-04
U-233/234	2.43±0.19E-04	2.96±0.39E-05	6.53±0.54E-05	7.82±0.54E-05	4.16±0.21E-04
U-235/236	5.10±1.27E-06	1.85±0.71E-06	2.08±0.62E-06	2.10±0.58E-06	1.11±0.17E-05
U-238	1.32±0.10E-04	2.16±0.33E-05	3.38±0.33E-05	4.47±0.33E-05	2.32±0.12E-04
Pu-238	1.27±0.20E-05	0.94±2.16E-07	9.19±4.96E-07	6.59±1.05E-06	2.03±0.23E-05
Pu-239/240	3.50±1.03E-06	-1.39±9.00E-08	2.98±2.82E-07	3.01±0.63E-06	6.79±1.24E-06
Am-241	3.57±1.08E-06	2.15±3.16E-07	1.67±5.42E-07	2.17±0.71E-06	6.12±1.44E-06
I-129	6.53±2.41E-05	2.90±1.48E-05	5.70±1.80E-05	3.44±1.68E-05	1.86±0.38E-04
C-14	2.06±0.87E-04	2.31±0.40E-04	1.63±0.42E-04	1.41±0.54E-04	7.41±1.18E-04
Tc-99	8.08±1.42E-03	2.58±0.82E-03	5.41±0.89E-03	3.30±1.16E-03	1.94±0.22E-02
Total U (g)	3.92±0.16E+02	7.18±0.11E+01	1.99±0.02E+02	1.45±0.08E+02	8.08±0.18E+02

* *Results for samples collected from monitoring location WNSP001.*

Table C - 1.2

Comparison of 1995 Lagoon 3* Liquid Effluent Radioactivity Concentrations with Department of Energy Guidelines

Isotope	Discharge Activity[a] (Ci)	Radioactivity[a] (Bequerels)	Concentration (μCi/mL)	DCG (μCi/mL)	% of DCG
Alpha	1.27±0.24E-03	4.68±0.87E+07	3.26±0.61E-08	N/A[b]	N/A
Beta	2.03±0.05E-02	7.50±0.19E+08	5.22±0.13E-07	N/A[b]	N/A
H-3	1.42±0.02E+00	5.27±0.08E+10	3.67±0.06E-05	2.00E-03	1.83
Sr-90	5.54±0.15E-03	2.05±0.06E+08	1.43±0.04E-07	1.00E-06	14.28
Cs-137	8.63±0.84E-04	3.19±0.31E+07	2.22±0.22E-08	3.00E-06	0.74
Co-60	0.00±9.23E-05	0.00±3.42E+06	0.00±2.38E-09	5.00E-06	<0.05
K-40	1.24±1.00E-03	4.59±3.69E+07	3.19±2.57E-08	N/A[b]	N/A
U-232 [c]	7.22±0.32E-04	2.67±0.12E+07	1.86±0.08E-08	1.00E-07	18.61
U-233/234 [c]	4.16±0.21E-04	1.54±0.08E+07	1.07±0.05E-08	5.00E-07	2.14
U-235/236 [c]	1.11±0.17E-05	4.12±0.62E+05	2.87±0.43E-10	5.00E-07	0.06
U-238 [c]	2.32±0.12E-04	8.59±0.43E+06	5.98±0.30E-09	6.00E-07	1.00
Pu-238	2.03±0.23E-05	7.51±0.86E+05	5.23±0.60E-10	4.00E-08	1.31
Pu-239/240	6.79±1.24E-06	2.51±0.46E+05	1.75±0.32E-10	3.00E-08	0.58
Am-241	6.12±1.44E-06	2.27±0.53E+05	1.58±0.37E-10	3.00E-08	0.53
I-129	1.86±0.38E-04	6.87±1.39E+06	4.78±0.97E-09	5.00E-07	0.96
C-14	7.41±1.18E-04	2.74±0.44E+07	1.91±0.30E-08	7.00E-05	0.03
Tc-99	1.94±0.22E-02	7.17±0.81E+08	4.99±0.57E-07	1.00E-04	0.50
Total % of DCGs					**42.61**

[a] *Total volume released: 3.88E+10 mL.*

[b] *Derived concentration guides (DCGs) are not applicable to gross alpha, gross beta, or potassium-40 activity.*

[c] *Total U (g) = 8.08±0.18E+02; average U (μg/mL) = 2.08±0.05E-02*

N/A - Not applicable.

Half-lives are listed in Table B-1.

** Results for samples collected from monitoring location WNSP001.*

Table C - 1.3

1995 Monthly Radioactivity Concentrations (μCi/mL) and pH in Surface Water at Location WNSP005

Month	Alpha	Beta	H-3	pH (standard units)
January	0.00±7.85E-09	1.15±0.17E-07	9.94±7.74E-08	7.09
February	-1.00±1.04E-08	1.33±0.17E-07	0.00±1.00E-07	7.49
March	1.04±1.47E-08	2.25±0.21E-07	8.95±5.53E-08	7.26
April	-0.54±1.30E-08	3.33±0.34E-07	1.10±0.78E-07	7.05
May	-1.19±3.06E-09	7.57±0.83E-08	1.85±0.80E-07	7.68
June	1.78±3.41E-09	6.84±0.77E-08	3.51±7.69E-08	7.77
July	-0.55±2.85E-09	5.05±0.70E-08	2.89±7.62E-08	7.78
August	1.29±2.48E-09	9.12±0.74E-08	7.68±7.71E-08	7.92
September	0.76±2.64E-09	7.65±0.69E-08	9.24±7.73E-08	7.77
October	0.41±2.04E-09	1.02±0.08E-07	1.51±0.84E-07	7.68
November	2.51±2.19E-09	1.72±0.09E-07	1.25±0.79E-07	7.35
December	2.17±2.53E-09	4.76±0.15E-07	7.08±7.56E-08	7.90

Table C - 1.4

1995 Radioactivity Concentrations (μCi/mL) in Surface Water Downstream of the WVDP at Frank's Creek (WNSP006)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
*January**	2.30±2.88E-09	4.90±0.48E-08	7.52±0.92E-07	2.10±0.34E-08	0.00±1.50E-08
February	1.38±3.15E-09	2.67±0.37E-08	1.14±0.76E-07	1.23±0.30E-08	0.00±1.02E-08
*March**	2.74±3.39E-09	5.42±0.52E-08	1.65±0.13E-06	1.64±0.30E-08	0.00±1.46E-08
April	-0.64±2.35E-09	2.86±0.40E-08	1.68±0.79E-07	1.26±0.30E-08	0.00±1.41E-08
May	0.01±1.40E-09	4.53±0.35E-08	1.69±0.80E-07	2.25±0.30E-08	0.00±1.45E-08
*June**	6.66±2.67E-09	1.88±0.07E-07	1.83±0.07E-05	1.38±0.33E-08	0.00±1.37E-08
July	1.22±3.07E-09	8.42±0.71E-08	4.12±0.81E-07	3.78±0.45E-08	0.00±2.01E-08
*August**	4.58±2.65E-09	1.98±0.10E-07	1.68±0.07E-05	6.56±0.62E-08	0.00±1.56E-08
September	0.68±2.21E-09	9.67±0.60E-08	4.86±0.76E-07	3.71±0.44E-08	0.00±1.20E-08
October	-0.30±1.37E-09	5.05±0.45E-08	2.03±0.81E-07	2.32±0.43E-08	0.00±1.34E-08
November	0.36±1.04E-09	3.07±0.36E-08	1.43±0.79E-07	1.24±0.28E-08	0.00±1.88E-08
*December**	1.65±1.04E-09	6.08±0.44E-08	1.68±0.11E-06	2.68±0.39E-08	0.00±1.75E-08

Quarter	C-14	I-129	U-232	U-233/234	U-235/236
1st Qtr	4.03±5.49E-09	0.58±1.03E-09	8.01±0.74E-10	7.25±1.37E-10	2.51±2.25E-11
2nd Qtr	2.42±7.24E-09	2.14±1.13E-09	0.00±1.16E-10	3.82±1.20E-10	4.42±4.93E-11
3rd Qtr	0.38±5.58E-09	7.11±7.65E-10	1.46±0.17E-09	1.33±0.27E-09	9.87±7.21E-11
4th Qtr	0.76±7.11E-09	-0.52±1.07E-09	3.07±0.24E-10	3.55±0.80E-10	5.06±2.96E-11

Quarter	U-238	Total U (μg/mL)	Pu-238	Pu-239/240	Am-241	Tc-99
1st Qtr	4.35±1.01E-10	8.85±0.16E-04	1.84±7.26E-11	1.51±2.14E-11	4.96±7.65E-11	1.43±0.18E-08
2nd Qtr	3.86±1.20E-10	1.74±0.02E-03	2.39±4.84E-11	-0.97±1.38E-11	-1.71±4.33E-11	3.11±0.26E-08
3rd Qtr	6.23±1.71E-10	1.61±0.02E-03	-0.69±3.31E-11	2.79±2.12E-11	1.55±3.11E-11	4.61±0.35E-08
4th Qtr	2.14±0.60E-10	8.42±0.46E-04	9.52±3.60E-11	0.76±1.11E-11	1.65±4.39E-11	7.76±1.66E-09

** Month of discharge from WNSP001. See Table C-1.27 for a summary of water quality parameters at WNSP006.*

Table C - 1.5

1995 Monthly Radioactivity Concentrations (μCi/mL) in Surface Water at Location WNSP007

Month	Alpha	Beta	H-3	Cs-137
January	3.06±9.70E-09	1.98±1.23E-08	0.00±1.00E-07	
February	-3.80±7.57E-09	1.26±0.98E-08	2.39±8.44E-08	
March	-0.08±1.10E-08	3.81±1.31E-08	7.10±8.70E-08	
1st Qtr				0.00±4.37E-09
April	-3.14±8.79E-09	3.54±1.10E-08	8.40±8.10E-08	
May	1.70±2.41E-09	1.92±0.53E-08	5.37±8.71E-08	
June	-0.56±3.65E-09	2.30±0.58E-08	2.95±8.59E-08	
2nd Qtr				0.00±4.50E-09
July	0.69±3.89E-09	2.49±0.59E-08	7.64±7.70E-08	
August	-1.35±3.27E-09	1.53±0.71E-08	3.12±6.52E-08	
September	-0.47±2.21E-09	2.54±0.48E-08	5.84±7.75E-08	
3rd Qtr				0.00±4.53E-09
October	0.76±1.93E-09	2.57±0.47E-08	4.87±8.89E-08	
November	-0.78±1.70E-09	2.74±0.44E-08	4.04±7.50E-08	
December	0.41±1.21E-09	2.56±0.45E-08	9.67±7.70E-08	
4th Qtr				0.00±5.23E-09

Table C - 1.6

1995 Monthly Radioactivity Concentrations (μCi/mL) in Surface Water at French Drain Location WNSP008

Month	Alpha	Beta	H-3
January	1.19±4.04E-09	3.43±0.83E-08	3.80±0.16E-06
February	-5.43±7.53E-09	4.58±0.89E-08	3.77±0.17E-06
March	-3.52±3.64E-09	3.22±0.54E-08	2.94±0.14E-06
April	1.37±8.05E-09	4.48±0.88E-08	2.94±0.14E-06
May	0.36±1.90E-09	4.46±0.44E-08	3.72±0.16E-06
June	3.32±2.62E-09	4.70±0.44E-08	3.83±0.17E-06
July	1.48±1.39E-09	4.67±0.31E-08	3.65±0.16E-06
August	-1.84±1.52E-09	3.22±0.29E-08	3.02±0.14E-06
September	1.52±2.21E-09	4.26±0.43E-08	3.80±0.16E-06
October	0.76±1.43E-09	3.38±0.27E-08	3.50±0.16E-06
November	-0.55±1.34E-09	2.50±0.37E-08	2.10±0.12E-06
December	1.26±1.08E-09	3.65±0.28E-08	2.28±0.12E-06

Table C - 1.7

1995 Radioactivity Concentrations (µCi/mL) in Surface Water at the Northeast Swamp Location (WNSWAMP)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
January	6.11±5.91E-09	1.50±0.04E-06	3.06±0.83E-07	6.56±0.18E-07	0.00±4.64E-09
February	5.39±7.19E-09	1.82±0.04E-06	2.86±0.80E-07	7.30±0.21E-07	0.00±4.43E-09
March	0.54±4.67E-09	1.76±0.04E-06	2.90±0.79E-07	8.12±0.22E-07	0.00±4.52E-09
April	3.51±8.12E-09	2.38±0.05E-06	3.81±0.81E-07	1.08±0.03E-06	0.00±4.56E-09
May	5.46±2.37E-09	3.07±0.03E-06	3.69±0.80E-07	1.21±0.03E-06	0.00±4.39E-09
June	5.66±2.57E-09	3.66±0.03E-06	4.42±0.81E-07	1.68±0.03E-06	0.00±4.26E-09
July	3.29±2.40E-09	3.96±0.04E-06	4.09±0.82E-07	1.77±0.03E-06	0.00±4.21E-09
August	2.10±2.30E-09	3.01±0.03E-06	3.98±0.82E-07	1.35±0.02E-06	0.00±4.62E-09
September	2.15±2.17E-09	4.55±0.04E-06	4.50±0.81E-07	2.01±0.03E-06	0.00±4.71E-09
October	0.97±1.73E-09	3.87±0.03E-06	3.11±0.79E-07	1.63±0.03E-06	0.00±4.42E-09
November	-0.52±1.25E-09	2.24±0.03E-06	2.46±0.78E-07	1.07±0.02E-06	0.00±1.43E-08
December	0.26±1.06E-09	2.12±0.02E-06	1.92±0.77E-07	9.89±0.21E-07	0.00±1.40E-08

Quarter	C-14	I-129	U-232	U-233/234	U-235/236
1st Qtr	0.59±1.09E-08	-0.18±9.06E-10	8.66±0.83E-11	2.45±0.82E-10	2.72±4.23E-11
2nd Qtr	-1.09±0.70E-08	1.12±1.56E-09	0.00±6.01E-10	2.81±2.57E-10	-5.18±7.34E-11
3rd Qtr	-0.59±9.39E-09	2.67±3.94E-10	3.30±0.41E-11	1.98±0.95E-10	1.05±0.64E-10
4th Qtr	0.13±1.44E-08	2.25±9.84E-10	0.00±2.79E-11	1.52±0.41E-10	0.28±1.13E-11

	U-238	Total U (µg/mL)	Pu-238	Pu-239/240	Am-241
1st Qtr	1.38±0.75E-10	9.82±0.79E-05	1.56±3.47E-11	4.89±9.78E-12	8.66±5.76E-11
2nd Qtr	2.04±2.05E-10	-8.86±0.21E-05	-0.51±2.50E-10	1.65±1.35E-10	1.35±0.67E-10
3rd Qtr	8.95±6.94E-11	-1.12±0.02E-04	4.41±3.43E-11	-0.27±1.38E-11	1.55±3.49E-11
4th Qtr	1.08±0.34E-10	2.88±0.17E-04	6.45±5.44E-11	1.21±2.43E-11	1.48±0.47E-10

See Table C-1.27 for a summary of water quality parameters at WNSWAMP.

Table C - 1.8

1995 Radioactivity Concentrations (μCi/mL) in Surface Water at the North Swamp Location (WNSW74A)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
January	2.14±3.66E-09	1.40±0.37E-08	3.39±8.21E-08	8.22±2.59E-09	0.00±1.36E-08
February	0.42±5.23E-09	1.31±0.37E-08	6.12±8.41E-08	5.34±2.03E-09	0.00±1.43E-08
March	-1.35±4.38E-09	1.26±0.45E-08	9.46±8.38E-08	6.23±2.51E-09	0.00±1.53E-08
April	-0.57±4.56E-09	1.32±0.49E-08	7.28±7.82E-08	7.08±2.56E-09	0.00±1.00E-08
May	0.91±1.22E-09	1.34±0.24E-08	7.75±8.40E-08	9.40±2.55E-09	0.00±1.20E-08
June	0.48±1.46E-09	1.14±0.24E-08	2.68±7.40E-08	1.09±0.32E-08	0.00±9.38E-09
July	0.61±1.44E-09	1.44±0.25E-08	2.62±7.54E-08	7.73±2.48E-09	0.00±1.22E-08
August	-0.24±1.39E-09	1.42±0.25E-08	2.05±8.76E-08	9.27±2.59E-09	0.00±1.36E-08
September	0.23±1.40E-09	1.23±0.24E-08	3.22±7.85E-08	1.00±0.30E-08	0.00±1.39E-08
October	0.07±1.01E-09	1.39±0.23E-08	5.44±8.54E-08	8.10±2.76E-09	0.00±1.37E-08
November	-0.35±1.02E-09	1.85±0.26E-08	3.14±8.11E-08	2.88±0.41E-08	0.00±1.12E-08
December	0.35±1.10E-09	1.94±0.26E-08	4.96±7.87E-08	1.98±0.36E-08	0.00±1.27E-08

Quarter	C-14	I-129	U-232	U-233/234	U-235/236
1st Qtr	5.26±5.55E-09	-0.91±9.23E-10	3.06±0.29E-11	1.29±0.57E-10	0.58±2.35E-11
2nd Qtr	-0.57±5.75E-09	6.90±5.74E-10	0.00±6.76E-11	1.12±0.61E-10	5.03±4.62E-11
3rd Qtr	2.57±5.62E-09	6.36±7.69E-10	6.27±5.11E-11	1.09±0.75E-10	1.55±3.12E-11
4th Qtr	-0.80±5.67E-09	0.07±1.10E-09	0.00±3.65E-11	8.16±3.62E-11	1.33±1.57E-11

	U-238	Total U (μg/mL)	Pu-238	Pu-239/240	Am-241
1st Qtr	1.23±0.54E-10	-2.34±0.10E-04	4.65±6.23E-11	1.89±2.19E-11	0.74±4.24E-11
2nd Qtr	7.74±4.94E-11	3.09±0.05E-04	1.05±4.56E-11	1.08±2.83E-11	-4.36±8.73E-12
3rd Qtr	2.06±3.88E-11	-1.70±0.02E-04	9.17±5.47E-11	0.30±2.04E-11	1.79±3.38E-11
4th Qtr	8.92±3.78E-11	1.90±0.12E-04	7.29±3.50E-11	2.58±8.47E-12	1.17±4.31E-11

See Table C-1.27 for a summary of water quality parameters at WNSW74A.

Table C - 1.9

1995 Monthly Radioactivity Concentrations (μCi/mL) and pH in Surface Water at Location WNFRC67

Month	Alpha	Beta	H-3	pH (standard units)
January	1.22±1.46E-09	1.46±1.71E-09	7.71±7.90E-08	7.32
February	-1.66±1.33E-09	2.35±1.70E-09	1.36±7.82E-08	7.03
March	0.00±1.21E-09	1.24±1.45E-09	1.09±0.78E-07	7.74
April	-0.61±1.47E-09	2.67±1.78E-09	5.97±7.77E-08	7.49
May	-1.82±4.69E-10	2.06±0.84E-09	6.61±7.89E-08	7.91
June	1.17±1.13E-09	3.64±0.98E-09	1.21±8.58E-08	7.53
July	0.63±1.17E-09	5.82±1.48E-09	1.92±7.79E-08	7.44
August	0.50±1.28E-09	5.10±1.63E-09	1.37±0.78E-07	7.65
September	2.25±4.25E-10	5.05±1.37E-09	2.11±0.57E-07	7.89
October	0.78±1.02E-09	5.92±2.11E-09	2.10±0.83E-07	7.45
November	-1.70±5.43E-10	2.60±1.90E-09	0.00±1.00E-07	7.54
December	4.87±5.68E-10	4.83±1.82E-09	8.84±7.66E-08	8.16

Table C - 1.10

1995 Monthly Radioactivity Concentrations (μCi/mL) and pH in Surface Water at Location WNERB53

Month	Alpha	Beta	H-3	pH (standard units)
January	1.21±2.34E-09	2.00±0.39E-08	1.43±0.81E-07	7.67
February	0.11±3.18E-09	2.24±0.42E-08	1.86±0.82E-07	7.45
March	-0.92±2.80E-09	1.87±0.38E-08	1.83±0.74E-07	7.56
April	-0.12±2.79E-09	1.67±0.40E-08	2.26±0.75E-07	7.67
May	0.30±1.50E-09	1.31±0.19E-08	7.72±8.30E-08	7.86
June	-0.02±1.33E-09	1.81±0.21E-08	7.98±7.68E-08	8.06
July	1.04±2.09E-09	2.15±0.29E-08	8.71±7.64E-08	7.99
August	-0.49±2.10E-09	1.69±0.39E-08	5.42±8.22E-08	7.97
September	0.33±1.64E-09	2.43±0.33E-08	4.19±8.44E-08	8.01
October	0.61±1.32E-09	1.89±0.30E-08	9.97±7.58E-08	7.83
November	0.89±8.40E-10	2.26±0.27E-08	1.30±0.78E-07	7.46
December	3.84±8.79E-10	1.66±0.30E-08	9.47±7.19E-08	7.69

Table C - 1.11

1995 Monthly Radioactivity Concentrations (µCi/mL) and pH in Surface Water at Location WNCOOLW

Month	Alpha	Beta	H-3	pH (standard units)
January	0.70±1.72E-09	8.28±3.34E-09	4.27±7.71E-08	8.24
February	-0.72±4.68E-09	9.53±4.62E-09	5.54±5.32E-08	8.02
March	-0.83±4.31E-09	2.12±0.51E-08	1.37±0.79E-07	8.34
April	3.55±4.26E-09	1.74±0.53E-08	9.86±7.85E-08	8.04
May	-0.19±1.51E-09	1.79±0.27E-08	7.06±7.79E-08	8.57
June	0.60±1.82E-09	1.94±0.32E-08	6.62±5.48E-08	8.59
July	2.95±2.32E-09	2.16±0.37E-08	0.00±1.00E-07	8.56
August	1.29±2.48E-09	1.36±0.46E-08	7.17±7.91E-08	8.85
September	-0.76±2.03E-09	3.04±0.51E-08	2.62±7.76E-08	8.88
October	1.28±2.09E-09	1.98±0.46E-08	7.09±8.23E-08	8.80
November	0.28±2.05E-09	1.98±0.47E-08	0.00±7.07E-08	8.93
December	0.45±1.21E-09	1.16±0.38E-08	1.56±0.78E-07	8.66

Table C - 1.12

1995 Monthly Radioactivity Concentrations (µCi/mL) in Surface Water at Location WNSDADR

Month	Alpha	Beta	H-3	Cs-137
January	0.31±1.05E-09	-0.15±2.48E-09	1.86±0.78E-07	0.00±1.51E-08
February	-8.46±9.58E-10	4.78±2.59E-09	7.79±5.45E-08	0.00±1.37E-08
March	-6.62±9.17E-10	0.83±2.43E-09	2.70±0.79E-07	0.00±1.40E-08
April	0.00±8.86E-10	0.73±2.28E-09	3.89±0.81E-07	0.00±1.45E-08
May	1.62±2.94E-10	9.24±7.42E-10	1.88±0.78E-07	0.00±1.50E-08
June	4.11±6.80E-10	3.91±0.98E-09	3.02±0.80E-07	0.00±1.47E-08
July	4.01±8.25E-10	2.78±0.86E-09	3.38±0.80E-07	0.00±1.45E-08
August	6.30±4.30E-10	4.66±1.01E-09	4.09±0.82E-07	0.00±1.36E-08
September	5.93±2.62E-10	3.92±0.73E-09	3.48±0.57E-07	0.00±1.03E-08
October	4.98±5.04E-10	1.01±1.24E-09	4.75±0.81E-07	0.00±1.04E-08
November	-1.34±4.96E-10	1.01±1.53E-09	4.40±0.81E-07	0.00±1.04E-08
December	4.59±4.93E-10	3.43±1.71E-09	1.70±0.78E-07	0.00±1.67E-08

Table C - 1.13

1995 Monthly Radioactivity Concentrations (µCi/mL) in Surface Water at Location WN8D1DR

Month	Alpha	Beta	H-3	Sr-90	Cs-137
January	1.81±4.36E-09	2.76±0.14E-07	2.71±0.80E-07	2.44±0.38E-08	0.00±1.40E-08
February	0.39±1.33E-08	1.59±0.18E-07	1.28±0.82E-07	2.21±0.32E-08	0.00±1.25E-08
March	-0.03±1.17E-08	9.21±1.72E-08	1.19±0.78E-07	4.09±0.36E-08	0.00±1.34E-08
April	-0.20±1.15E-08	1.04±0.16E-07	1.69±0.75E-07	2.56±0.40E-08	0.00±1.36E-08
May	1.15±2.66E-09	1.23±0.10E-07	1.32±0.68E-07	2.36±0.56E-08	0.00±1.34E-08
June	0.15±3.22E-09	1.16±0.09E-07	8.88±7.70E-08	1.86±0.39E-08	0.00±1.30E-08
July	0.99±2.25E-09	6.63±0.15E-07	1.25±0.77E-07	1.81±0.34E-08	0.00±1.31E-08
August	0.60±1.44E-09	3.83±0.12E-07	2.04±0.67E-07	2.33±0.35E-08	0.00±1.32E-08
September	1.25±1.22E-09	5.84±0.10E-07	3.83±0.82E-07	2.30±0.41E-08	0.00±1.41E-08
October	0.59±1.08E-09	2.45±0.08E-07	2.31±0.75E-07	1.79±0.41E-08	0.00±1.36E-08
November	0.12±1.03E-09	9.38±0.46E-08	1.21±0.72E-07	1.81±0.33E-08	0.00±1.36E-08
December	1.22±1.54E-09	6.36±0.40E-08	8.27±7.41E-08	2.80±0.42E-08	0.00±1.36E-08

Table C - 1.14

1995 Radioactivity Concentrations (µCi/mL) in Surface Water at Location WNDCELD

Month	Alpha	Beta	H-3	Cs-137	I-129	Sr-90
January	-1.19±3.98E-10	2.50±1.00E-09	0.00±1.00E-07	0.00±1.32E-08		
February	1.09±1.68E-09	2.80±1.59E-09	6.79±7.72E-08	0.00±1.35E-08		
March	1.19±2.01E-09	3.64±1.56E-09	1.17±0.56E-07	0.00±1.31E-08		
1st Qtr					-2.63±7.65E-10	9.27±2.59E-09
April	-3.04±5.95E-10	3.46±1.75E-09	0.00±1.00E-07	0.00±1.56E-08		
May	2.50±6.19E-10	1.22±0.81E-09	1.02±6.30E-08	0.00±1.22E-08		
June	1.81±9.46E-10	3.66±0.96E-09	8.09±7.80E-08	0.00±9.63E-09		
2nd Qtr					6.68±9.15E-10	1.94±2.47E-09
July	6.80±8.96E-10	6.76±1.17E-09	0.00±1.00E-07	0.00±1.44E-08		
August	-1.98±5.93E-10	4.77±1.02E-09	2.28±8.10E-08	0.00±1.39E-08		
September	-4.38±8.19E-10	8.04±1.63E-09	0.69±9.78E-08	0.00±1.38E-08		
3rd Qtr					0.71±1.02E-09	6.75±1.92E-09
October	0.03±3.70E-10	3.57±0.94E-09				
November	3.43±3.10E-10	3.08±0.85E-09				
December	4.23±4.21E-10	1.67±1.12E-09				
4th Qtr			2.85±7.42E-08	0.00±1.36E-08	-2.64±7.71E-10	1.47±1.93E-09

Table C - 1.15

1995 Monthly Radioactivity Concentrations (µCi/mL), pH, and Conductivity at Site Potable Water Location WNDNKEL

Month	Alpha	Beta	H-3	pH (standard units)	Conductivity (µmhos/cm@25°C)
January	0.00±7.27E-10	0.54±1.60E-09	2.75±7.83E-08	8.18	197
February	-1.29±1.33E-09	1.17±1.56E-09	3.65±7.43E-08	8.35	195
March	0.00±1.51E-09	1.44±1.50E-09	8.72±7.84E-08	8.50	195
April	-0.80±1.17E-09	1.19±1.62E-09	8.67±7.65E-08	8.24	182
May	-0.47±3.64E-10	1.53±0.79E-09	5.91±7.69E-08	8.59	198
June	0.26±4.59E-10	1.48±0.75E-09	5.93±7.71E-08	8.41	272
July	5.64±4.33E-10	2.31±0.57E-09	0.53±7.51E-08	8.00	247
August	-4.82±5.37E-10	6.60±8.42E-10	1.45±8.23E-08	8.03	262
September	1.90±5.09E-10	2.58±0.85E-09	3.19±7.57E-08	8.41	276
October	5.77±5.50E-10	1.73±0.83E-09	3.52±8.46E-08	7.95	285
November	2.52±4.75E-10	2.44±0.87E-09	3.04±7.26E-08	8.33	238
December	1.08±2.91E-10	1.51±0.73E-09	7.94±7.60E-08	8.55	725

Table C - 1.16

1995 Monthly Radioactivity Concentrations (µCi/mL), pH, and Conductivity at Site Potable Water Location WNDNKMS

Month	Alpha	Beta	H-3	pH (standard units)	Conductivity (µmhos/cm@25°C)
January	-2.61±5.11E-10	0.90±1.64E-09	0.00±1.00E-07	7.83	199
February	-1.02±1.42E-09	1.17±1.56E-09	0.00±1.00E-07	8.02	202
March	-1.07±1.05E-09	1.35±1.49E-09	1.02±0.78E-07	8.39	200
April	-0.26±1.35E-09	0.51±1.54E-09	8.89±7.66E-08	8.41	182
May	1.95±4.06E-10	2.14±0.82E-09	9.21±7.66E-08	8.45	204
June	-0.38±4.36E-10	2.04±0.78E-09	3.96±7.53E-08	8.19	242
July	2.99±4.51E-10	1.75±0.78E-09	1.64±6.33E-08	7.81	244
August	-1.62±5.18E-10	5.82±8.27E-10	0.00±1.00E-07	7.74	250
September	2.62±5.55E-10	2.94±0.86E-09	3.51±7.58E-08	8.36	269
October	1.70±4.57E-10	1.90±0.83E-09	9.50±8.39E-08	7.93	275
November	-0.15±4.10E-10	5.14±0.69E-09	0.00±1.00E-07	7.85	267
December	3.27±3.04E-10	2.69±0.79E-09	7.11±7.65E-08	9.04	714

Table C - 1.17

1995 Monthly Radioactivity Concentrations (μCi/mL), pH, and Conductivity at Site Potable Water Location WNDNKMP

Month	Alpha	Beta	H-3	pH (standard units)	Conductivity (μmhos/cm@25°C)
January	0.76±1.11E-09	-0.27±1.50E-09	7.30±7.76E-08	7.96	203
February	-0.90±1.04E-09	0.49±1.05E-09	0.00±1.00E-07	7.96	193
March	0.27±1.58E-09	2.07±1.57E-09	5.76±7.49E-08	8.15	201
April	-6.67±8.65E-10	0.55±1.09E-09	8.29±7.59E-08	7.79	180
May	-1.08±3.60E-10	8.79±7.56E-10	1.28±0.77E-07	8.43	201
June	-0.07±5.04E-10	1.36±0.74E-09	1.80±0.78E-07	8.30	239
July	1.90±4.34E-10	2.84±0.84E-09	3.44±7.54E-08	7.81	252
August	2.54±6.44E-10	1.27±0.87E-09	6.99±7.71E-08	7.76	265
September	1.93±5.78E-10	1.83±0.81E-09	9.07±7.68E-08	8.23	284
October	5.44±5.55E-10	1.51±0.82E-09	1.21±0.59E-07	8.02	282
November	0.21±4.30E-10	1.24±0.81E-09	0.00±1.00E-07	8.11	273
December	1.65±3.04E-10	2.54±0.79E-09	3.11±7.55E-08	8.52	719

Table C - 1.18

1995 Monthly Radioactivity Concentrations (μCi/mL), pH, Conductivity, Nitrate-Nitrogen, and Metals Concentrations at Site Potable Water Location WNDNKUR

Month	Alpha	Beta	H-3	pH (standard units)	Conductivity (μmhos/cm@25°C)
January	2.56±8.68E-10	0.45±1.58E-09	1.26±0.78E-07	8.10	204
February	-0.52±1.60E-09	0.72±1.52E-09	2.48±7.84E-08	8.33	201
March	-0.82±1.20E-09	1.99±1.56E-09	3.46±7.58E-08	8.78	193
April	-1.11±1.09E-09	1.11±1.61E-09	9.16±7.71E-08	8.05	183
May	-1.81±2.44E-10	6.85±5.25E-10	1.17±0.55E-07	8.62	204
June	-4.26±4.30E-10	1.28±0.73E-09	1.12±0.77E-07	8.35	236
July	3.65±4.74E-10	2.52±1.02E-09	0.00±1.00E-07	8.04	247
August	-5.82±5.37E-10	1.02±0.86E-09	4.22±7.62E-08	7.99	263
September	5.75±6.27E-10	1.67±0.80E-09	0.97±7.64E-08	8.42	274
October	-3.00±2.99E-10	2.11±0.60E-09	1.03±0.59E-07	8.03	285
November	-1.62±3.97E-10	1.37±0.82E-09	2.94±7.52E-08	8.33	275
December	2.97±3.19E-10	1.73±0.75E-09	4.52±7.55E-08	8.78	705

Date	Nitrate-N (mg/L)	Arsenic Total (μg/L)	Cadmium Total (μg/L)	Chromium Total (μg/L)	Mercury Total (μg/L)	Selenium Total (μg/L)	Fluoride (mg/L)
03/15	3.8	<25.0	<2.0	<10.0	<0.19	<2.00	<0.10

Table C - 1.19

1995 Radioactivity Concentrations (µCi/mL), NPOC, TOX, and pH in Surface Water at Location WNNDADR

Month	Alpha	Beta	H-3	Cs-137	I-129	Sr-90
January	0.89±3.03E-09	2.14±0.14E-07	4.18±0.18E-06	0.00±1.29E-08		
February	0.00±5.00E-09	1.87±0.13E-07	3.84±0.17E-06	0.00±1.38E-08		
March	0.02±2.79E-09	1.57±0.08E-07	3.59±0.16E-06	0.00±1.52E-08		
1st Qtr					-6.25±7.11E-10	8.07±0.63E-08
April	-2.05±4.91E-09	2.41±0.15E-07	5.46±0.21E-06	0.00±1.40E-08		
May	1.11±1.84E-09	2.59±0.08E-07	6.94±0.25E-06	0.00±1.12E-08		
June	2.86±1.75E-09	2.66±0.06E-07	5.34±0.21E-06	0.00±1.44E-08		
2nd Qtr					9.23±9.45E-10	1.10±0.08E-07
July	0.38±1.13E-09	2.06±0.07E-07	3.38±0.15E-06	0.00±1.43E-08		
August	-0.01±2.17E-09	2.97±0.09E-07	2.70±0.14E-06	0.00±1.64E-08		
September	0.39±1.67E-09	2.19±0.08E-07	2.12±0.12E-06	0.00±1.25E-08		
3rd Qtr					1.37±0.97E-09	1.11±0.07E-07
October	0.07±1.40E-09	2.33±0.09E-07	2.78±0.14E-06	0.00±1.15E-08		
November	2.23±1.43E-09	1.76±0.06E-07	1.85±0.12E-06	0.00±1.72E-08		
December	5.69±6.41E-10	1.42±0.04E-07	9.78±0.90E-07	0.58±1.08E-08		
4th Qtr					8.03±6.81E-10	7.51±0.63E-08

	NPOC (mg/L)	**TOX** (µg/L)	**pH** (standard units)
January	7.10	21.8	7.7
February	7.40	128	7.5
March	4.98	39.9	7.7
April	6.88	25.0	7.6
May	8.35	25.8	7.4
June	11.15	42.6	7.8
July	10.88	47.2	7.2
August	12.14	37.2	7.3
September	8.60	38.3	7.4
October	7.32	24.5	7.4
November	5.34	15.0	7.6
December	5.22	16.1	7.6

Table C - 1.20

1995 Radioactivity Concentrations (μCi/mL), NPOC, and TOX in Groundwater at Location WNNDATR

Month	Alpha	Beta	H-3	Cs-137	I-129
January	4.35±4.10E-09	8.72±0.68E-08	1.90±0.06E-05	0.00±1.35E-08	
February	6.69±8.70E-09	6.84±0.87E-08	1.78±0.06E-05	0.00±1.50E-08	
March	0.00±5.48E-09	9.95±1.01E-08	1.44±0.05E-05	0.00±1.49E-08	
1st Qtr					0.28±6.51E-10
April	2.76±5.41E-09	1.05±0.11E-07	2.57±0.08E-05	0.00±1.24E-08	
May	1.90±2.39E-09	9.10±0.52E-08	2.67±0.08E-05	0.00±1.33E-08	
June	1.47±1.17E-09	4.49±0.26E-08	1.10±0.04E-05	0.00±1.40E-08	
2nd Qtr					0.68±1.50E-09
July	2.56±1.87E-09	5.79±0.40E-08	1.24±0.04E-05	0.00±1.04E-08	
August	1.44±1.61E-09	6.77±0.31E-08	9.81±0.34E-06	0.00±9.68E-09	
September	0.18±1.97E-09	7.22±0.45E-08	1.79±0.06E-05	0.00±1.60E-08	
3rd Qtr					0.92±1.09E-09
October	1.54±1.11E-09	4.39±0.35E-08	1.97±0.08E-05	0.00±1.51E-08	
November	2.82±1.68E-09	6.47±0.43E-08	5.67±0.16E-06	0.00±1.58E-08	
December	1.77±1.38E-09	7.16±0.43E-08	5.74±0.22E-06	0.00±1.53E-08	
4th Qtr					0.98±1.05E-09

	NPOC (mg/L)	**TOX** (μg/L)
January	5.80	30.0
February	3.10	20.0
March	5.40	138
April	6.20	31.0
May	3.70	27.0
June	5.20	26.0
July	4.40	28.0
August	5.50	15.0
September	3.60	13.0
October	4.40	12.6
November	7.40	20.0
December	3.70	23.0

Table C - 1.21

1995 Radioactivity Concentrations (µCi/mL) and Water Quality Parameters in Surface Water at WNSTAW Series Sampling Locations

Location	Alpha	Beta	H-3	pH	Conductivity (µmhos/cm@25°C)
WNSTAW4	1.46±3.46E-10	3.50±1.36E-09	1.24±0.82E-07	7.44	110
WNSTAW5	0.99±4.58E-10	1.07±1.79E-09	2.27±0.84E-07	6.56	66
WNSTAW6	-2.24±6.40E-10	5.57±1.83E-09	1.47±0.78E-07	7.55	246
WNSTAW9	-0.22±5.86E-10	0.54±1.79E-09	1.41±0.83E-07	7.67	245
WNSTAWB*	3.62±9.27E-10	5.00±1.83E-09	0.00±1.00E-07	8.05	382

	Date	Chloride (mg/L)	Iron Total (µg/L)	Manganese Total (µg/L)	Sodium Total (µg/L)	Nitrate+ Nitrite (mg/L)	Sulfate (mg/L)
WNSTAW4	11/06	6.5	300	41	5540	0.06	35.3
WNSTAW5	11/06	<1.0	325	21	2140	<0.05	9.60
WNSTAW6	11/13	<1.0	284	14	13400	<0.05	19.4
WNSTAW9	11/06	6.1	450	134	6890	0.07	20.9
WNSTAWB*	11/14	20.2	<100	41	1670	0.10	14.4

* *Background location.*

Table C - 1.22

1995 Radioactivity Concentrations (µCi/mL) in Surface Water Upstream of the WVDP at Fox Valley (WFBCBKG)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
January	1.15±1.38E-09	3.30±1.74E-09	1.81±8.68E-08		
February	-0.75±1.46E-09	3.63±1.72E-09	0.00±1.00E-07		
March	-0.25±1.28E-09	2.78±1.44E-09	5.02±7.63E-08		
1st Qtr				3.29±1.92E-09	0.00±4.45E-09
April	1.16±1.40E-09	1.27±1.51E-09	4.51±8.04E-08		
May	2.18±5.39E-10	1.04±0.79E-09	7.28±7.68E-08		
June	7.34±7.99E-10	2.29±0.85E-09	1.01±7.54E-08		
2nd Qtr				3.69±2.07E-09	0.00±4.16E-09
July	6.35±7.69E-10	1.34±0.88E-09	0.00±1.00E-07		
August	6.05±8.74E-10	2.42±0.86E-09	0.00±1.00E-07		
September	0.48±6.47E-10	2.07±1.03E-09	5.39±7.70E-08		
3rd Qtr				5.06±2.03E-09	0.00±4.41E-09
October	2.13±5.66E-10	2.67±0.97E-09	3.66±7.60E-08		
November	6.31±5.22E-10	5.27±1.08E-09	6.72±7.75E-08		
December	6.84±4.28E-10	2.96±0.95E-09	9.54±7.68E-08		
4th Qtr				4.43±1.78E-09	0.00±4.92E-09

	C-14	I-129	U-232	U-233/234	U-235/236
1st Qtr	2.70±5.46E-09	1.47±8.44E-10	8.86±0.85E-11	7.95±4.15E-11	0.68±4.04E-11
2nd Qtr	-0.92±5.73E-09	0.58±1.02E-09	0.00±2.91E-11	8.23±5.94E-11	0.48±2.18E-11
3rd Qtr	-0.21±1.40E-08	1.29±4.62E-10	0.36±4.46E-11	8.38±6.54E-11	1.01±2.81E-11
4th Qtr	-2.63±7.12E-09	0.93±7.89E-10	0.00±3.68E-11	1.05±0.42E-10	1.92±1.96E-11

	U-238	Total U (µg/mL)	Pu-238	Pu-239/240	Am-241	Tc-99
1st Qtr	7.54±5.39E-11	-3.63±0.09E-04	1.17±4.22E-11	0.04±1.98E-11	4.19±5.21E-11	-3.89±1.37E-09
2nd Qtr	8.72±5.87E-11	-2.93±0.08E-04	1.40±2.80E-11	2.10±2.43E-11	2.06±5.98E-11	-6.71±1.31E-09
3rd Qtr	4.43±4.54E-11	-1.83±0.03E-04	-0.86±3.64E-11	-2.73±5.46E-12	1.92±1.73E-11	0.30±1.76E-09
4th Qtr	7.84±3.56E-11	2.50±0.15E-04	4.56±2.36E-11	1.07±1.07E-11	-0.95±2.83E-11	-0.45±1.36E-09

See Table C-1.27 for a summary of water quality parameters at WFBCBKG.

Table C - 1.23

1995 Radioactivity Concentrations (μCi/mL) in Surface Water Downstream of the WVDP at Thomas Corners (WFBCTCB)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
*January**	1.37±1.64E-09	6.89±2.20E-09	2.09±8.60E-08		
February	0.00±1.66E-09	4.97±2.15E-09	5.58±7.60E-08		
*March**	0.26±1.52E-09	5.12±1.70E-09	7.79±7.71E-08		
1st Qtr				3.57±1.90E-09	0.00±4.10E-09
April	0.00±9.06E-10	5.36±1.95E-09	1.03±0.78E-07		
May	4.64±6.33E-10	5.90±1.04E-09	5.25±7.66E-08		
*June**	1.41±0.96E-09	8.22±1.15E-09	6.16±7.67E-08		
2nd Qtr				7.13±2.48E-09	0.00±4.29E-09
July	5.50±8.80E-10	9.38±1.27E-09	8.83±7.70E-08		
*August**	8.39±9.12E-10	1.73±0.14E-08	8.71±0.88E-07		
September	4.09±7.78E-10	1.25±0.15E-08	2.41±0.80E-07		
3rd Qtr				6.52±2.22E-09	0.00±4.28E-09
October	3.95±6.54E-10	1.20±0.14E-08	7.02±7.78E-08		
November	3.10±5.13E-10	1.17±0.14E-08	6.53±7.53E-08		
*December**	7.89±4.45E-10	5.90±1.10E-09	1.20±0.78E-07		
4th Qtr				7.13±2.14E-09	0.00±4.63E-09

** Month of discharge from WNSP001.*

Table C - 1.24

1995 Monthly Radioactivity Concentrations (μCi/mL) in Surface Water Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR)

Month	Alpha	Beta	H-3	Sr-90	Cs-137
*January**	1.11±1.50E-09	5.59±2.04E-09	5.86±7.62E-08	-0.04±1.59E-09	0.00±4.62E-09
February	1.08±1.77E-09	4.01±1.36E-09	6.12±7.62E-08	3.58±1.86E-09	0.00±4.38E-09
*March**	0.50±2.19E-09	4.23±2.03E-09	6.74±7.85E-08	3.73±2.08E-09	0.00±4.72E-09
April	-1.04±2.48E-09	2.98±1.74E-09	1.36±0.77E-07	2.00±1.89E-09	0.00±4.58E-09
May	3.39±8.39E-10	2.35±1.06E-09	4.68±7.43E-08	2.11±1.72E-09	0.00±4.67E-09
*June**	0.77±1.15E-09	3.12±1.02E-09	1.02±0.77E-07	4.56±2.16E-09	0.00±4.47E-09
July	1.06±1.12E-09	2.98±1.28E-09	1.34±7.61E-08	6.25±2.03E-09	0.00±4.51E-09
*August**	1.14±1.03E-09	6.46±1.28E-09	5.15±7.75E-08	3.85±1.90E-09	0.00±4.41E-09
September	-2.76±7.90E-10	2.67±1.36E-09	4.16±7.42E-08	5.11±2.06E-09	0.00±4.33E-09
October	4.62±7.65E-10	4.40±1.40E-09	7.66±7.63E-08	3.99±2.13E-09	0.00±4.64E-09
November	1.38±5.95E-10	4.70±1.23E-09	4.14±7.43E-08	5.32±1.55E-09	0.00±4.55E-09
*December**	2.09±0.89E-09	5.30±1.37E-09	4.81±7.68E-08	5.35±1.93E-09	0.00±4.42E-09

** Month of discharge from WNSP001.*

Table C - 1.25

1995 Monthly Radioactivity Concentrations (μCi/mL) in Surface Water Upstream of the WVDP in Cattaraugus Creek at Bigelow Bridge (WFBIGBR)*

Month	Alpha	Beta	H-3	Sr-90	Cs-137
January	0.47±1.58E-09	3.01±2.31E-09	0.00±1.00E-07	2.16±1.85E-09	0.00±4.69E-09
February	0.00±2.24E-09	3.94±2.30E-09	0.00±1.00E-07	3.86±2.01E-09	0.00±4.51E-09
March	-1.05±1.37E-09	3.57±1.43E-09	1.38±0.77E-07	2.80±2.01E-09	0.00±4.61E-09
April	0.00±3.18E-09	3.35±2.15E-09	0.00±1.00E-07	2.98±2.07E-09	0.00±4.64E-09
May	2.53±6.00E-10	9.60±7.80E-10	8.75±7.63E-08	3.05±1.89E-09	0.00±4.34E-09
June	4.20±6.82E-10	3.01±0.75E-09	0.00±1.00E-07	3.54±1.49E-09	0.00±4.58E-09
July	5.57±8.91E-10	1.49±1.09E-09	1.18±8.37E-08	6.10±2.01E-09	0.00±4.31E-09
August	-4.10±8.71E-10	2.03±1.03E-09	0.00±1.00E-07	3.01±1.80E-09	0.00±4.33E-09
September	6.57±8.97E-10	1.10±1.00E-09	0.00±1.00E-07	1.99±1.66E-09	0.00±4.24E-09
October	-1.71±5.53E-10	4.14±1.36E-09	3.87±7.93E-08	9.78±1.91E-09	0.00±4.30E-09
November	3.06±5.81E-10	3.99±0.96E-09	2.73±0.79E-07	2.70±1.34E-09	0.00±3.04E-09
December	2.45±5.36E-10	4.75±1.08E-09	7.36±7.59E-08	3.46±1.65E-09	0.00±3.05E-09

** Background location.*

Table C - 1.26

1995 Radioactivity Concentrations (μCi/mL), pH, and Conductivity in Potable Well Water around the WVDP

Well	pH (standard units)	Conductivity (μmhos/cm@25°C)	Alpha	Beta	H-3	Cs-137
WFWEL01	7.41	414	-0.91±5.23E-10	4.67±1.20E-09	0.00±1.00E-07	0.00±1.80E-08
WFWEL02	6.65	665	-6.73±6.44E-10	4.11±1.65E-09	8.21±7.65E-08	0.00±1.33E-08
WFWEL03	6.73	775	0.18±1.14E-09	5.67±1.80E-09	4.59±7.66E-08	0.00±1.36E-08
WFWEL04	8.18	1705	0.49±1.95E-09	1.86±1.77E-09	0.63±7.49E-08	0.00±1.51E-08
WFWEL05	6.59	290	2.63±6.88E-10	4.67±1.68E-09	8.63±7.56E-08	0.00±1.36E-08
WFWEL06*	7.89	271	-3.14±7.26E-10	1.42±1.59E-09	7.06±5.42E-08	0.00±1.13E-08
WFWEL07	7.66	374	2.37±7.71E-10	2.74±1.56E-09	5.16±7.57E-08	0.00±9.69E-09
WFWEL08	7.52	474	-0.78±8.75E-10	6.67±1.83E-09	0.00±1.00E-07	0.00±1.46E-08
WFWEL09	8.02	667	0.84±1.06E-09	3.92±1.67E-09	0.00±1.00E-07	0.00±1.47E-08
WFWEL10	7.37	586	-1.61±9.28E-10	3.36±1.64E-09	5.33±7.66E-08	0.00±2.00E-08

** Background location.*

Table C - 1.27

1995 Surface Water Quality at Locations WFBCBKG, WNSP006, WNSWAMP, and WNSW74A*

Location	Date	pH (standard units)	Conductivity (μmhos/cm@25°C)	NPOC (mg/L)	TOX (μg/L)	Chloride (mg/L)	Sulfate (mg/L)	Nitrate/ Nitrite (mg/L)	Fluoride (mg/L)	Bicarbonate Alkalinity ($CaCO_3$) (mg/L)	Carbonate Alkalinity ($CaCO_3$) (mg/L)
WFBCBKG*	06/23	7.86	222	1.0	11.0	9.6	21.9	0.120	<0.10	114.0	<1.0
WFBCBKG*	10/19	7.82	293	1.5	11.8	11.7	31.2	<0.050	<0.10	116.0	<5.0
WNSP006	06/23	7.71	786	4.6	70.0	201.0	156	22.600	0.11	82.2	<1.0
WNSP006	10/19	7.63	1158	3.9	101	92.7	52.0	12.700	0.12	398.0	<25.0
WNSWAMP	06/29	7.39	935	3.0	30.0	230.0	28.0	2.000	0.90	180.0	<5.0
WNSWAMP	10/19	7.54	984	3.0	20.0	120.0	50.0	1.300	0.80	170.0	<1.0
WNSW74A	06/23	7.27	872	6.3	49.0	110.0	65.2	0.150	0.13	140.0	<1.0
WNSW74A	10/19	7.20	772	3.0	23.9	83.6	78.8	0.077	<0.10	145.0	<25.0

		Calcium Total (μg/L)	Magnesium Total (μg/L)	Sodium Total (μg/L)	Potassium Total (μg/L)	Barium Total (μg/L)	Manganese Total (μg/L)	Iron Total (μg/L)
WFBCBKG*	06/23	46,400	6,700	9,000	1,700	<200	85	660
WFBCBKG*	10/19	50,000	7,140	11,700	1,890	<200	63	553
WNSP006	06/23	59,400	9,600	178,000	10,300	<200	96	150
WNSP006	10/19	70,000	9,450	78,200	7,580	<200	46	476
WNSWAMP	06/29	120,000	15,000	64,000	1,500	140	140	67
WNSWAMP	10/19	110,000	14,000	55,000	1,800	130	75	66
WNSW74A	06/23	79,100	10,200	53,900	3,400	<200	280	680
WNSW74A	10/19	87,800	10,500	39,100	1,220	<200	26	77

* *Background location.*

Table C - 1.28

1995 Radioactivity Concentrations (μCi/g dry weight from upper 5 cm) in On-site Soils/Sediments

Location	Alpha	Beta	K-40	Co-60	Sr-90	Cs-137
SNSP006	1.28±0.12E-05	3.66±0.12E-05	2.11±0.06E-05	2.52±1.72E-08	5.83±2.44E-07	2.65±0.01E-05
SNSW74A	1.99±0.16E-05	3.47±0.12E-05	1.96±0.06E-05	8.46±2.65E-08	5.30±0.50E-07	8.82±0.09E-06
SNSWAMP	2.14±0.15E-05	8.98±0.18E-05	1.95±0.05E-05	1.31±1.19E-08	2.80±0.10E-05	3.83±0.06E-06

Location	U-232	U-233/234	U-235/236	U-238	Total U (μg/g)	Pu-239/240
SNSP006	1.09±0.07E-08	1.02±0.11E-06	3.05±2.21E-08	9.15±0.99E-07	3.04±0.04E-00	3.06±1.17E-08
SNSW74A	4.23±0.36E-08	1.06±0.15E-06	6.65±3.66E-08	1.35±0.18E-06	3.54±0.05E-00	1.92±0.32E-07
SNSWAMP	3.61±0.23E-09	8.90±0.93E-07	0.91±1.59E-08	9.25±0.96E-07	3.69±0.04E-00	8.16±2.02E-08

Location	Am-241
SNSP006	4.16±2.01E-08
SNSW74A	2.19±0.34E-07
SNSWAMP	9.52±2.28E-08

Table C - 1.29

1995 Metals Concentrations (mg/kg dry) in On-site Soils/Sediments

Location	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium
SNSP006	8,300	<8.3	10.0	54.0	0.40	0.18
SNSW74A	14,000	< 18.0	16.0	190.0	0.55	0.52
SNSWAMP	18,000	< 13.0	10.0	140.0	0.71	0.22

Location	Calcium	Chromium	Cobalt	Copper	Iron	Lead
SNSP006	19,000	11.0	10.0	15.0	19,000	15.0
SNSW74A	5,200	17.0	11.0	28.0	30,000	27.0
SNSWAMP	10,000	21.0	9.8	29.0	27,000	27.0

Location	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium
SNSP006	6,600	730	0.06	19.0	1,400	1.30
SNSW74A	4,000	5,500	0.16	25.0	1,900	3.30
SNSWAMP	6,200	2,100	0.15	24.0	2,900	2.70

Location	Silver	Sodium	Thallium	Vanadium	Zinc
SNSP006	<1.4	110.0	0.61	17.0	66.0
SNSW74A	<3.0	230.0	1.6	23.0	330.0
SNSWAMP	<2.2	210.0	1.1	27.0	130.0

Table C - 1.30

1995 Radioactivity Concentrations in Surface Soil Collected at Air Sampling Stations around the WVDP (μCi/g dry weight from upper 5 cm)

Location	Alpha	Beta	K-40	Cs-137	Sr-90	Co-60
SFBLKST	9.13±3.74E-06	2.40±0.41E-05	1.92±0.26E-05	3.05±0.56E-07	5.59±3.73E-08	2.43±2.17E-08
SFBOEHN	9.58±3.73E-06	2.02±0.42E-05	1.49±0.21E-05	3.08±0.66E-07	8.79±4.24E-08	-0.68±2.72E-08
SFFXVRD	1.11±0.39E-05	1.57±0.34E-05	1.14±0.09E-05	3.43±0.54E-07	1.16±0.42E-07	2.93±2.27E-08
SFGRVAL*	9.11±3.83E-06	1.74±0.39E-05	1.28±0.08E-05	3.86±0.38E-07	2.89±0.63E-07	-0.19±1.67E-08
SFNASHV*	8.38±3.44E-06	2.28±0.42E-05	1.61±0.10E-05	1.37±0.39E-07	-1.20±0.30E-07	0.09±2.33E-08
SFRSPRD	7.24±3.56E-06	2.30±0.44E-05	1.29±0.10E-05	1.48±0.08E-06	9.08±4.28E-08	0.22±2.45E-08
SFRT240	1.21±0.41E-05	1.98±0.37E-05	1.27±0.08E-05	7.56±0.43E-07	1.54±3.67E-08	-1.06±1.79E-08
SFSPRVL	1.14±0.39E-05	2.06±0.39E-05	1.49±0.10E-05	3.43±0.54E-07	1.12±0.44E-07	-0.18±2.45E-08
SFTCORD	1.48±0.44E-05	2.57±0.40E-05	2.13±0.12E-05	6.77±4.30E-08	-0.89±3.31E-08	2.10±2.39E-08
SFWEVAL	1.47±0.51E-05	2.10±0.57E-05	1.16±0.09E-05	8.36±0.77E-07	1.26±0.51E-07	-0.22±2.65E-08

	U-233/234	U-235/236	U-238	Pu-239/240	Am-241
SFBLKST				8.24±8.43E-09	-0.59±9.49E-09
SFBOEHN	8.26±0.96E-07	3.76±1.87E-08	7.82±0.93E-07	1.38±1.01E-08	1.11±2.21E-08
SFFXVRD				2.11±1.23E-08	4.98±8.46E-09
SFGRVAL*	8.62±1.01E-07	2.82±1.57E-08	9.31±1.06E-07	1.43±1.00E-08	0.61±1.23E-08
SFNASHV*				1.05±0.91E-08	-1.06±9.63E-09
SFRSPRD	7.87±0.91E-07	2.72±1.56E-08	8.66±0.97E-07	2.45±1.42E-08	1.25±1.10E-08
SFRT240				2.23±1.39E-08	1.62±1.08E-08
SFSPRVL				1.82±1.24E-08	1.43±0.94E-08
SFTCORD				2.77±8.63E-09	5.74±8.45E-09
SFWEVAL				1.61±1.10E-08	1.24±1.23E-08

	U-232	Total U (μg/g)
SFBOEHN	0.00±2.52E-08	2.96±0.05E-00
SFGRVAL*	0.00±2.30E-08	1.78±0.03E-00
SFRSPRD	0.00±3.37E-08	1.06±0.03E-00

* *Background location.*

Table C - 1.31

1995 Radioactivity Concentrations in Stream Sediments around the WVDP (µCi/g dry weight from upper 15 cm)

Location	Alpha	Beta	K-40	Cs-137	Sr-90	Co-60
SFBCSED*	1.73±0.38E-05	2.71±0.29E-05	1.42±0.05E-05	1.92±1.16E-08	-1.37±2.34E-08	0.65±1.08E-08
SFBISED*	1.28±0.32E-05	2.29±0.28E-05	1.36±0.03E-05	4.85±1.05E-08	-1.52±2.28E-08	-0.09±6.72E-09
SFCCSED	8.20±2.66E-06	1.93±0.26E-05	1.38±0.04E-05	2.58±0.23E-07	-0.80±2.66E-08	-2.64±9.49E-09
SFSDSED	1.02±0.29E-05	2.39±0.28E-05	1.30±0.05E-05	2.64±0.32E-07	1.25±2.52E-08	0.84±1.64E-08
SFTCSED	1.59±0.35E-05	2.55±0.28E-05	1.67±0.05E-05	3.20±0.05E-06	3.81±2.78E-08	3.62±9.44E-09

Location	U-233/234	U-235/236	U-238	Pu-238	Pu-239/240	Am-241
SFBCSED*	6.97±1.35E-07	5.84±3.83E-08	8.60±1.52E-07	1.52±1.18E-08	4.77±5.52E-09	0.05±1.13E-08
SFBISED*	8.58±1.68E-07	2.78±0.92E-07	7.32±1.52E-07	0.26±1.28E-08	2.78±5.02E-09	-2.19±8.60E-09
SFCCSED	5.74±1.17E-07	3.90±2.77E-08	6.75±1.28E-07	1.61±1.47E-08	1.57±1.13E-08	1.75±1.09E-08
SFSDSED	5.20±1.06E-07	2.16±2.89E-08	6.60±1.19E-07	5.62±2.18E-08	1.41±1.11E-08	5.02±8.98E-09
SFTCSED	6.63±1.15E-07	4.48±2.73E-08	8.61±1.35E-07	1.81±2.26E-08	0.16±1.06E-08	0.95±1.08E-08

Location	U-232	Total U (µg/g)
SFBCSED*	0.00±6.97E-08	2.92±0.04E-00
SFBISED*	0.00±4.99E-08	2.57±0.03E-00
SFCCSED	0.00±8.46E-08	1.95±0.02E-00
SFSDSED	1.20±0.12E-08	2.22±0.03E-00
SFTCSED	8.96±0.80E-09	2.19±0.03E-00

* *Background location.*

Appendix C - 2

Summary of Air Monitoring Data

Ambient Air and Atmospheric Fallout Samples Are Collected from Numerous Locations in the West Valley Area

Table C - 2.1

1995 Airborne Radioactive Effluent Totals (curies) from the Main Ventilation Stack (ANSTACK)

Month	**Alpha**	**Beta**	**H-3**
January	1.17±0.27E-07	2.18±0.09E-06	1.69±0.04E-03
February	8.13±2.21E-08	1.70±0.08E-06	5.87±0.21E-04
March	4.06±1.92E-08	1.78±0.08E-06	5.91±0.09E-03
April	3.16±2.01E-08	1.02±0.07E-06	3.71±0.06E-03
May	6.96±2.46E-08	3.12±0.12E-06	3.57±0.06E-03
June	4.76±2.53E-08	7.82±0.76E-07	2.65±0.05E-03
July	9.62±2.52E-08	1.19±0.08E-06	3.61±0.07E-03
August	4.37±2.39E-08	3.90±0.13E-06	3.63±0.07E-03
September	4.79±0.55E-07	1.67±0.01E-04	3.86±0.06E-03
October	7.56±0.63E-07	8.74±0.06E-05	4.12±0.07E-03
November	1.76±1.91E-08	2.61±0.03E-05	1.36±0.03E-03
December	3.22±2.89E-08	2.56±0.03E-05	1.06±0.02E-03
Annual Total	1.77±0.12E-06	3.15±0.01E-04	3.58±0.02E-02

Isotope	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Annual Total**
Co-60	0.24±3.08E-08	2.97±4.20E-08	2.08±3.78E-08	4.55±5.00E-08	9.84±8.15E-08
Sr-90	5.95±0.44E-07	1.02±0.07E-06	5.74±0.04E-05	1.46±0.02E-05	7.36±0.05E-05
I-129	3.70±0.68E-06	5.96±0.90E-06	9.39±1.28E-07	9.96±5.86E-08	1.07±0.11E-05
Cs-134	0.61±3.00E-08	-0.70±4.80E-08	3.38±6.61E-08	5.10±8.72E-08	0.84±1.23E-07
Cs-137	2.26±0.12E-06	1.82±0.17E-06	5.82±0.05E-05	8.21±0.08E-05	1.44±0.01E-04
Eu-154	-0.74±2.44E-07	0.22±3.72E-07	2.17±3.57E-07	0.38±3.11E-07	2.03±6.50E-07
U-232	3.57±0.31E-08	0.00±9.99E-09	0.00±2.27E-09	2.83±1.84E-08	6.40±2.13E-08
U-233/234	1.09±0.46E-08	1.46±0.71E-08	1.73±0.40E-08	1.80±0.41E-08	6.08±1.02E-08
U-235/236	4.76±9.53E-10	-2.41±2.44E-09	1.21±0.99E-09	3.31±1.72E-09	2.59±3.29E-09
U-238	9.00±4.42E-09	1.26±0.60E-08	1.18±0.32E-08	2.06±0.45E-08	5.40±0.93E-08
Pu-238	3.43±0.97E-08	4.00±2.07E-08	6.56±0.80E-08	8.01±0.88E-08	2.20±0.26E-07
Pu-239/240	6.55±1.26E-08	3.14±1.36E-08	8.88±0.98E-08	9.32±0.98E-08	2.79±0.23E-07
Am-241	9.76±1.84E-08	6.90±1.80E-08	2.41±0.24E-07	6.14±0.46E-07	1.02±0.06E-06
Total U(g)	1.60±0.02E-02	3.79±0.05E-02	3.83±0.10E-02	2.58±0.07E-02	1.18±0.01E-01

Table C - 2.2

Comparison of 1995 Main Stack Exhaust Radioactivity Concentrations with Department of Energy Guidelines

Isotope	**Half Life** (years)	**Total Curies Released**[a] (Ci)	**Radioactivity** (Becquerels)	**Average Concentration** (μCi/mL)	**DCG** (μCi/mL)	**% of DCG**
Alpha	N/A	1.77±0.12E-06	6.55±0.44E+04	2.37±0.16E-15	N/A[b]	N/A
Beta	N/A	3.15±0.01E-04	1.16±0.01E+07	4.22±0.02E-13	N/A[b]	N/A
H-3	12.35	3.58±0.02E-02	1.32±0.01E+09	4.80±0.03E-11	1.00E-07	0.0
Co-60	5.27	9.84±8.15E-08	3.64±3.02E+03	1.32±1.09E-16	8.00E-11	0.0
Sr-90	29.124	7.36±0.05E-05	2.72±0.02E+06	9.88±0.06E-14	9.00E-12	1.1
I-129	1.57E+07	1.07±0.11E-05	3.96±0.42E+05	1.44±0.15E-14	7.00E-11	0.0
Cs-134	2.06	0.84±1.23E-07	3.10±4.56E+03	1.13±1.65E-16	2.00E-10	< 0.0
Cs-137	30	1.44±0.01E-04	5.34±0.04E+06	1.94±0.01E-13	4.00E-10	0.0
Eu-154	8.8	2.03±6.50E-07	0.75±2.40E+04	2.72±8.72E-16	5.00E-11	< 0.0
U-232[c]	72	6.40±2.13E-08	2.37±0.79E+03	8.59±2.86E-17	2.00E-14	0.4
U-233/234[c]	2.45E+05	6.08±1.02E-08	2.25±0.38E+03	8.16±1.37E-17	9.00E-14	0.1
U-235/236[c]	7.04E+08	2.59±3.29E-09	0.96±1.22E+02	3.47±4.41E-18	1.00E-13	< 0.0
U-238[c]	4.47E+09	5.40±0.93E-08	2.00±0.34E+03	7.25±1.24E-17	1.00E-13	0.1
Pu-238	87.07	2.20±0.26E-07	8.14±0.95E+03	2.95±0.35E-16	3.00E-14	1.0
Pu-239/240	2.41E+04	2.79±0.23E-07	1.03±0.09E+04	3.74±0.31E-16	2.00E-14	1.9
Am-241	432	1.02±0.06E-06	3.78±0.21E+04	1.37±0.08E-15	2.00E-14	6.9
Total % of DCGs[d]						**11.5**

[a] *Total volume released at 50,000 cfm = 7.44E+14 mL/yr.*

[b] *Derived concentration guides (DCGs) are not specified for gross alpha and gross beta activity.*

[c] *Total uranium = 1.18±0.01E-01 g; average = 1.58±0.01E-10 μg/mL.*

[d] *Total percent DCGs for applicable measured radionuclides.*

N/A - Not applicable.

DCGs are listed for reference only. They are applicable to average concentrations at the site boundary but not to stack concentrations, as might be inferred from their inclusion in this table.

Table C - 2.3

1995 Airborne Radioactive Effluent Concentrations (μCi/mL) from the Vitrification System Ventilation Stack (ANVITSK)

Month	Alpha	Beta
December 1995	1.57±4.40E-15	3.92±1.20E-14

	Co-60	Sr-90	Cs-134	Cs-137	Eu-154
4th Qtr	5.14±4.02E-16	5.37±1.67E-16	-2.11±4.35E-16	-2.11±3.89E-16	3.56±9.89E-16

	U-232	U-233/234	U-235/236	U-238	Total U (μg/mL)
4th Qtr	2.56±0.90E-16	4.51±3.19E-17	1.94±1.65E-17	4.44±2.58E-17	1.66±0.08E-11

	Pu-238	Pu-239/240	Am-241
4th Qtr	1.66±2.33E-17	0.73±1.04E-17	3.14±2.33E-17

Table C - 2.4

1995 Airborne Radioactive Effluent Concentrations (μCi/mL) from the Seismic Sampler (ANSEISK)

Month	Alpha	Beta
December 1995	0.32±6.67E-16	5.35±1.82E-15

Note: These results represent baseline, nonradioactive operations. Quarterly data are for December 1995 only. Data represent two sampling points from the same stack. (See Chapter 2, Environmental Monitoring.) ANSEISK provides back-up samples for the primary vitrification sampler (ANVITSK).

Table C - 2.5

1995 Airborne Radioactive Effluent Totals (curies) from the Cement Solidification System Ventilation Stack (ANCSSTK)

Month	Alpha	Beta
January	-0.02±4.90E-09	-1.54±1.24E-08
February	0.36±3.62E-09	-0.68±1.08E-08
March	-1.59±4.72E-09	-0.40±1.06E-08
April	3.72±5.64E-09	0.86±1.24E-08
May	-0.04±4.61E-09	-1.58±1.18E-08
June	1.08±3.38E-09	-1.29±0.81E-08
July	1.11±3.11E-09	-1.23±0.77E-08
August	-3.13±3.23E-09	0.33±7.60E-09
September	1.34±3.04E-09	-7.63±7.94E-09
October	2.77±2.78E-09	-1.20±0.74E-08
November	3.11±3.86E-09	-1.32±0.97E-08
December	-4.16±4.03E-09	-1.08±0.97E-08
Annual Total	0.46±1.36E-08	-1.02±0.34E-07

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Co-60	-2.23±9.12E-09	-0.21±1.14E-08	0.95±1.11E-08	7.74±7.40E-09	1.29±1.98E-08
Sr-90	-1.13±0.60E-08	8.77±4.15E-09	-1.72±5.22E-09	1.66±0.47E-08	1.24±1.01E-08
I-129	1.62±0.63E-08	6.25±1.93E-08	0.99±1.04E-08	-1.76±5.68E-09	8.68±2.35E-08
Cs-134	-0.17±1.13E-08	0.00±1.06E-08	-1.08±1.17E-08	-3.23±7.35E-09	-1.57±2.08E-08
Cs-137	0.89±1.01E-08	0.19±1.16E-08	-1.15±1.10E-08	4.77±8.23E-09	0.41±2.06E-08
Eu-154	-0.60±9.46E-08	-0.55±1.24E-07	4.03±9.58E-08	1.54±2.16E-08	-0.05±1.84E-07
U-232	2.32±0.24E-09	0.00±2.37E-09	1.28±0.15E-09	2.99±1.17E-09	6.59±2.66E-09
U-233/234	2.48±1.51E-09	2.25±1.26E-09	4.62±1.27E-09	2.66±0.72E-09	1.20±0.25E-08
U-235/236	-4.51±6.39E-10	2.63±1.66E-09	5.05±4.15E-10	4.30±3.10E-10	3.11±1.85E-09
U-238	1.36±1.27E-09	4.51±1.93E-09	0.51±1.13E-09	3.39±0.77E-09	9.77±2.68E-09
Pu-238	6.08±7.31E-10	4.87±6.07E-10	2.87±1.06E-09	-1.01±2.30E-10	3.86±1.44E-09
Pu-239/240	6.00±6.02E-10	6.07±4.80E-10	6.27±5.47E-10	1.64±1.65E-10	2.00±0.96E-09
Am-241	1.55±1.04E-09	3.89±0.34E-07	0.87±1.12E-09	4.95±3.38E-10	3.92±0.34E-07
Total U (g)	6.84±0.08E-03	8.33±0.12E-03	6.82±0.32E-03	6.42±0.13E-03	2.84±0.04E-02

Table C - 2.6

1995 Airborne Radioactive Effluent Totals (curies) from the Contact Size-Reduction Facility Ventilation Stack (ANCSRFK)

Month	Alpha	Beta
January	-1.66±2.52E-10	7.86±7.47E-10
February	1.19±1.77E-10	1.94±0.55E-09
March	2.53±7.21E-11	5.13±1.78E-10
April	0.50±1.05E-10	1.07±0.28E-09
May	4.16±9.16E-11	5.59±2.83E-10
June	1.14±2.92E-10	2.06±0.71E-09
July	-0.43±2.50E-10	3.62±0.82E-09
August	-4.36±3.44E-10	4.47±1.00E-09
September	4.71±4.48E-10	4.74±1.42E-09
October	0.92±2.45E-10	1.85±0.87E-09
November	1.51±1.63E-10	7.93±4.76E-10
December	-1.20±2.20E-10	1.94±0.64E-09
Annual Total	2.99±8.49E-10	2.43±0.26E-08

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Co-60	0.29±2.73E-10	6.91±4.84E-10	-1.13±2.86E-10	-3.31±4.06E-10	2.76±7.45E-10
Sr-90	-1.22±1.29E-10	1.97±0.27E-09	-5.30±2.97E-10	4.01±1.70E-10	1.72±0.46E-09
I-129	1.38±0.37E-08	6.75±1.96E-09	2.69±1.15E-09	0.00±4.59E-10	2.32±0.44E-08
Cs-134	2.14±5.12E-10	2.36±2.09E-10	-1.70±9.44E-10	4.39±3.48E-10	0.72±1.15E-09
Cs-137	1.48±2.69E-10	0.80±2.94E-10	1.20±2.53E-10	-0.69±3.89E-10	2.79±6.12E-10
Eu-154	-1.63±2.58E-09	0.06±3.04E-09	-3.47±6.10E-09	0.43±1.05E-09	-4.61±7.36E-09
U-232	1.89±0.18E-11	0.00±5.19E-11	3.88±0.40E-11	2.54±0.82E-10	3.12±0.97E-10
U-233/234	1.11±0.50E-10	9.92±5.21E-11	1.74±0.48E-10	1.17±0.33E-10	5.01±0.93E-10
U-235/236	1.85±2.27E-11	0.55±1.10E-11	0.00±8.55E-12	1.45±1.32E-11	3.85±2.97E-11
U-238	6.47±3.51E-11	8.82±4.94E-11	1.25±0.40E-10	1.09±0.31E-10	3.87±0.79E-10
Pu-238	3.02±2.47E-11	3.61±8.80E-11	-0.48±5.50E-11	0.37±1.65E-11	0.65±1.08E-10
Pu-239/240	0.00±1.50E-11	0.85±3.48E-11	0.42±1.80E-11	1.39±0.93E-11	2.66±4.30E-11
Am-241	2.07±2.07E-11	1.25±0.65E-10	0.98±5.06E-11	0.80±2.04E-11	1.64±0.87E-10
Total U (g)	2.54±0.03E-04	1.84±0.03E-04	3.59±0.10E-04	1.56±0.03E-04	9.54±0.12E-04

Table C - 2.7

1995 Airborne Radioactive Effluent Totals (curies) from the Supernatant Treatment System Ventilation Stack (ANSTSTK)

Month	Alpha	Beta	H-3
January	0.30±2.07E-09	-2.61±5.26E-09	*Dry*
February	0.77±1.61E-09	1.59±4.67E-09	*Dry*
March	0.00±1.98E-09	4.98±4.57E-09	*Dry*
April	-0.14±2.01E-09	6.71±5.01E-09	*Dry*
May	0.47±1.87E-09	-3.08±4.73E-09	6.56±0.82E-05
June	0.96±1.88E-09	-3.50±4.39E-09	6.18±0.47E-05
July	1.61±1.90E-09	0.31±4.71E-09	1.89±0.21E-05
August	-0.56±2.06E-09	6.27±0.68E-08	3.70±0.74E-05
September	2.32±2.11E-09	3.00±0.64E-08	2.95±0.47E-05
October	0.44±1.54E-09	-4.17±4.82E-09	7.35±0.60E-05
November	-1.61±1.36E-09	-9.63±4.45E-09	1.98±0.19E-05
December	-2.26±1.91E-09	-7.17±4.57E-09	1.67±0.57E-05
Annual Total	2.29±6.48E-09	7.61±1.76E-08	3.23±0.49E-04

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Co-60	0.23±3.01E-09	1.67±5.81E-09	-0.29±4.27E-09	-2.18±3.75E-09	-0.57±8.67E-09
Sr-90	-0.48±1.96E-09	-5.01±2.06E-09	0.52±1.60E-09	5.31±2.11E-09	0.34±3.89E-09
I-129	5.05±0.77E-07	3.84±0.75E-07	1.25±0.16E-07	1.22±0.21E-07	1.14±0.11E-06
Cs-134	0.21±3.01E-09	4.10±5.31E-09	1.10±4.27E-09	-2.64±4.31E-09	2.77±8.61E-09
Cs-137	-1.46±3.15E-09	-1.31±4.46E-09	9.42±1.13E-08	3.72±4.36E-09	9.52±1.33E-08
Eu-154	-0.85±2.85E-08	-1.19±4.40E-08	2.53±2.46E-08	0.89±1.07E-08	1.38±5.89E-08
U-232	3.56±0.34E-11	0.00±7.60E-10	2.70±0.28E-10	1.24±0.51E-09	1.55±0.92E-09
U-233/234	1.10±0.20E-08	1.88±0.74E-09	1.84±0.44E-09	2.90±0.52E-09	1.76±0.22E-08
U-235/236	0.60±3.37E-10	0.00±1.89E-10	0.76±1.12E-10	2.44±1.41E-10	3.80±3.82E-10
U-238	1.24±0.61E-09	1.75±0.79E-09	1.08±0.34E-09	2.34±0.46E-09	6.41±1.15E-09
Pu-238	4.68±0.50E-08	-0.42±1.16E-09	3.74±2.51E-10	0.65±1.59E-10	4.68±0.51E-08
Pu-239/240	1.93±2.23E-10	3.72±6.33E-10	1.23±0.47E-09	4.90±7.93E-11	1.84±0.82E-09
Am-241	1.57±0.88E-09	5.40±6.52E-10	0.45±1.88E-10	3.21±2.21E-10	2.48±1.13E-09
Total U (g)	2.28±0.03E-03	2.96±0.05E-03	2.24±0.06E-03	4.81±0.07E-03	1.23±0.01E-02

NA - Not available.

Table C - 2.8

1995 Airborne Radioactive Effluent Totals (curies) from the Supercompactor Ventilation Stack (ANSUPCV)

Month	**Alpha**	**Beta**
January	-0.28±2.21E-10	-0.29±5.80E-10
February	1.69±1.57E-10	2.61±0.56E-09
March	0.77±1.81E-10	8.59±4.05E-10
April	N/A	N/A
May	0.24±1.24E-10	2.68±3.82E-10
June	N/A	N/A
July	-0.42±6.15E-11	-0.92±1.59E-10
August	-0.22±1.75E-10	4.72±4.92E-10
September	N/A	N/A
October	N/A	N/A
November	N/A	N/A
December	N/A	N/A
Annual Total	2.16±3.95E-10	4.09±1.11E-09

Isotope	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**	**Annual Total**
Co-60	-0.50±6.88E-10	2.76±7.78E-10	0.00±1.33E-09	NA	0.23±1.69E-09
Sr-90	0.04±1.60E-09	-1.07±3.95E-10	1.87±1.29E-10	NA	0.12±1.65E-09
Cs-134	-3.00±7.25E-10	-2.63±8.30E-10	-1.34±1.96E-10	NA	-0.70±1.12E-09
Cs-137	5.60±6.24E-10	1.12±7.91E-10	-3.87±6.75E-10	NA	0.29±1.21E-09
Eu-154	-4.14±6.01E-09	-7.40±7.18E-09	-1.64±2.06E-09	NA	-1.32±0.96E-08
U-232	5.83±0.52E-11	0.00±1.63E-10	5.80±0.61E-11	NA	1.16±1.63E-10
U-233/234	6.01±7.30E-11	1.01±1.03E-10	2.97±1.18E-11	NA	1.91±1.27E-10
U-235/236	2.03±2.87E-11	2.30±6.06E-11	5.28±4.75E-12	NA	4.86±6.72E-11
U-238	4.04±4.05E-11	1.17±4.77E-11	1.54±0.93E-11	NA	6.75±6.33E-11
Pu-238	1.36±0.77E-10	-0.20±1.22E-10	1.12±1.00E-11	NA	1.27±1.45E-10
Pu-239/240	1.05±2.10E-11	-2.57±3.63E-11	3.91±1.64E-11	NA	2.39±4.50E-11
Am-241	1.82±1.15E-10	1.14±1.04E-10	6.95±7.10E-12	NA	3.03±1.55E-10
Total U (g)	2.34±0.05E-05	-4.03±0.10E-05	-1.28±0.06E-04	NA	-1.45±0.06E-04

N/A - Not applicable. Ventilation system was not operating during these months.
NA - Not available.

Table C - 2.9

*1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at ANLLWTVC**

Month	Alpha	Beta	Sr-90	Cs-137
January	1.44±5.69E-16	6.69±1.91E-15		
February	7.54±6.65E-16	9.05±2.03E-15		
March	2.69±6.26E-16	6.01±1.68E-15		
1st Qtr			-7.87±9.16E-17	0.20±1.29E-16
April	1.79±5.38E-16	6.03±1.63E-15		
May	4.04±6.08E-16	1.88±1.50E-15		
June	1.57±5.98E-16	0.64±1.47E-15		
2nd Qtr			-1.25±0.70E-16	-0.17±2.24E-16
July	-0.03±5.10E-16	0.69±1.48E-15		
August	-1.97±6.26E-16	0.83±1.52E-15		
September	-0.37±4.78E-16	1.55±1.59E-15		
3rd Qtr			-0.78±7.95E-17	-0.20±1.97E-16
October	2.23±5.30E-16	3.96±1.86E-15		
November	3.51±7.10E-16	5.44±2.20E-15		
December	*Not Available*			
4th Qtr			*Not Applicable (see footnote)*	

Table C - 2.10

*1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at ANLLWTVH**

Month	Alpha	Beta	Sr-90	Cs-137
January	0.38±5.57E-16	-0.08±1.44E-15		
February	1.86±5.19E-16	1.03±1.49E-15		
March	-0.31±5.87E-16	0.80±1.36E-15		
1st Qtr			-1.41±0.86E-16	0.36±1.92E-16
April	-1.70±4.83E-16	1.03±1.35E-15		
May	0.91±5.59E-16	-0.21±1.42E-15		
June	0.18±5.46E-16	0.49±1.43E-15		
2nd Qtr			-1.24±0.91E-16	0.62±2.29E-16
July	-0.44±4.96E-16	1.03±1.52E-15		
August	-1.93±6.18E-16	1.25±1.53E-15		
September	1.21±5.21E-16	0.46±1.47E-15		
3rd Qtr			-1.27±0.92E-16	0.81±2.07E-16
October	-0.21±4.52E-16	0.61±1.61E-15		
November	3.06±6.25E-16	1.46±1.72E-15		
December	*Not Available*			
4th Qtr			*Not Applicable (see footnote)*	

** ANLLWTVC is the "cold" operations side and ANLLWTVH is the "hot" process equipment side of ANLLWTV.*
No fourth-quarter sample was collected because the one-year sampling period was completed in the third-quarter 1995.

Table C - 2.11

1995 Radioactivity Concentrations in Airborne Particulates (µCi/mL) at ANLAUNV

Month	Alpha	Beta	Sr-90	Cs-137
January	0.35±2.59E-14	-2.32±6.63E-14		
February	0.19±2.18E-14	1.30±5.94E-14		
March	1.12±4.15E-14	0.46±8.11E-14		
1st Qtr			-6.93±3.54E-15	0.99±1.06E-14
April	0.18±2.97E-14	2.02±6.95E-14		
May	4.87±7.11E-15	-0.85±2.52E-14		
June	-5.01±8.50E-15	-0.56±1.81E-14		
2nd Qtr			-1.07±0.51E-14	-0.20±1.47E-14
July	-3.89±4.40E-15	0.30±2.28E-14		
August	1.28±1.66E-14	2.39±4.05E-14		
September	4.91±5.56E-15	-0.25±1.24E-14		
3rd Qtr			-2.90±6.79E-15	0.98±1.31E-14
October	2.74±4.73E-15	-1.62±1.66E-14		
November	-5.83±6.59E-15	3.14±3.23E-14		
December	0.58±1.13E-14	-1.45±2.45E-14		
4th Qtr			*Not Applicable*	

No fourth-quarter sample was collected because the one-year sampling period was completed in the third-quarter 1995.

Table C - 2.12

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at ANLAGAM

Month	Alpha	Beta
February	6.27±7.24E-16	1.62±0.23E-14
March	7.27±7.81E-16	1.60±0.24E-14
April	6.50±7.14E-16	1.19±0.21E-14
May	7.15±7.39E-16	8.84±2.12E-15
June	5.56±6.78E-16	1.23±0.22E-14
July	1.02±0.78E-15	1.52±0.25E-14
August	6.40±8.16E-16	1.79±0.26E-14
September	6.23±6.62E-16	1.25±0.23E-14
October	3.99±5.76E-16	1.10±0.23E-14
November	5.81±6.84E-16	2.02±1.73E-15
December	-1.58±5.97E-16	1.08±1.51E-15

	K-40	Co-60	Sr-90	Cs-137
1st Qtr	6.45±6.94E-15	-0.85±5.72E-16	-4.31±2.48E-16	-0.76±5.43E-16
2nd Qtr	0.80±4.29E-15	-0.66±2.45E-16	-1.67±0.80E-16	3.25±3.21E-16
3rd Qtr	0.39±4.39E-15	1.04±2.12E-16	-0.13±9.90E-17	1.81±2.10E-16
4th Qtr	0.00±5.38E-15	1.21±2.08E-16	4.30±1.31E-16	0.53±2.11E-16

	U-232	U-233/234	U-235/236	U-238	Total U (μg/mL)
1st Qtr	1.06±0.10E-15	1.16±0.72E-16	0.96±3.36E-17	1.03±0.64E-16	1.72±0.03E-10
2nd Qtr	0.00±4.35E-17	5.84±2.72E-17	-0.27±1.35E-17	8.91±3.38E-17	1.91±0.02E-10
3rd Qtr	0.00±1.13E-17	6.17±1.62E-17	7.72±6.21E-18	5.63±1.54E-17	1.34±0.03E-10
4th Qtr	8.94±3.18E-17	7.58±1.95E-17	1.43±5.67E-18	7.34±1.90E-17	1.25±0.03E-10

	Pu-238	Pu-239/240	Am-241
1st Qtr	5.59±4.41E-17	2.09±2.41E-17	1.32±0.65E-16
2nd Qtr	1.52±4.58E-17	5.69±3.96E-17	1.02±0.59E-16
3rd Qtr	-0.98±6.24E-18	0.49±3.95E-18	-2.57±9.47E-18
4th Qtr	7.42±6.69E-18	2.43±3.45E-18	-0.02±8.80E-18

Table C - 2.13

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at ANNDAAM

Month	Alpha	Beta
February	1.28±0.88E-15	1.74±0.24E-14
March	1.05±0.85E-15	1.73±0.25E-14
April	7.33±7.33E-16	1.46±0.23E-14
May	7.83±7.55E-16	9.46±2.16E-15
June	9.56±7.68E-16	1.28±0.23E-14
July	1.17±0.81E-15	1.80±0.26E-14
August	1.28±0.95E-15	1.88±0.26E-14
September	8.37±7.16E-16	1.59±0.25E-14
October	1.13±0.76E-15	2.32±0.29E-14
November	1.06±0.79E-15	1.48±0.25E-14
December	6.29±7.78E-16	1.92±0.26E-14

	K-40	Co-60	Sr-90	Cs-137
1st Qtr	1.04±0.64E-14	3.47±4.96E-16	-0.58±2.93E-16	-1.91±4.99E-16
2nd Qtr	2.24±2.68E-15	1.24±2.29E-16	-2.65±1.12E-16	4.87±3.71E-16
3rd Qtr	4.21±4.17E-15	-0.75±2.30E-16	-3.09±7.59E-17	-0.24±2.26E-16
4th Qtr	4.50±4.07E-15	1.61±2.06E-16	2.22±1.17E-16	2.78±2.54E-16

	U-232	U-233/234	U-235/236	U-238	Total U (μg/mL)
1st Qtr	2.85±0.26E-17	6.67±6.28E-17	2.50±3.73E-17	7.50±6.05E-17	1.19±0.01E-10
2nd Qtr	4.23±0.44E-15	6.82±4.10E-17	-0.34±1.26E-17	2.69±3.06E-17	1.87±0.03E-10
3rd Qtr	2.39±2.51E-17	6.95±1.76E-17	7.98±5.69E-18	8.38±1.97E-17	1.19±0.03E-10
4th Qtr	1.06±0.49E-16	7.08±1.91E-17	4.28±4.29E-18	6.29±1.70E-17	1.12±0.02E-10

	Pu-238	Pu-239/240	Am-241
1st Qtr	-2.36±4.33E-17	0.84±1.68E-17	1.74±0.90E-16
2nd Qtr	6.68±6.62E-17	1.98±2.38E-17	2.13±3.13E-17
3rd Qtr	1.50±0.39E-16	1.24±1.02E-17	0.23±1.19E-17
4th Qtr	3.88±6.85E-18	-0.76±1.52E-18	3.18±9.76E-18

Table C - 2.14

1995 Airborne Radioactivity Concentrations (μCi/mL) at ANSDAT9

Month	Alpha	Beta	H-3
January	0.69±1.02E-15	1.65±0.34E-14	0.70±1.41E-12
February	9.65±9.74E-16	2.04±0.35E-14	9.77±3.23E-13
March	0.98±1.15E-15	1.67±0.32E-14	2.76±0.46E-12
April	0.72±1.01E-15	1.51±0.31E-14	1.52±0.41E-12
May	3.49±9.29E-16	8.95±2.92E-15	1.14±0.57E-12
June	4.90±9.40E-16	1.49±0.32E-14	2.95±0.83E-12
July	0.78±1.58E-15	1.80±0.54E-14	3.33±1.36E-12
August	0.33±1.10E-15	2.25±0.38E-14	1.66±1.24E-12
September	8.25±9.93E-16	1.58±0.33E-14	3.72±0.87E-12
October	1.50±1.70E-15	2.31±0.54E-14	2.07±0.74E-12
November	0.99±1.32E-15	1.68±0.41E-14	1.72±0.47E-12
December	-0.38±1.40E-13	-0.10±3.10E-13	8.76±2.42E-13

	K-40	Co-60	Cs-137	I-129
1st Qtr	2.27±6.27E-15	2.12±2.90E-16	-2.78±2.90E-16	4.07±4.05E-16
2nd Qtr	4.31±6.47E-15	-0.42±3.39E-16	5.06±2.57E-16	1.27±2.33E-16
3rd Qtr	0.00±9.09E-15	-1.44±3.09E-16	-2.16±3.38E-16	1.70±2.46E-16
4th Qtr	3.96±7.53E-15	1.34±4.04E-16	-0.03±3.99E-16	-1.12±3.13E-16

Table C - 2.15

1995 Airborne Radioactive Effluent Totals (curies) from Outdoor Ventilation Enclosures/Portable Ventilation Units

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Gross Alpha	4.62±4.74E-11	N/A	N/A	N/A
Gross Beta	4.32±1.51E-10	N/A	N/A	N/A
Co-60	0.56±1.45E-10	N/A	N/A	N/A
Sr-90	-3.73±6.41E-11	N/A	N/A	N/A
Cs-134	1.02±1.59E-10	N/A	N/A	N/A
Cs-137	0.79±1.53E-10	N/A	N/A	N/A
Eu-154	-0.30±1.29E-09	N/A	N/A	N/A
U-232	1.88±0.91E-11	N/A	N/A	N/A
U-233/234	0.00±2.26E-11	N/A	N/A	N/A
U-235/236	1.53±1.54E-11	N/A	N/A	N/A
U-238	5.42±2.72E-11	N/A	N/A	N/A
Pu-238	0.03±1.17E-11	N/A	N/A	N/A
Pu-239/240	4.21±5.96E-12	N/A	N/A	N/A
Am-241	0.74±1.15E-11	N/A	N/A	N/A
Total U (g)	-1.84±0.04E-05	N/A	N/A	N/A

N/A - Not applicable; No PVUs operational during this quarter.

Table C - 2.16

1995 Airborne Radioactivity Concentrations (μCi/mL) at the Rock Springs Road Air Sampler (AFRSPRD)

Month	Alpha	Beta	H-3
January	0.94±1.06E-15	1.62±0.33E-14	2.93±4.55E-13
February	1.42±1.07E-15	1.89±0.34E-14	4.20±4.28E-13
March	1.14±1.17E-15	1.79±0.32E-14	7.32±0.41E-12
April	1.20±1.11E-15	1.58±0.31E-14	5.19±2.79E-13
May	0.85±1.07E-15	1.00±0.30E-14	3.18±5.98E-13
June	0.88±1.03E-15	1.24±0.30E-14	0.34±1.13E-12
July	0.87±1.03E-15	1.61±0.34E-14	0.04±2.43E-12
August	0.82±1.20E-15	2.02±0.36E-14	0.87±1.78E-12
September	7.41±9.56E-16	1.57±0.33E-14	2.03±1.22E-12
October	1.48±1.10E-15	2.46±0.39E-14	2.37±0.66E-12
November	7.06±9.88E-16	1.46±0.33E-14	8.16±3.60E-13
December	0.25±1.02E-15	2.01±0.35E-14	3.27±2.46E-13

	K-40	Co-60	Sr-90	Cs-137	I-129
1st Qtr	0.79±6.28E-15	0.57±2.96E-16	-2.91±1.40E-16	3.00±3.09E-16	2.11±2.16E-16
2nd Qtr	6.86±4.68E-15	3.55±5.47E-16	-1.90±1.53E-16	-1.20±3.10E-16	0.41±2.33E-16
3rd Qtr	6.14±3.74E-15	-0.60±3.27E-16	-1.58±1.12E-16	0.77±2.88E-16	6.88±3.58E-16
4th Qtr	0.00±7.83E-15	0.20±3.14E-16	6.00±1.72E-16	-3.17±3.04E-16	-0.70±1.90E-16

	U-232	U-233/234	U-235/236	U-238	Total U (μg/mL)
1st Qtr	4.38±0.40E-17	1.42±0.53E-16	1.63±3.06E-17	1.42±0.54E-16	2.24±0.03E-10
2nd Qtr	0.00±6.01E-17	1.24±0.58E-16	1.53±2.60E-17	1.29±0.52E-16	2.62±0.03E-10
3rd Qtr	9.23±1.15E-18	9.74±3.38E-17	0.81±1.10E-17	1.01±0.34E-16	2.00±0.05E-10
4th Qtr	1.77±0.52E-16	1.23±0.29E-16	4.62±7.87E-18	1.09±0.27E-16	2.07±0.04E-10

	Pu-238	Pu-239/240	Am-241
1st Qtr	2.70±2.79E-17	1.33±1.54E-17	0.84±1.19E-17
2nd Qtr	2.32±3.21E-17	0.92±1.78E-17	-1.84±0.99E-16
3rd Qtr	2.60±3.54E-17	-0.1±1.51E-17	0.97±1.32E-17
4th Qtr	0.75±1.15E-17	1.12±3.44E-18	0.84±1.42E-17

Table C - 2.17

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Dutch Hill Air Sampler (AFBOEHN)

Month	Alpha	Beta	Sr-90	Cs-137
January	6.72±9.93E-16	1.61±0.33E-14		
February	1.04±0.98E-15	2.38±0.36E-14		
March	1.29±1.19E-15	1.97±0.33E-14		
1st Qtr			5.37±2.42E-16	-0.30±2.84E-16
April	1.12±1.09E-15	1.72±0.31E-14		
May	0.79±1.09E-15	1.23±0.33E-14		
June	0.90±1.04E-15	1.71±0.33E-14		
2nd Qtr			-0.73±1.56E-16	0.72±3.72E-16
July	1.86±1.78E-15	2.06±0.49E-14		
August	0.71±1.16E-15	2.76±0.40E-14		
September	5.19±8.84E-16	2.05±0.35E-14		
3rd Qtr			-1.03±1.13E-16	-0.43±3.14E-16
October	1.26±1.04E-15	3.21±0.42E-14		
November	0.36±1.06E-15	1.75±0.40E-14		
December	0.68±1.13E-15	2.00±0.35E-14		
4th Qtr			1.23±1.20E-16	-0.28±3.14E-16

Table C - 2.18

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Fox Valley Air Sampler (AFFXVRD)

Month	Alpha	Beta	Sr-90	Cs-137
January	5.25±9.78E-16	1.67±0.34E-14		
February	1.38±1.08E-15	2.25±0.36E-14		
March	1.26±1.21E-15	1.85±0.33E-14		
1st Qtr			-1.38±0.54E-16	-1.48±3.14E-16
April	6.19±9.90E-16	1.77±0.32E-14		
May	0.81±1.08E-15	1.14±0.31E-14		
June	4.24±8.69E-16	1.49±0.31E-14		
2nd Qtr			2.44±1.74E-16	-0.73±3.56E-16
July	0.48±1.29E-15	1.80±0.52E-14		
August	0.46±9.73E-16	2.07±0.35E-14		
September	7.54±9.23E-16	1.69±0.33E-14		
3rd Qtr			-1.99±1.59E-16	2.92±3.00E-16
October	1.03±0.96E-15	2.37±0.37E-14		
November	8.23±9.78E-16	1.84±0.34E-14		
December	0.65±1.11E-15	2.20±0.36E-14		
4th Qtr			4.93±1.45E-16	-1.84±3.20E-16

Table C - 2.19

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at Location AFBLKST

Month	Alpha	Beta	Sr-90	Cs-137
January	1.00±1.10E-15	1.34±0.32E-14		
February	8.00±9.35E-16	1.96±0.35E-14		
March	0.41±1.03E-15	1.55±0.32E-14		
1st Qtr			-1.92±2.50E-16	0.96±2.87E-16
April	0.92±1.08E-15	1.48±0.31E-14		
May	1.38±8.59E-16	1.03±0.30E-14		
June	1.09±1.14E-15	1.58±0.33E-14		
2nd Qtr			-2.69±1.42E-16	-2.19±3.43E-16
July	1.48±1.16E-15	1.99±0.36E-14		
August	0.57±1.14E-15	2.30±0.37E-14		
September	7.76±9.61E-16	1.82±0.34E-14		
3rd Qtr			-6.58±9.19E-17	-0.27±1.96E-16
October	1.25±1.04E-15	2.46±0.38E-14		
November	5.68±9.45E-16	1.58±0.34E-14		
December	1.05±1.19E-15	2.07±0.35E-14		
4th Qtr			4.79±2.11E-16	0.23±3.20E-16

Table C - 2.20

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Route 240 Air Sampler (AFRT240)

Month	Alpha	Beta	Sr-90	Cs-137
January	0.99±1.07E-15	1.40±0.31E-14		
February	1.07±0.98E-15	1.76±0.33E-14		
March	1.02±1.14E-15	1.44±0.30E-14		
1st Qtr			-0.22±2.41E-16	0.25±2.28E-16
April	0.85±1.05E-15	1.40±0.30E-14		
May	0.74±1.05E-15	1.28±0.32E-14		
June	1.21±1.12E-15	1.37±0.31E-14		
2nd Qtr			-2.55±1.51E-16	-0.30±3.53E-16
July	1.28±1.10E-15	1.97±0.35E-14		
August	0.92±1.24E-15	2.28±0.37E-14		
September	0.89±1.00E-15	1.68±0.34E-14		
3rd Qtr			-1.81±1.29E-16	1.49±3.13E-16
October	9.95±9.95E-16	2.59±0.40E-14		
November	0.92±1.09E-15	2.04±0.38E-14		
December	0.20±1.01E-15	2.17±0.35E-14		
4th Qtr			3.15±1.54E-16	0.38±3.36E-16

Table C - 2.21

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Thomas Corners Road Air Sampler (AFTCORD)

Month	Alpha	Beta	Sr-90	Cs-137
January	0.72±1.02E-15	1.50±0.33E-14		
February	1.34±1.07E-15	2.02±0.35E-14		
March	0.63±1.07E-15	1.61±0.32E-14		
1st Qtr			-6.68±9.77E-17	3.47±2.95E-16
April	0.69±1.02E-15	1.46±0.31E-14		
May	3.54±9.43E-16	1.03±0.30E-14		
June	0.77±1.02E-15	1.48±0.32E-14		
2nd Qtr			-1.51±1.42E-16	-2.66±3.01E-16
July	0.81±1.05E-15	1.84±0.36E-14		
August	0.57±1.66E-15	2.20±0.50E-14		
September	0.90±1.00E-15	1.53±0.33E-14		
3rd Qtr			-1.39±1.40E-16	2.88±3.60E-16
October	9.15±9.68E-16	2.42±0.39E-14		
November	1.01±1.33E-15	1.58±0.42E-14		
December	0.33±1.06E-15	1.99±0.35E-14		
4th Qtr			2.62±0.31E-15	-1.01±3.20E-16

Table C - 2.22

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the West Valley Air Sampler (AFWEVAL)

Month	Alpha	Beta	Sr-90	Cs-137
January	5.04±9.39E-16	1.75±0.33E-14		
February	1.15±1.01E-15	2.26±0.36E-14		
March	0.84±1.09E-15	1.90±0.33E-14		
1st Qtr			-6.67±9.67E-17	-1.81±2.74E-16
April	0.84±1.14E-15	1.66±0.34E-14		
May	0.81±1.07E-15	1.32±0.32E-14		
June	1.05±1.09E-15	1.73±0.33E-14		
2nd Qtr			-2.04±2.00E-16	2.72±3.21E-16
July	1.15±1.11E-15	2.33±0.38E-14		
August	0.90±1.20E-15	2.52±0.39E-14		
September	1.18±1.07E-15	1.97±0.35E-14		
3rd Qtr			-2.64±1.90E-16	2.93±3.05E-16
October	9.12±9.89E-16	3.16±0.43E-14		
November	3.85±9.01E-16	1.75±0.35E-14		
December	0.34±1.04E-15	2.14±0.35E-14		
4th Qtr			3.94±1.41E-16	-0.79±3.31E-16

Table C - 2.23

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Springville Air Sampler (AFSPRVL)

Month	Alpha	Beta	Sr-90	Cs-137
January	2.69±8.82E-16	1.44±0.32E-14		
February	1.08±0.99E-15	1.72±0.33E-14		
March	0.56±1.03E-15	1.47±0.30E-14		
1st Qtr			-0.91±1.30E-16	0.18±2.98E-16
April	5.05±9.51E-16	1.42±0.30E-14		
May	3.90±9.54E-16	1.10±0.31E-14		
June	1.12±1.11E-15	1.30±0.31E-14		
2nd Qtr			-0.96±1.13E-16	3.01±3.33E-16
July	1.11±1.08E-15	1.65±0.34E-14		
August	0.95±1.25E-15	1.92±0.36E-14		
September	6.84±9.53E-16	1.51±0.33E-14		
3rd Qtr			-0.36±1.61E-16	1.84±3.05E-16
October	1.22±1.05E-15	2.06±0.37E-14		
November	5.73±9.48E-16	1.34±0.33E-14		
December	0.90±1.15E-15	1.67±0.33E-14		
4th Qtr			2.79±1.70E-16	-1.30±3.13E-16

Table C - 2.24

1995 Airborne Radioactivity Concentrations (µCi/mL) at the Great Valley Background Air Sampler (AFGRVAL)

Month	Alpha	Beta	H-3
January	2.81±9.20E-16	1.49±0.33E-14	0.07±1.92E-12
February	1.54±1.13E-15	1.79±0.34E-14	0.31±1.69E-12
March	0.70±1.10E-15	1.52±0.32E-14	1.22±0.14E-11
April	1.26±3.58E-15	1.76±0.85E-14	7.15±7.89E-12
May	0.90±1.07E-15	1.19±0.31E-14	1.69±6.46E-13
June	0.87±1.02E-15	1.44±0.31E-14	0.28±1.10E-12
July	1.32±1.13E-15	1.80±0.35E-14	0.64±1.16E-12
August	0.73±1.16E-15	2.33±0.37E-14	0.38±1.27E-12
September	0.95±1.00E-15	1.79±0.34E-14	1.61±0.76E-12
October	7.66±9.13E-16	2.66±0.40E-14	1.48±0.66E-12
November	1.10±1.09E-15	1.58±0.34E-14	1.80±0.77E-12
December	0.62±1.10E-15	2.07±0.35E-14	2.60±7.42E-13

	K-40	Co-60	Sr-90	Cs-137	I-129
1st Qtr	-0.04±3.48E-15	-1.15±2.83E-16	-3.78±1.42E-16	0.10±2.67E-16	0.06±2.27E-16
2nd Qtr	3.67±8.96E-15	-0.32±4.45E-16	-2.26±1.84E-16	-3.71±4.10E-16	-0.15±2.73E-16
3rd Qtr	1.84±8.14E-15	4.37±5.03E-16	0.72±1.47E-16	8.12±6.77E-16	1.52±1.99E-16
4th Qtr	0.83±9.66E-15	0.31±3.07E-16	5.27±1.85E-16	-1.02±3.22E-16	-1.10±1.99E-16

	U-232	U-233/234	U-235/236	U-238	Total U (µg/mL)
1st Qtr	3.79±0.35E-17	1.25±0.48E-16	0.83±1.77E-17	1.21±0.47E-16	2.69±0.03E-10
2nd Qtr	0.00±7.01E-17	1.92±0.70E-16	0.09±2.95E-17	1.34±0.63E-16	3.47±0.05E-10
3rd Qtr	0.00±4.35E-17	1.03±0.29E-16	-0.73±1.02E-17	7.29±2.47E-17	2.18±0.06E-10
4th Qtr	8.29±3.87E-17	1.12±0.25E-16	1.24±0.79E-17	1.04±0.24E-16	2.22±0.06E-10

	Pu-238	Pu-239/240	Am-241
1st Qtr	1.92±2.32E-17	0.00±1.43E-17	4.05±3.08E-17
2nd Qtr	0.27±1.12E-16	9.78±8.29E-17	4.71±3.58E-17
3rd Qtr	-0.35±1.33E-17	-1.97±3.92E-18	1.63±1.75E-17
4th Qtr	1.28±1.00E-17	7.80±5.92E-18	0.70±1.40E-17

Table C - 2.25

*1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Nashville Background Air Sampler (AFNASHV)**

Month	Alpha	Beta	Sr-90	Cs-137
May	0.87±1.06E-15	1.09±0.30E-14		
June	1.10±1.08E-15	1.47±0.31E-14		
2nd Qtr			-2.67±2.19E-16	1.34±5.58E-16
July	1.50±1.17E-15	1.90±0.35E-14		
August	0.51±1.11E-15	2.26±0.37E-14		
September	7.04±9.37E-16	2.01±0.35E-14		
3rd Qtr			-5.76±9.11E-17	3.02±2.77E-16
October	1.00±0.98E-15	2.53±0.39E-14		
November	1.03±1.07E-15	1.78±0.35E-14		
December	0.84±1.15E-15	2.06±0.35E-14		
4th Qtr			8.77±1.49E-16	1.37±3.21E-16

Table C - 2.26

1995 Radioactivity Concentrations in Airborne Particulates (μCi/mL) at the Dunkirk Background Air Sampler (AFDNKRK)

Month	Alpha	Beta	Sr-90	Cs-137
January	1.04±1.08E-15	1.75±0.33E-14		
February	1.58±1.11E-15	2.17±0.35E-14		
March	0.72±1.06E-15	1.89±0.33E-14		
1st Qtr			1.16±0.95E-16	-0.08±2.70E-16
April	0.88±1.02E-15	1.62±0.31E-14		
May	4.52±9.49E-16	1.11±0.30E-14		
June	1.04±1.00E-15	1.21±0.30E-14		
2nd Qtr			-0.66±1.87E-16	2.29±3.75E-16

* *Replaces AFDNKRK.*

Table C - 2.27

Radioactivity in Fallout During 1995 (nCi/m²/mo)

Dutch Hill (AFDHFOP)

Month	Alpha	Beta	Tritium (μCi/mL)
January	0.00±1.36E-02	4.32±0.82E-01	0.00±1.00E-07
February	0.40±1.09E-02	2.94±0.39E-01	0.00±1.00E-07
March	-0.42±1.00E-02	6.87±2.46E-02	1.56±0.82E-07
April	0.60±1.03E-02	2.74±0.29E-01	2.17±7.71E-08
May	2.41±1.35E-02	9.31±0.36E-01	0.00±1.00E-07
June	1.19±0.37E-02	2.43±0.14E-01	0.00±1.00E-07
July	4.00±2.81E-02	1.41±0.12E-00	0.00±1.00E-07
August	9.08±6.39E-03	1.98±0.21E-01	0.00±1.00E-07
September	1.09±0.39E-02	3.08±0.18E-01	0.00±1.00E-07
October	5.31±2.66E-03	1.03±0.11E-01	3.02±7.86E-08
November	2.43±1.04E-02	3.90±0.43E-01	2.12±0.78E-07
December	2.07±0.56E-02	4.48±0.29E-01	1.38±0.76E-07

Route 240 (AF24FOP)

Month	Alpha	Beta	Tritium (μCi/mL)
January	3.59±2.78E-02	3.41±0.70E-01	4.84±7.60E-08
February	1.95±1.97E-02	3.89±0.54E-01	0.00±1.00E-07
March	1.02±1.45E-02	2.27±0.32E-01	4.71±8.10E-08
April	3.10±1.86E-02	3.42±0.38E-01	4.95±7.86E-08
May	1.33±0.46E-02	2.55±0.17E-01	0.00±1.00E-07
June	1.21±0.32E-02	2.09±0.13E-01	0.00±1.00E-07
July	8.92±1.59E-02	9.09±0.62E-01	1.74±7.72E-08
August	2.53±4.85E-03	2.44±0.26E-01	1.83±7.65E-08
September	2.30±0.49E-02	4.24±0.23E-01	1.88±0.85E-07
October	5.11±1.37E-02	7.05±0.61E-01	9.78±7.66E-08
November	1.34±1.18E-02	5.50±0.58E-01	0.27±7.69E-08
December	2.08±0.56E-02	4.59±0.29E-01	0.00±1.00E-07

Fox Valley (AFFXFOP)

Month	Alpha	Beta	Tritium (μCi/mL)
January	2.25±2.70E-02	5.66±0.99E-01	0.00±1.00E-07
February	3.37±3.09E-02	4.45±0.74E-01	1.87±7.59E-08
March	0.80±1.74E-02	2.15±0.32E-01	9.79±8.01E-08
April	1.28±1.81E-02	3.47±0.44E-01	7.91±8.00E-08
May	1.38±0.47E-02	2.27±0.17E-01	2.15±8.26E-08
June	1.51±0.59E-02	2.43±0.20E-01	0.00±1.00E-07
July	8.65±1.43E-02	7.34±0.52E-01	3.57±7.71E-08
August	1.53±0.60E-02	2.83±0.26E-01	0.00±1.00E-07
September	2.87±0.60E-02	4.64±0.25E-01	1.45±0.87E-07
October	7.22±1.70E-02	5.28±0.56E-01	0.00±1.00E-07
November	2.45±1.31E-02	6.88±0.63E-01	8.12±7.57E-08
December	1.94±0.55E-02	3.80±0.27E-01	0.00±1.00E-07

Rain Gauge (ANRGFOP)

Month	Alpha	Beta	Tritium (μCi/mL)
January	2.61±3.12E-01	4.78±1.93E-01	0.00±1.00E-07
February	-1.31±3.15E-01	5.00±2.19E-01	0.00±1.00E-07
March	1.19±2.57E-02	2.73±0.38E-01	9.55±8.38E-08
April	0.89±2.74E-02	2.98±0.50E-01	2.75±7.83E-08
May	2.32±0.60E-02	2.71±0.20E-01	0.00±1.00E-07
June	2.00±0.68E-02	2.91±0.22E-01	0.00±1.00E-07
July	8.04±1.58E-02	8.52±0.63E-01	0.00±1.00E-07
August	1.07±0.62E-02	1.08±0.21E-01	0.00±1.00E-07
September	2.33±0.58E-02	4.06±0.26E-01	7.45±8.02E-08
October	2.19±1.23E-02	4.58±0.59E-01	0.00±1.00E-07
November	1.28±1.20E-02	6.20±0.61E-01	3.70±7.58E-08
December	1.76±0.57E-02	7.25±0.35E-01	0.00±1.00E-07

Thomas Corners (AFTCFOP)

Month	Alpha	Beta	Tritium (μCi/mL)
January	5.16±4.00E-02	7.31±1.19E-01	0.00±1.00E-07
February	6.81±4.09E-02	5.33±0.82E-01	4.32±7.70E-08
March	1.22±2.07E-02	1.57±0.31E-01	5.74±8.12E-08
April	2.43±2.18E-02	4.19±0.52E-01	7.57±7.76E-08
May	3.67±0.60E-02	4.24±0.21E-01	9.02±7.86E-08
June	1.76±0.47E-02	2.39±0.18E-01	2.75±7.83E-08
July	7.41±1.58E-02	9.94±0.70E-01	5.92±7.70E-08
August	4.78±5.82E-03	2.26±0.28E-01	0.00±1.00E-07
September	3.83±0.84E-02	6.67±0.40E-01	1.42±0.84E-07
October	3.39±1.26E-02	4.52±0.54E-01	0.00±1.00E-07
November	2.64±1.31E-02	6.06±0.60E-01	1.40±0.77E-07
December	1.39±0.50E-02	2.60±0.23E-01	6.87±7.62E-08

Table C - 2.27 (concluded)

pH (standard units) of Precipitation Collected in Fallout Pots in 1995

Month	Dutch Hill (AFDHFOP)	Fox Valley Road (AFFXFOP)	Route 240 (AF24FOP)	Thomas Corners Road (AFTCFOP)	Rain Gauge (ANRGFOP)
January	4.04	4.24	3.97	4.06	6.79
February	3.76	4.02	3.81	4.30	7.56
March	3.66	5.88	4.16	6.36	6.71
April	3.06	4.29	3.25	3.48	6.49
May	7.58	6.28	7.22	3.83	8.61
June	7.41	8.71	4.38	4.58	8.47
July	6.07	3.83	3.64	3.58	3.69
August	4.61	3.56	3.58	3.81	3.92
September	4.27	3.80	3.56	3.01	3.86
October	6.22	4.68	4.08	4.23	4.05
November	4.10	3.44	3.49	3.86	4.17
December	3.97	4.53	4.10	6.65	6.25

Appendix C - 3

Summary of Biological Data

Milk and Meat Samples Are Collected from Local Bovine Herds

Table C - 3.1

1995 Radioactivity Concentrations in Milk (μCi/mL)

Location	H-3 (μCi/mL)	Sr-90	I-129	Cs-134	Cs-137	K-40
BFMCOBO						
(WNW Farm)						
1st Qtr	0.56±1.31E-07	4.19±0.62E-09	0.59±3.15E-10	-2.29±1.17E-09	0.59±1.14E-09	1.42±0.24E-07
2nd Qtr	1.95±6.86E-08	1.73±0.39E-09	-1.90±4.30E-10	0.69±1.60E-09	1.43±1.93E-09	9.13±0.71E-07
3rd Qtr	2.96±0.81E-07	8.53±4.59E-10	6.44±4.23E-10	-1.52±1.28E-09	6.40±2.85E-09	9.02±0.57E-07
4th Qtr	-0.16±1.01E-07	2.05±0.38E-09	2.73±4.64E-10	0.02±2.04E-09	0.35±1.83E-09	1.21±0.10E-06
BFMCTLN						
(Control)						
1st Qtr	-4.01±8.81E-08	1.51±0.56E-09	5.96±3.60E-10	-0.68±1.15E-09	-0.45±1.10E-09	1.51±0.05E-06
2nd Qtr	8.85±6.98E-08	2.96±0.45E-09	3.33±4.98E-10	1.04±1.70E-09	0.86±1.77E-09	1.39±0.09E-06
3rd Qtr	0.77±1.03E-07	9.74±2.90E-10	3.29±4.00E-10	-0.88±1.45E-09	0.01±1.30E-09	1.16±0.06E-06
4th Qtr	-6.52±9.82E-08	1.14±0.38E-09	1.56±3.28E-10	-0.36±1.84E-09	-1.48±2.17E-09	1.41±0.10E-06
BFMCTLS						
(Control)						
1st Qtr	-9.83±8.07E-08	1.47±0.34E-09	4.59±4.29E-10	3.55±9.74E-10	0.76±2.57E-09	1.45±0.06E-06
2nd Qtr	4.53±7.06E-08	1.17±0.36E-09	1.11±4.16E-10	1.78±2.02E-09	1.42±1.78E-09	1.32±0.08E-06
3rd Qtr	2.38±1.09E-07	8.71±2.31E-10	1.81±2.38E-10	0.22±1.25E-09	0.54±1.36E-09	1.33±0.15E-06
4th Qtr	-5.31±9.96E-08	1.66±0.33E-09	1.42±2.31E-10	-0.38±1.43E-09	0.23±1.35E-09	1.45±0.07E-06
BFMREED						
(NNW Farm)						
1st Qtr	1.77±1.41E-07	7.33±4.87E-10	7.80±3.63E-10	5.61±4.90E-09	1.49±2.28E-09	1.43±0.11E-06
2nd Qtr	3.17±6.82E-08	1.78±0.40E-09	3.48±5.16E-10	0.28±1.49E-09	1.28±1.83E-09	1.40±0.09E-06
3rd Qtr	1.92±1.08E-07	1.54±0.50E-09	4.80±5.52E-10	-0.75±1.38E-09	0.47±1.38E-09	1.44±0.07E-06
4th Qtr	-0.64±1.01E-07	2.11±0.41E-09	1.79±3.18E-10	-0.05±2.06E-09	0.96±2.24E-09	1.28±0.16E-06
BFMSCHT						
(S Farm)						
Annual	-0.38±1.00E-07	2.37±0.36E-09	0.00±3.58E-10	-1.64±2.28E-09	1.81±1.93E-09	1.44±0.11E-06
BFMWIDR						
(SE Farm)						
Annual	-0.33±1.00E-07	1.37±0.37E-09	1.28±3.92E-10	0.52±1.79E-09	1.70±2.33E-09	1.44±0.11E-06

Table C - 3.2

1995 Radioactivity Concentrations in Meat

1995 Radioactivity Concentrations in Beef
(μCi/g – Dry)

Location	% Moisture	H-3 (μCi/mL)	Sr-90	Cs-134	Cs-137	K-40
Beef Flesh Background (BFBCTRL 05/95)	77.00	0.63±1.17E-07	1.93±0.42E-08	-0.32±1.60E-08	3.00±1.93E-08	1.58±0.06E-05
Beef Flesh Background (BFBCTRL 10/95)	74.00	-6.70±9.81E-08	2.87±1.09E-09	0.27±2.26E-08	4.71±4.06E-08	1.29±0.09E-05
Beef Flesh Near-site (BFBNEAR 06/95)	75.00	0.33±1.15E-07	-1.29±2.83E-09	-0.38±1.64E-08	1.75±1.78E-08	1.69±0.08E-05
Beef Flesh Near-site (BFBNEAR 12/95)	71.00	-1.61±9.86E-08	4.24±1.88E-09	-1.44±1.98E-08	1.76±2.02E-08	1.00±0.09E-05

1995 Radioactivity Concentrations in Venison
(μCi/g – Dry)

Location	% Moisture	H-3 (μCi/mL)	Sr-90	Cs-134	Cs-137	K-40
Deer Flesh Background (BFDCTRL 1)	70.00	-0.66±1.01E-07	2.10±1.14E-09	-0.09±1.08E-08	8.76±2.31E-08	9.12±0.64E-06
Deer Flesh Background (BFDCTRL 2)	77.00	-0.41±1.03E-07	0.06±1.07E-09	-0.09±1.24E-08	1.23±0.36E-07	1.24±0.08E-05
Deer Flesh Background (BFDCTRL 3)	72.00	-0.43±1.04E-07	2.40±1.15E-09	-0.47±1.43E-08	2.39±2.04E-08	9.73±0.84E-06
Deer Flesh Near-site (NYSDEER 1)	72.00	0.33±1.04E-07	6.20±4.74E-09	-0.36±2.36E-08	4.26±3.61E-08	1.49±0.10E-05
Deer Flesh Near-site (NYSDEER 2)	70.00	0.00±1.07E-07	4.52±2.59E-09	-0.10±2.44E-08	1.13±2.23E-08	9.00±0.84E-06
Deer Flesh Near-site (BFDNEAR 3)	72.00	-0.68±1.05E-07	0.12±1.03E-09	-1.10±1.56E-08	4.59±3.30E-08	9.93±0.88E-06

Table C - 3.3

1995 Radioactivity Concentrations in Food Crops (μCi/g Dry)

Location	% Moisture	H-3 (μCi/mL)	Sr-90	K-40	Co-60	Cs-137
CORN						
Background (BFVCTRC)	86.00	4.03±9.69E-08	8.45±2.01E-09	1.93±0.10E-05	0.60±2.64E-08	2.91±2.70E-08
Near-site (BFVNEAC)	79.00	8.27±1.19E-07	8.72±2.71E-09	1.67±0.07E-05	-1.46±2.10E-08	1.34±1.90E-08
BEANS						
Background (BFVCTRB)	93.00	2.00±1.00E-07	1.25±0.12E-07	3.21±0.12E-05	1.30±3.33E-08	1.32±2.67E-08
Near-site (BFVNEAB)	93.00	1.40±1.01E-07	1.06±0.73E-07	3.66±0.12E-05	3.81±3.24E-08	-0.94±2.70E-08
APPLES						
Background (BFVCTRA)	86.70	1.65±1.01E-07	2.02±0.34E-08	9.92±0.52E-06	0.20±1.24E-08	0.06±1.24E-08
Near-site (BFVNEAA)	86.90	7.81±9.82E-08	8.03±0.71E-08	1.02±0.05E-05	1.92±1.45E-08	0.84±1.14E-08
HAY						
Background (BFHCTLN)	NA	NA	1.90±0.10E-07	2.01±0.11E-05	-0.05±2.95E-08	1.38±2.68E-08
Near-site (BFHNEAR)	NA	NA	5.75±0.62E-08	2.55±0.10E-05	-1.61±3.03E-08	3.54±3.30E-08

NA - Not available.

Table C - 3.4

1995 Radioactivity Concentrations in Fish Flesh from Cattaraugus Creek

Cattaraugus Creek above the Springville Dam (BFFCATC)
(µCi/g – dry)

1st half 1995

Species	**% moisture**	**Sr-90**	**Cs-134**	**Cs-137**
Hog-nosed Sucker	79.0	1.54±0.26E-08	0.87±9.67E-08	3.88±8.19E-08
Hog-nosed Sucker	81.0	6.53±2.21E-09	-0.76±1.25E-07	0.93±1.08E-07
Hog-nosed Sucker	80.0	-1.55±1.67E-09	-6.15±9.75E-08	0.33±1.04E-07
Hog-nosed Sucker	76.0	9.51±1.63E-09	1.61±7.33E-08	3.50±2.09E-07
Hog-nosed Sucker	78.0	1.15±0.28E-08	8.00±7.41E-08	5.41±9.23E-08
Hog-nosed Sucker	79.0	6.27±1.19E-09	0.09±1.03E-07	1.17±0.96E-07
Hog-nosed Sucker	79.0	8.71±2.52E-09	-1.76±9.72E-08	4.60±9.33E-08
Brown Trout	79.0	-4.62±1.91E-09	-0.43±1.13E-07	6.95±6.14E-08
Brown Trout	78.0	-3.09±2.27E-09	-0.21±1.18E-07	2.47±9.50E-08
Brown Trout	80.0	-1.75±2.52E-09	-0.56±1.19E-07	2.34±1.70E-07
Average % Moisture	78.9			
Median		6.40E-09	<1.00E-07	9.95E-08
Maximum		1.54E-08	8.00E-08	3.50E-07
Minimum		<1.67E-09	<7.33E-08	6.95E-08

2nd half 1995

Species	**% moisture**	**Sr-90**	**Cs-134**	**Cs-137**
Hog-nosed Sucker	80.0	4.07±0.76E-08	0.14±2.71E-08	0.40±2.33E-08
Hog-nosed Sucker	80.0	1.01±0.14E-07	0.36±2.50E-08	2.12±2.53E-08
Hog-nosed Sucker	80.0	9.12±1.45E-09	0.45±2.33E-08	3.22±5.19E-08
Hog-nosed Sucker	79.0	4.55±0.67E-08	0.51±2.07E-08	1.42±2.20E-08
Hog-nosed Sucker	80.0	5.92±0.82E-08	0.85±2.01E-08	0.05±1.92E-08
Hog-nosed Sucker	79.0	2.31±0.84E-08	-0.25±2.42E-08	0.89±2.20E-08
Hog-nosed Sucker	80.0	3.19±1.14E-08	-0.76±2.17E-08	1.34±1.94E-08
Hog-nosed Sucker	79.0	1.81±0.68E-08	1.65±1.88E-08	-0.88±1.88E-08
Hog-nosed Sucker	79.0	2.11±0.49E-08	-0.73±1.97E-08	0.99±1.65E-08
Rainbow Trout	78.0	4.00±1.03E-08	0.69±1.52E-08	0.96±1.46E-08
Average % Moisture	79.4			
Median		3.60E-08	<2.12E-08	<2.07E-08
Maximum		1.01E-07	<2.71E-08	<5.19E-08
Minimum		9.12E-09	<1.52E-08	<1.46E-08

Table C - 3.4 (continued)

1995 Radioactivity Concentrations in Fish Flesh from Cattaraugus Creek

Cattaraugus Creek Background (BFFCTRL)
(μCi/g – dry)

1st half 1995

Species	% moisture	Sr-90	Cs-134	Cs-137
Hog-nosed Sucker	79.0	1.62±1.57E-09	2.52±9.62E-08	1.24±1.00E-07
Hog-nosed Sucker	79.0	8.51±9.78E-10	0.05±1.08E-07	2.37±8.95E-08
Hog-nosed Sucker	81.0	-2.61±5.28E-09	-0.52±1.10E-07	4.46±8.79E-08
Hog-nosed Sucker	77.0	5.79±1.57E-09	2.50±8.48E-08	2.22±6.87E-08
Hog-nosed Sucker	78.0	-1.67±1.89E-09	-0.56±1.22E-07	-4.19±9.59E-08
Hog-nosed Sucker	80.0	1.13±0.87E-09	0.50±1.05E-07	-0.44±1.02E-07
Brown Trout	76.0	-1.75±3.52E-09	-0.30±1.14E-07	0.75±9.08E-08
Brown Trout	77.0	-3.34±1.54E-09	-1.86±8.69E-08	4.05±8.91E-08
Brown Trout	77.0	-3.19±2.64E-09	-0.29±1.18E-07	-0.17±1.08E-07
Brown Trout	73.0	-9.22±8.79E-10	-6.15±8.07E-08	-1.36±6.81E-08
Average % moisture	77.7			
Median		1.76E-09	<1.07E-07	<9.02E-08
Maximum		5.79E-09	<1.22E-07	1.24E-07
Minimum		<8.79E-10	<8.07E-08	<6.81E-08

2nd half 1995

Species	% moisture	Sr-90	Cs-134	Cs-137
Hog-nosed Sucker	80.0	8.72±5.41E-09	-0.37±2.08E-08	0.00±1.77E-08
Hog-nosed Sucker	80.0	1.53±0.45E-08	0.39±1.44E-08	-0.96±1.27E-08
Hog-nosed Sucker	78.0	1.22±0.43E-08	2.30±2.49E-08	0.52±1.81E-08
Hog-nosed Sucker	79.0	1.53±0.41E-08	-0.62±1.95E-08	-0.76±2.29E-08
Hog-nosed Sucker	80.0	1.71±0.57E-08	-0.16±2.13E-08	0.68±2.00E-08
White Sucker	81.0	1.94±0.74E-08	-0.74±1.90E-08	0.05±1.63E-08
Brown Trout	79.0	5.04±5.69E-09	0.16±1.95E-08	0.85±1.95E-08
Brown Trout	78.0	1.53±9.32E-09	0.24±1.95E-08	-0.16±1.91E-08
Brown Trout	81.0	1.18±0.44E-08	0.04±2.28E-08	0.31±2.05E-08
Brown Trout	75.0	1.10±0.32E-08	0.23±2.02E-08	0.33±1.95E-08
Average % moisture	79.1			
Median		1.20E-08	<1.99E-08	<1.93E-08
Maximum		1.94E-08	<2.49E-08	<2.29E-08
Minimum		<5.69E-09	<1.44E-08	<1.27E-08

Table C - 3.4 (concluded)

1995 Radioactivity Concentrations in Fish Flesh from Cattaraugus Creek

Cattaraugus Creek below the Springville Dam (BFFCATD)
(μCi/g – dry)

Annual

Species	**% Moisture**	**Sr-90**	**Cs-134**	**Cs-137**
Steelhead	66.0	4.93±1.23E-09	-0.40±1.36E-08	2.22±1.28E-08
Steelhead	70.0	-1.25±1.06E-09	-0.92±1.73E-08	1.31±1.89E-08
Steelhead	73.0	1.54±1.13E-09	-0.76±1.57E-08	0.94±1.80E-08
Steelhead	74.0	-5.98±0.90E-09	-1.55±2.24E-08	0.36±2.29E-08
Steelhead	73.0	1.97±1.39E-09	-0.28±1.95E-08	2.12±1.98E-08
Steelhead	61.0	5.26±1.86E-09	-0.71±1.93E-08	1.06±2.06E-08
Steelhead	75.0	2.25±1.17E-09	-0.27±1.79E-08	2.81±3.11E-08
Steelhead	74.0	9.52±3.62E-09	2.23±2.02E-08	-0.05±1.88E-08
Steelhead	75.0	3.05±2.04E-09	-0.93±2.36E-08	-0.76±2.14E-08
Steelhead	76.0	4.57±1.86E-09	-0.07±1.86E-08	1.54±2.06E-08
Average % moisture	71.7			
Median		2.65E-09	<1.90E-08	<2.09E-08
Maximum		9.52E-09	2.23E-08	2.22E-08
Minimum		<9.00E-10	<1.36E-08	<1.80E-08

Appendix C - 4

Summary of Direct Radiation Monitoring Data

An Environmental TLD Package

Table C - 4.1
Summary of 1995 Quarterly Averages of Off-site TLD Measurements

(Roentgen ± 3 SD/Quarter)

*Location Number**	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Location Average*
DFTLD01	0.016 ± 0.003	0.017 ± 0.003	0.025 ± 0.005	0.014 ± 0.001	0.018 ± 0.003
DFTLD02	0.017 ± 0.005	0.018 ± 0.005	0.026 ± 0.005	0.014 ± 0.002	0.019 ± 0.004
DFTLD03	0.016 ± 0.003	0.016 ± 0.003	0.021 ± 0.004	0.013 ± 0.002	0.016 ± 0.003
DFTLD04	0.016 ± 0.003	0.016 ± 0.003	0.023 ± 0.004	0.017 ± 0.002	0.018 ± 0.003
DFTLD05	0.017 ± 0.004	0.017 ± 0.005	0.025 ± 0.006	0.015 ± 0.002	0.019 ± 0.004
DFTLD06	0.016 ± 0.003	0.017 ± 0.002	0.022 ± 0.002	0.020 ± 0.003	0.019 ± 0.002
DFTLD07	0.016 ± 0.004	0.016 ± 0.006	0.020 ± 0.004	0.015 ± 0.001	0.017 ± 0.004
DFTLD08	0.016 ± 0.002	0.016 ± 0.003	0.024 ± 0.004	0.014 ± 0.001	0.017 ± 0.002
DFTLD09	0.016 ± 0.004	0.017 ± 0.005	0.023 ± 0.002	0.014 ± 0.002	0.017 ± 0.003
DFTLD10	0.016 ± 0.003	0.016 ± 0.004	0.024 ± 0.003	0.015 ± 0.002	0.018 ± 0.003
DFTLD11	0.018 ± 0.004	0.019 ± 0.006	0.026 ± 0.006	0.016 ± 0.001	0.020 ± 0.004
DFTLD12	0.018 ± 0.003	0.018 ± 0.003	0.022 ± 0.004	0.016 ± 0.002	0.018 ± 0.003
DFTLD13	0.018 ± 0.003	0.018 ± 0.004	0.029 ± 0.005	0.016 ± 0.001	0.020 ± 0.003
DFTLD14	0.019 ± 0.003	0.018 ± 0.003	0.024 ± 0.004	0.015 ± 0.001	0.019 ± 0.003
DFTLD15	0.016 ± 0.004	0.022 ± 0.004	0.023 ± 0.005	0.013 ± 0.001	0.019 ± 0.003
DFTLD16	0.018 ± 0.003	0.017 ± 0.002	0.029 ± 0.008	0.015 ± 0.001	0.020 ± 0.003
DFTLD17	0.018 ± 0.003	0.018 ± 0.002	0.028 ± 0.014	0.015 ± 0.001	0.020 ± 0.005
DFTLD20	0.017 ± 0.003	0.018 ± 0.002	0.025 ± 0.005	0.015 ± 0.001	0.019 ± 0.003
DFTLD21	0.017 ± 0.005	0.019 ± 0.002	0.026 ± 0.005	0.015 ± 0.000	0.019 ± 0.003
DFTLD22	0.018 ± 0.002	0.018 ± 0.003	0.024 ± 0.003	0.015 ± 0.002	0.019 ± 0.002
DFTLD23	0.017 ± 0.003	0.017 ± 0.004	0.023 ± 0.001	0.014 ± 0.001	0.018 ± 0.003
DFTLD37	0.017 ± 0.002	0.016 ± 0.002	0.024 ± 0.006	0.015 ± 0.002	0.018 ± 0.003
DFTLD41	0.016 ± 0.006	0.017 ± 0.002	0.020 ± 0.003	0.014 ± 0.001	0.017 ± 0.003

** Off-site locations are shown on Figures 2-14, A-7, and A-9. Background measurements are provided by off-site TLDs 17, 23, 37, and 41.*

Table C - 4.2
Summary of 1995 Quarterly Averages of On-site TLD Measurements

(Roentgen ± 3 SD/Quarter)

*Location Number**	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Location Average*
DNTLD18	0.038 ± 0.009	0.034 ± 0.012	0.048 ± 0.008	0.031 ± 0.002	0.038 ± 0.008
DNTLD19	0.019 ± 0.003	0.019 ± 0.008	0.029 ± 0.002	0.018 ± 0.001	0.021 ± 0.004
DNTLD24	0.929 ± 0.182	0.795 ± 0.059	0.935 ± 0.155	0.757 ± 0.030	0.854 ± 0.107
DNTLD25	0.026 ± 0.007	0.025 ± 0.006	0.037 ± 0.002	0.022 ± 0.001	0.028 ± 0.004
DNTLD26	0.024 ± 0.006	0.024 ± 0.005	0.034 ± 0.006	0.019 ± 0.001	0.025 ± 0.004
DNTLD27	0.019 ± 0.006	0.019 ± 0.003	0.026 ± 0.003	0.016 ± 0.001	0.020 ± 0.003
DNTLD28	0.020 ± 0.004	0.022 ± 0.005	0.028 ± 0.004	0.020 ± 0.002	0.022 ± 0.004
DNTLD29	0.019 ± 0.002	0.020 ± 0.009	0.028 ± 0.005	0.016 ± 0.002	0.021 ± 0.004
DNTLD30	0.023 ± 0.003	0.026 ± 0.004	0.031 ± 0.006	0.019 ± 0.001	0.025 ± 0.004
DNTLD31	0.017 ± 0.005	0.019 ± 0.004	0.025 ± 0.004	0.015 ± 0.002	0.019 ± 0.004
DNTLD32	0.033 ± 0.004	0.031 ± 0.017	0.033 ± 0.005	0.027 ± 0.001	0.031 ± 0.007
DNTLD33	0.035 ± 0.006	0.036 ± 0.006	0.048 ± 0.005	0.029 ± 0.002	0.037 ± 0.005
DNTLD34	0.059 ± 0.021	0.067 ± 0.010	0.075 ± 0.010	0.055 ± 0.005	0.064 ± 0.012
DNTLD35	0.092 ± 0.013	0.092 ± 0.018	0.105 ± 0.024	0.083 ± 0.004	0.093 ± 0.015
DNTLD36	0.055 ± 0.010	0.053 ± 0.008	0.058 ± 0.011	0.048 ± 0.004	0.053 ± 0.008
DNTLD38	0.031 ± 0.004	0.033 ± 0.002	0.044 ± 0.009	0.028 ± 0.002	0.034 ± 0.004
DNTLD39	0.059 ± 0.009	0.062 ± 0.015	0.075 ± 0.014	0.062 ± 0.004	0.064 ± 0.010
DNTLD40	0.150 ± 0.023	0.230 ± 0.038	0.225 ± 0.048	0.207 ± 0.008	0.203 ± 0.029
DNTLD42	0.078 ± 0.012	0.080 ± 0.014	0.101 ± 0.016	0.071 ± 0.005	0.083 ± 0.012
DNTLD43	0.040 ± 0.005	0.036 ± 0.007	0.045 ± 0.007	0.031 ± 0.002	0.038 ± 0.005

** On-site locations are shown on Figures 2-13 and A-8.*

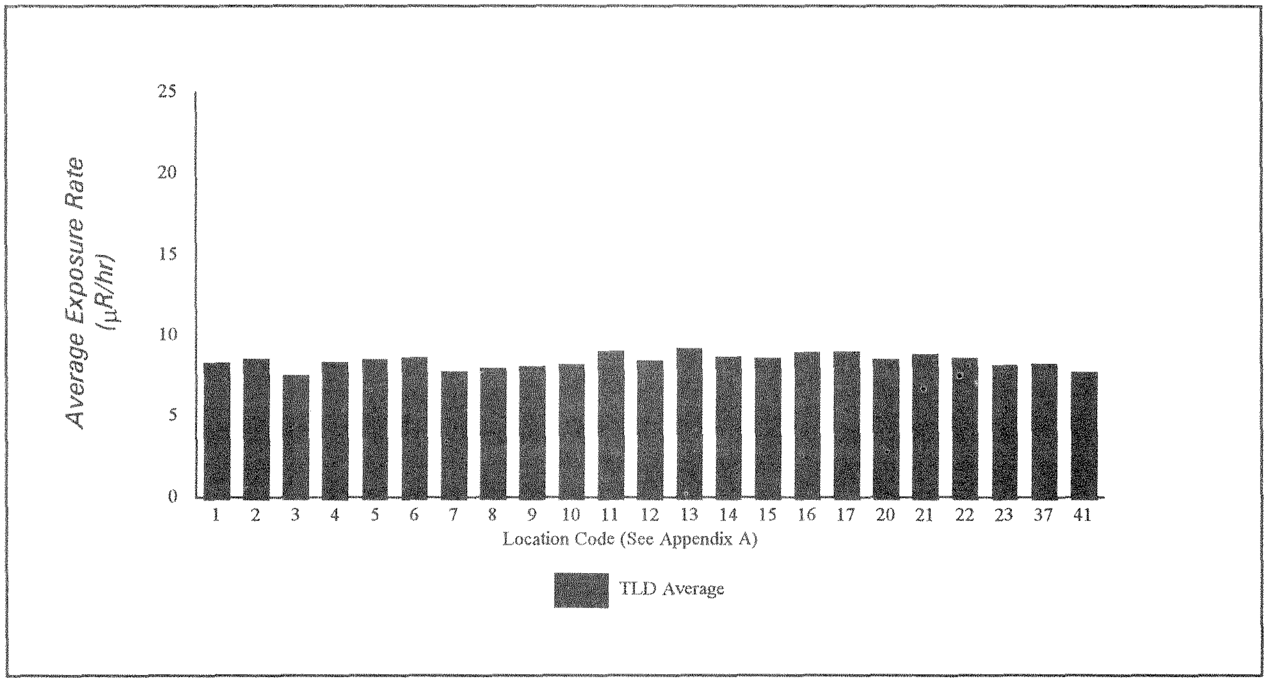


Figure C - 4.1

1995 Average Quarterly Gamma Exposure Rates around the West Valley Demonstration Project Site

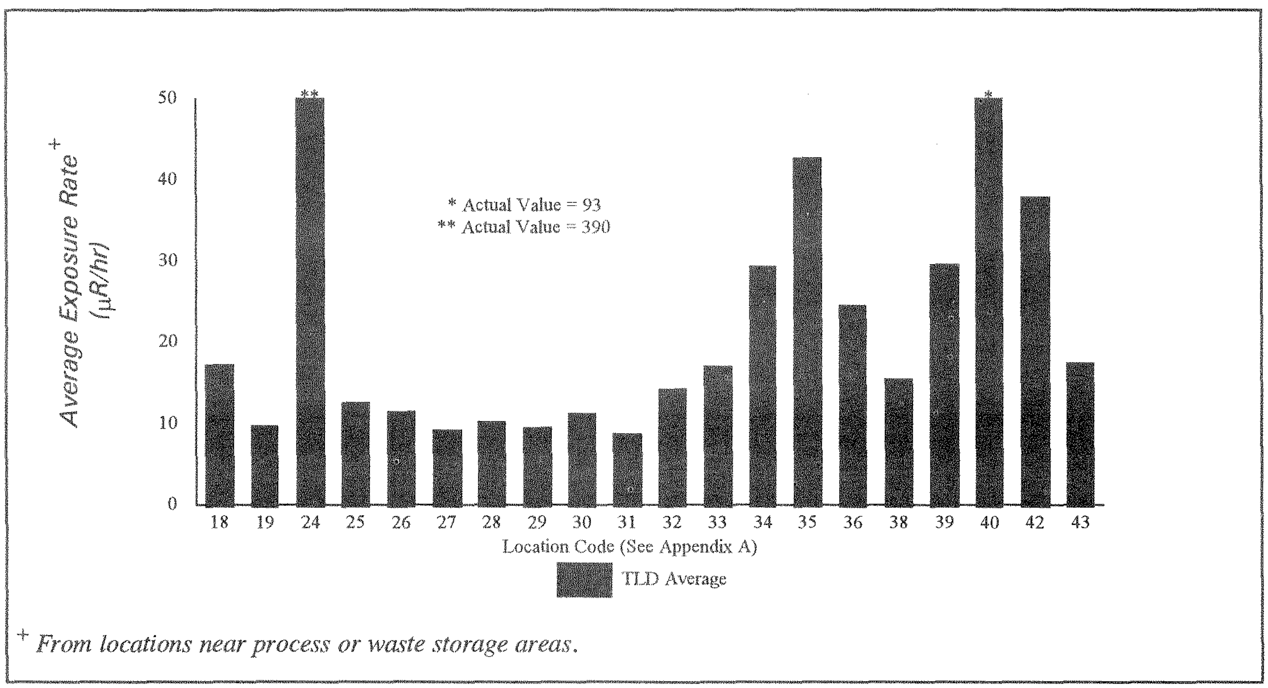
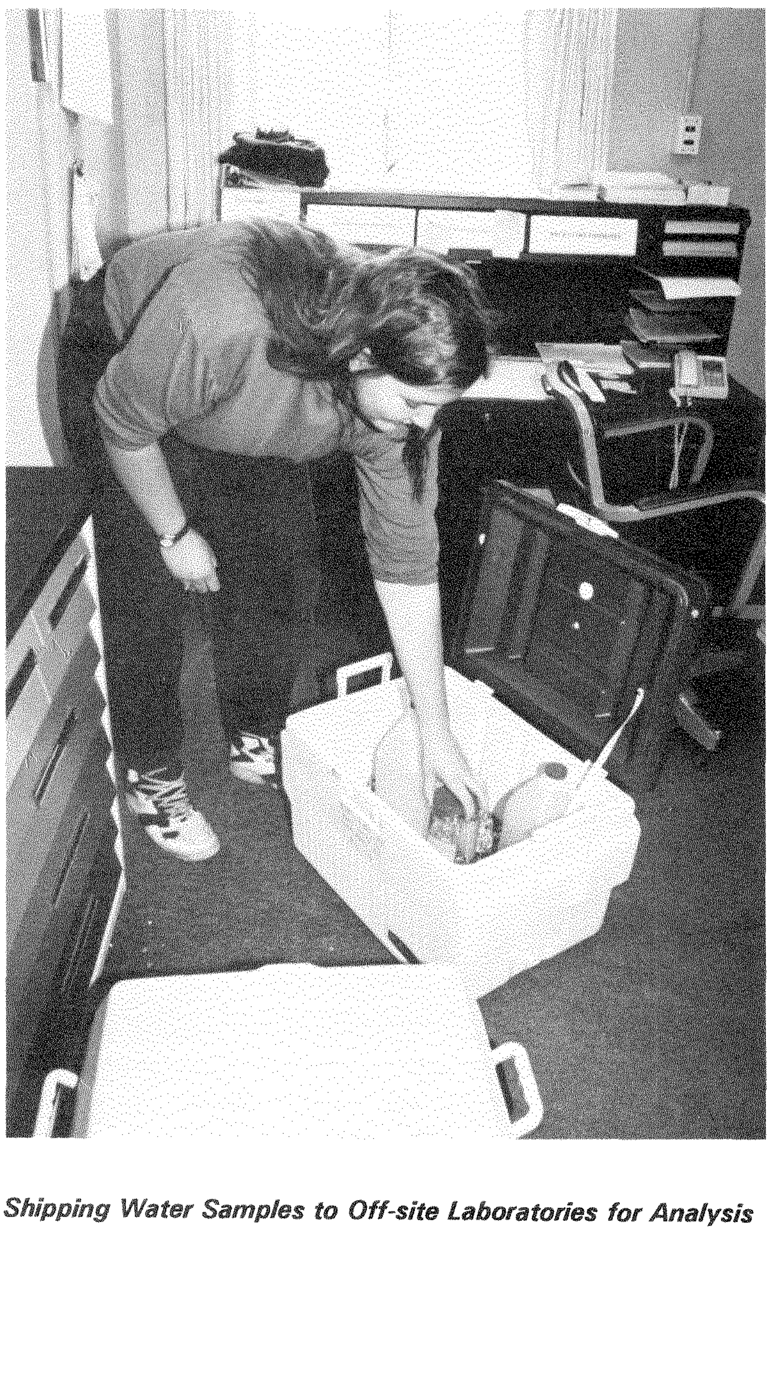


Figure C - 4.2

1995 Average Quarterly Gamma Exposure Rates on the West Valley Demonstration Project Site

Appendix C - 5

Summary of Nonradiological Monitoring Data



Shipping Water Samples to Off-site Laboratories for Analysis

Table C - 5.1
West Valley Demonstration Project State Pollutant Discharge Elimination System (SPDES) Sampling Program

Outfall	Parameter	Daily Maximum* Limit	Sample Frequency
001 (Process and Storm Wastewater)	Flow	Monitor	2 per discharge
	Aluminum, Total	14.0 mg/L	2 per discharge
	Ammonia (NH_3)	Monitor	2 per discharge
	Arsenic, dissolved	0.15 mg/L	2 per discharge
	BOD-5	10.0 mg/L	2 per discharge
	Iron, Total	Monitor	2 per discharge
	Zinc, Total recoverable	0.48 mg/L	2 per discharge
	Suspended solids	45.0 mg/L	2 per discharge
	Cyanide, amenable to chlorination	0.022 mg/L	2 per discharge
	Settleable solids	0.30 ml/L	2 per discharge
	pH (range)	6.5 - 8.5	2 per discharge
	Oil and grease	15.0 mg/L	2 per discharge
	Sulfate	Monitor	2 per discharge
	Sulfide, dissolved	0.4 mg/L	2 per discharge
	Manganese, Total	2.0 mg/L	2 per discharge
	Nitrate	Monitor	2 per discharge
	Nitrite	0.1 mg/L	2 per discharge
	Chromium, Total recoverable	0.3 mg/L	2 per discharge
	Chromium (hexavalent)	0.011 mg/L	2 per discharge
	Cadmium, Total recoverable	0.002 mg/L	2 per discharge
	Copper, Total recoverable	0.030 mg/L	2 per discharge
	Copper, dissolved	Monitor	2 per discharge
	Lead, Total recoverable	0.006 mg/L	2 per discharge
	Nickel, Total recoverable	0.14 mg/L	2 per discharge
	Dichlordifluoromethane	0.01 mg/L	2 per discharge
	Trichloroflouromethane	0.01 mg/L	2 per discharge
	3,3-dichlorobenzidine	0.01 mg/L	2 per discharge
	Tributyl phosphate	32 mg/L	2 per discharge
	Vanadium, Total recoverable	0.014 mg/L	2 per discharge
	Cobalt, Total recoverable	0.005 mg/L	2 per discharge
	Selenium, Total recoverable	0.004 mg/L	2 per discharge
	Hexachlorobenzene	0.02 mg/L	2 per discharge
	Alpha - BHC	0.00001 mg/L	2 per discharge
	Heptachlor	0.00001 mg/L	2 per discharge
	Surfactant (as LAS)	0.4 mg/L	2 per discharge
	Xylene	0.05 mg/L	2 per discharge
	2-butanone	0.5 mg/L	2 per discharge
	Total Dissolved Solids	Monitor	2 per discharge
	Barium	0.5 mg/L	annual
	Antimony	1.0 mg/L	annual
	Chloroform	0.3 mg/L	annual
	Bis(2-ethylhexyl)phthalate	1.6 mg/L	semiannual
	4-Dodecene	0.6 mg/L	semiannual
	Titanium	0.65 mg/L	semiannual

** Daily average limitations are also identified in the permit but require monitoring only for all parameters except aluminum, total (daily average limit - 7.0 mg/L); solids, suspended (daily average limit - 30.0 mg/L); BOD-5 for the sum of outfalls 001, 007, and 008 (daily average limit - 5.0 mg/L); and ammonia for the sum of outfalls 001 and 007 (daily average limit - 1.49 mg/L).*

Table C - 5.1 (concluded)
West Valley Demonstration Project State Pollutant Discharge Elimination System (SPDES) Sampling Program

Outfall	Parameter	Daily Maximum* Limit	Sample Frequency
007 (Sanitary and Utility Wastewater)	Flow	Monitor	3 per month
	Ammonia (as NH_3)	Monitor	3 per month
	BOD-5	10.0 mg/L	3 per month
	Iron, Total	Monitor	3 per month
	Solids, suspended	45.0 mg/L	3 per month
	Solids, settleable	0.3 ml/L	weekly
	pH (Range)	6.5 - 8.5	weekly
	Nitrite (as N)	0.1 mg/L	3 per month
	Oil and Grease	15.0 mg/L	3 per month
	Chlorine, Total residual	0.1 mg/L	weekly
	Chloroform	0.20 mg/L	annual
008 (French Drain Wastewater)	Flow	Monitor	3 per month
	BOD-5	5.0 mg/L	3 per month
	Iron, Total	Monitor	3 per month
	pH (Range)	6.5 - 8.5	3 per month
	Cadmium, Total recoverable	0.002 mg/L	3 per month
	Lead, Total recoverable	0.006 mg/L	3 per month
	Silver, total	0.008 mg/L	annual
	Zinc, total	0.1 mg/L	annual
	Arsenic	0.17 mg/L	annual
	Chromium	0.13 mg/L	annual
Sum of Outfalls 001, 007, and 008	Iron, Total	0.30 mg/L	3 per month
	BOD-5	Monitor	3 per month
Sum of Outfalls 001 and 007	Ammonia (NH_3)	2.1 mg/L	3 per month

** Daily average limitations are also identified in the permit but require monitoring only for all parameters except aluminum, total (daily average limit - 7.0 mg/L); solids, suspended (daily average limit - 30.0 mg/L); BOD-5 for the sum of outfalls 001, 007, and 008 (daily average limit - 5.0 mg/L); and ammonia for the sum of outfalls 001 and 007 (daily average limit - 1.49 mg/L).*

Table C - 5.2
West Valley Demonstration Project 1995 SPDES Noncompliance Episodes

Date	Outfall	Parameters	Limit	Value	Comments
Jan 13	*007*	NO_2-N	0.10 mg/L	0.89 mg/L	*Change in wastewater temperature*
Feb 02	*007*	BOD-5	10 mg/L	21.9 mg/L	*Overgrowth of filamentous bacteria*
Feb 08	*007*	BOD-5	10 mg/L	178 mg/L	*Overgrowth of filamentous bacteria*
Mar 03	*007*	NO_2-N	0.10 mg/L	11.6 mg/L	*Change in wastewater temperature*
Mar 08	*007*	NO_2-N	0.10 mg/L	2.5 mg/L	*Change in wastewater temperature*
Aug 10	*007*	pH	6.5 - 8.5	8.7	*Possible transcription or instrument reading error*

AJN:96:6048:SER95\2-16(C-5.1).DWG

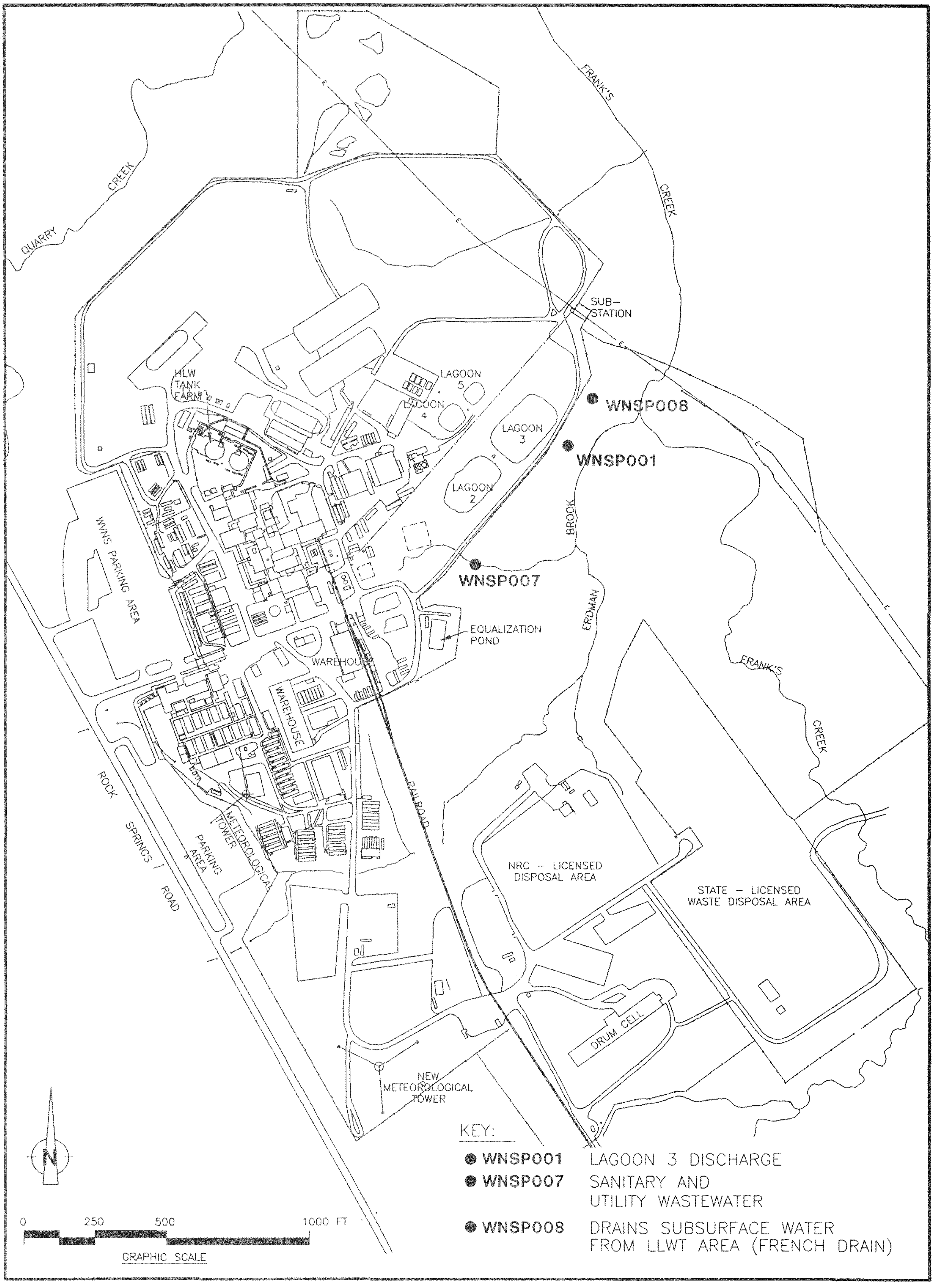


Figure C-5.1. SPDES Monitoring Points.

Figure C - 5.2

WATER QUALITY

BIOCHEMICAL OXYGEN DEMAND-5 (mg/L)

Outfall 001

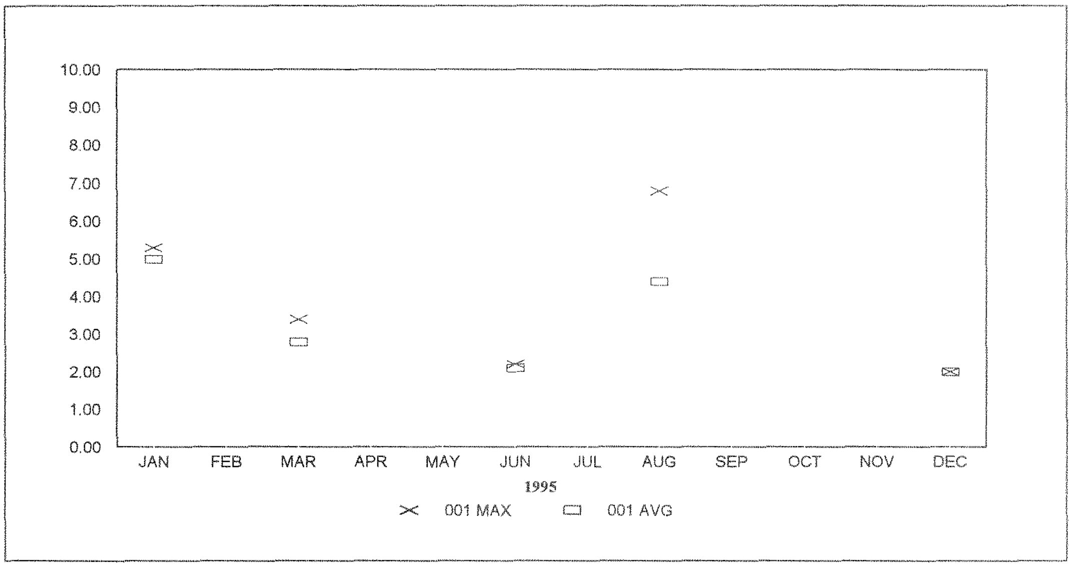


Figure C - 5.3

WATER QUALITY

BIOCHEMICAL OXYGEN DEMAND-5 (mg/L)

Outfalls 007 and 008

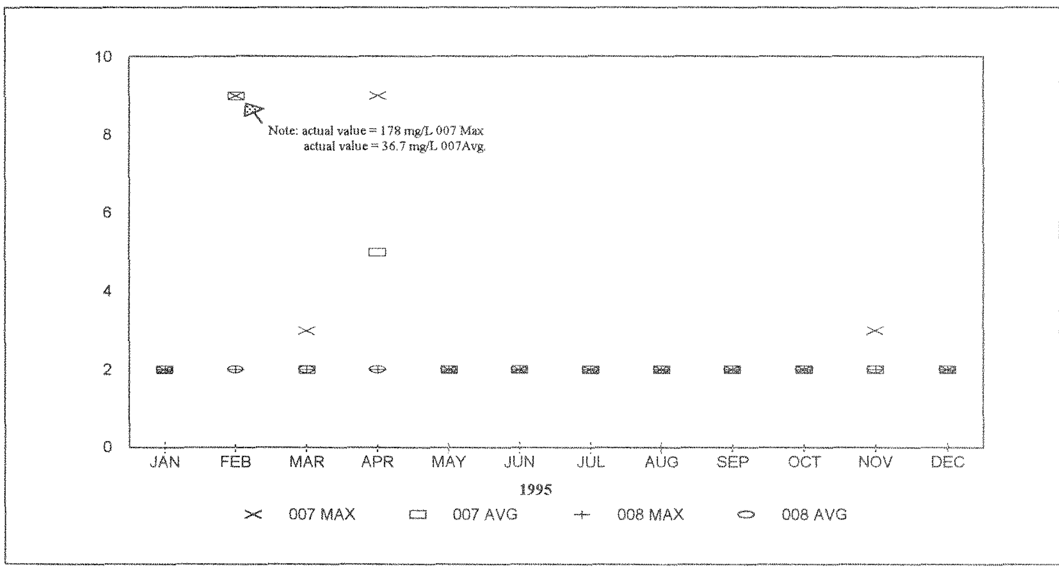
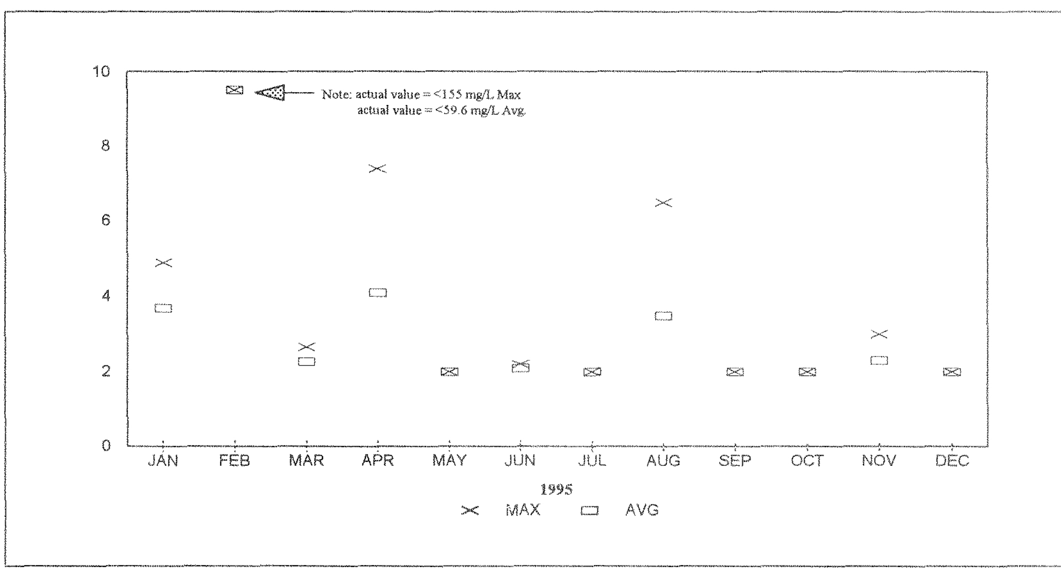


Figure C - 5.4

WATER QUALITY

BIOCHEMICAL OXYGEN DEMAND – 5 (mg/L)

Sum of Outfalls 001, 007, and 008



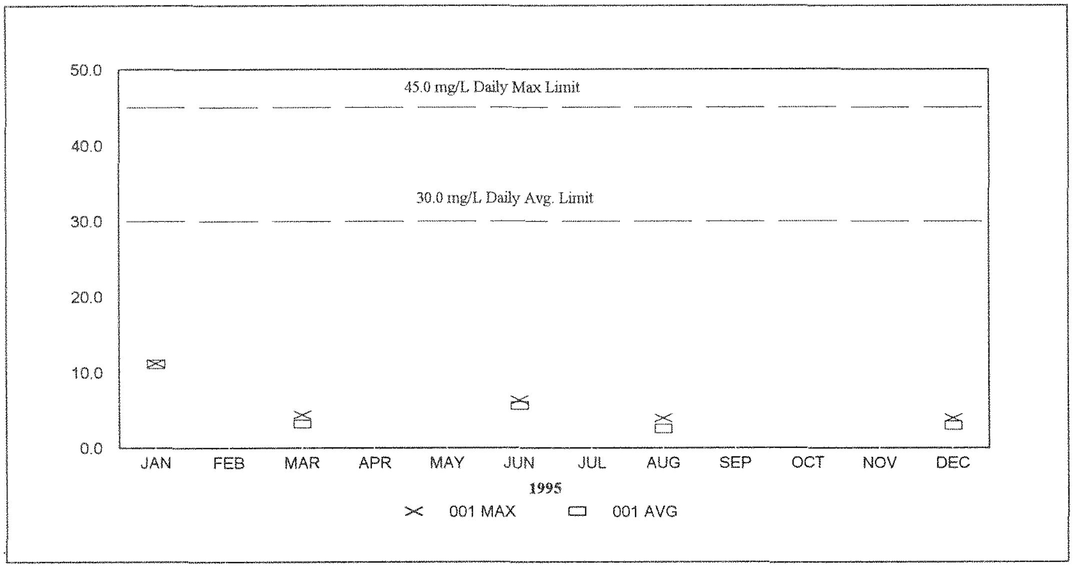


Figure C - 5.5

WATER QUALITY

SUSPENDED SOLIDS (mg/L)

Outfall 001

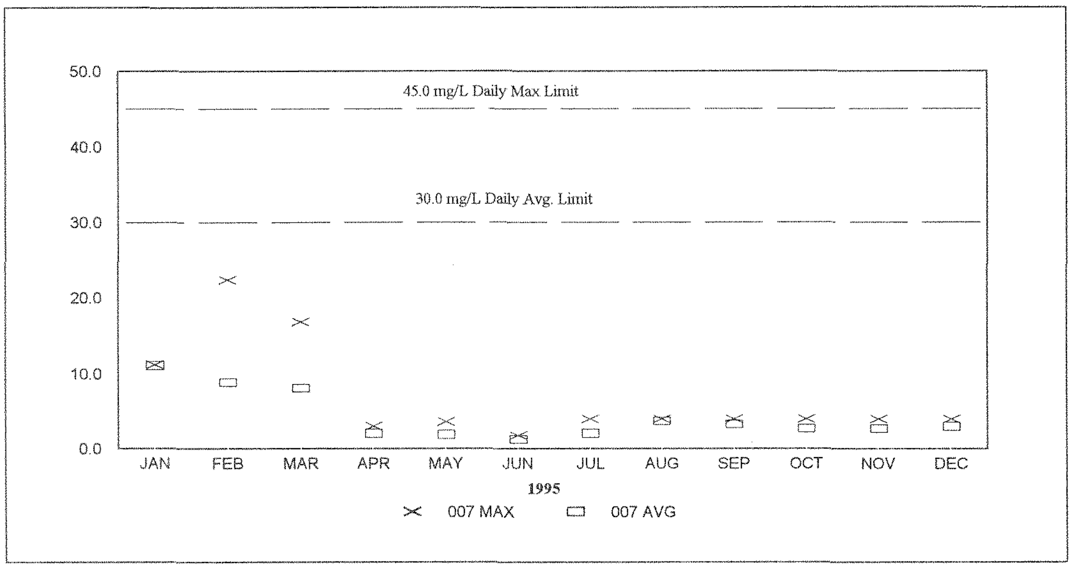


Figure C - 5.6

WATER QUALITY

SUSPENDED SOLIDS (mg/L)

Outfall 007

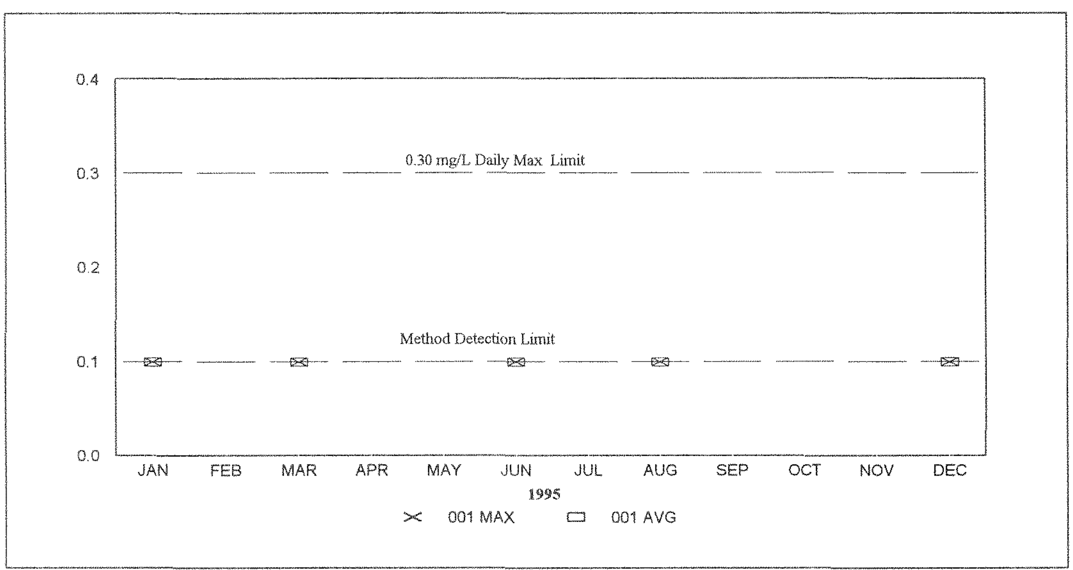


Figure C - 5.7

WATER QUALITY

SETTLEABLE SOLIDS (ml/L)

Outfall 001

Figure C - 5.8

WATER QUALITY

SETTLEABLE SOLIDS (ml/L)

Outfall 007

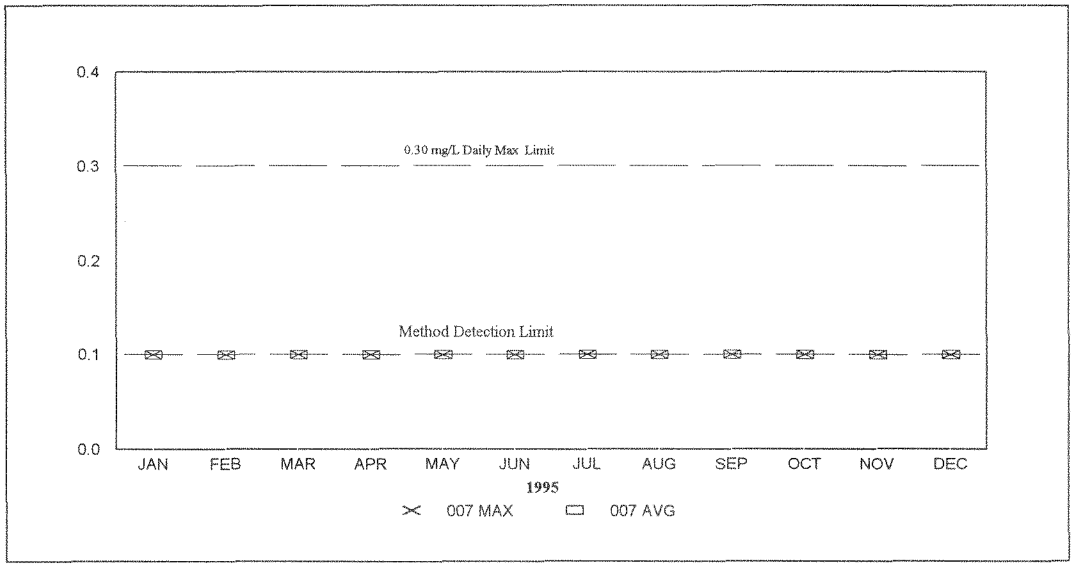


Figure C - 5.9

WATER QUALITY

AMMONIA (mg/L)

Outfall 001

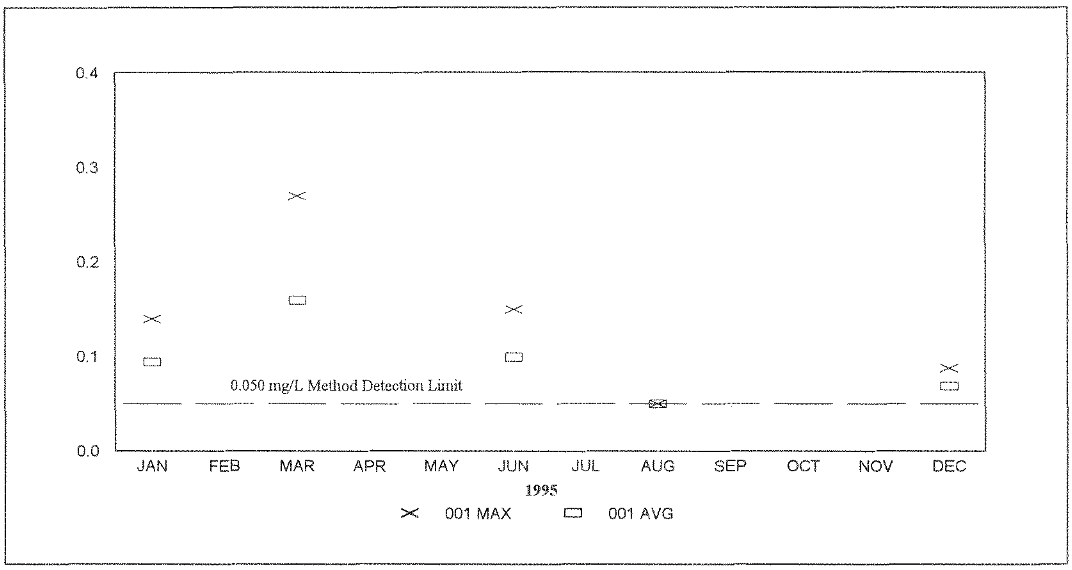
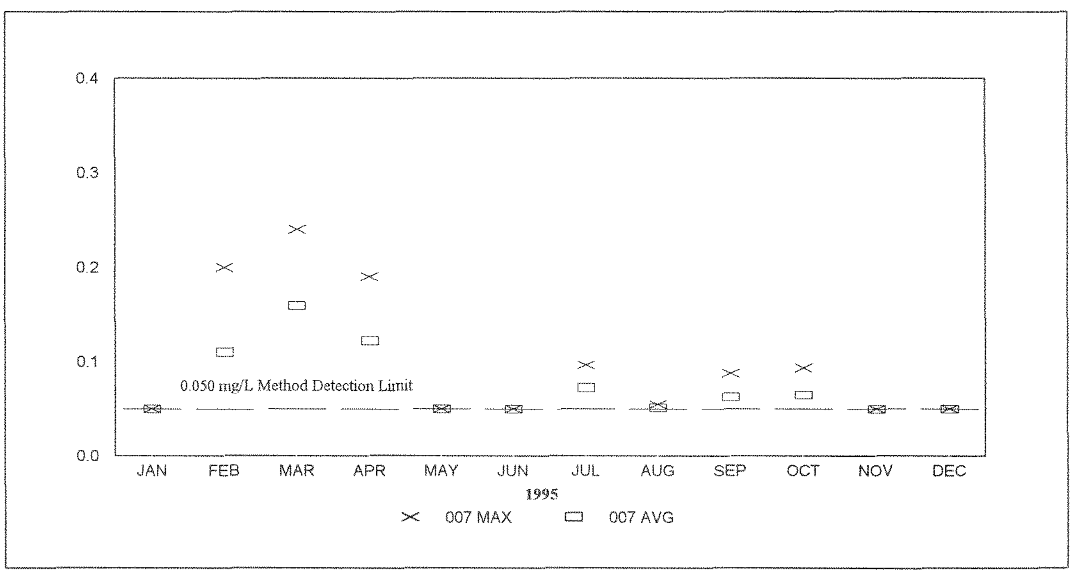


Figure C - 5.10

WATER QUALITY

AMMONIA (mg/L)

Outfall 007



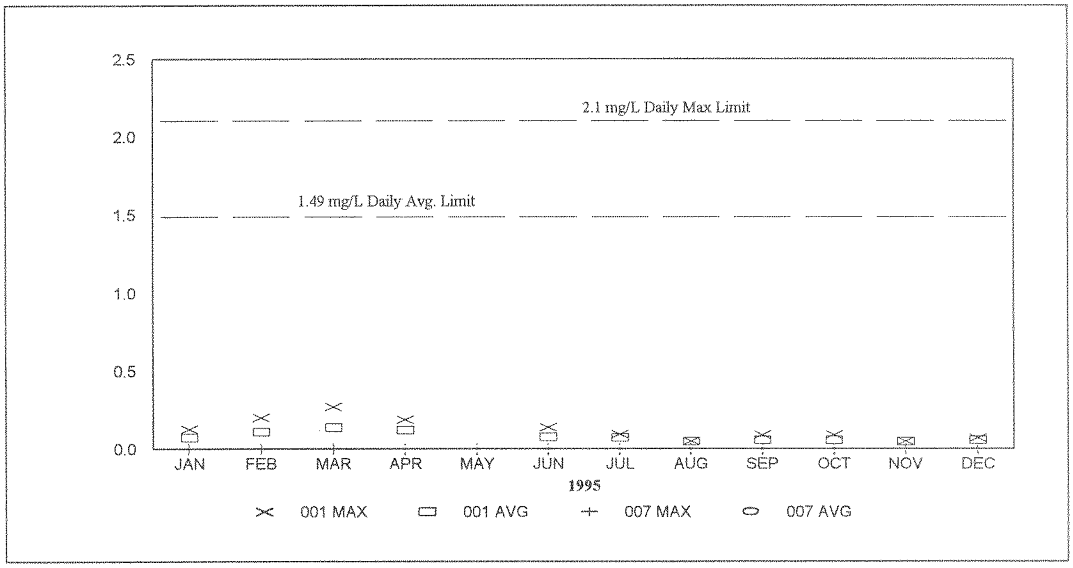


Figure C - 5.11

WATER QUALITY

FLOW-WEIGHTED AVERAGES

AMMONIA (mg/L)

Sum of Outfalls 001 and 007

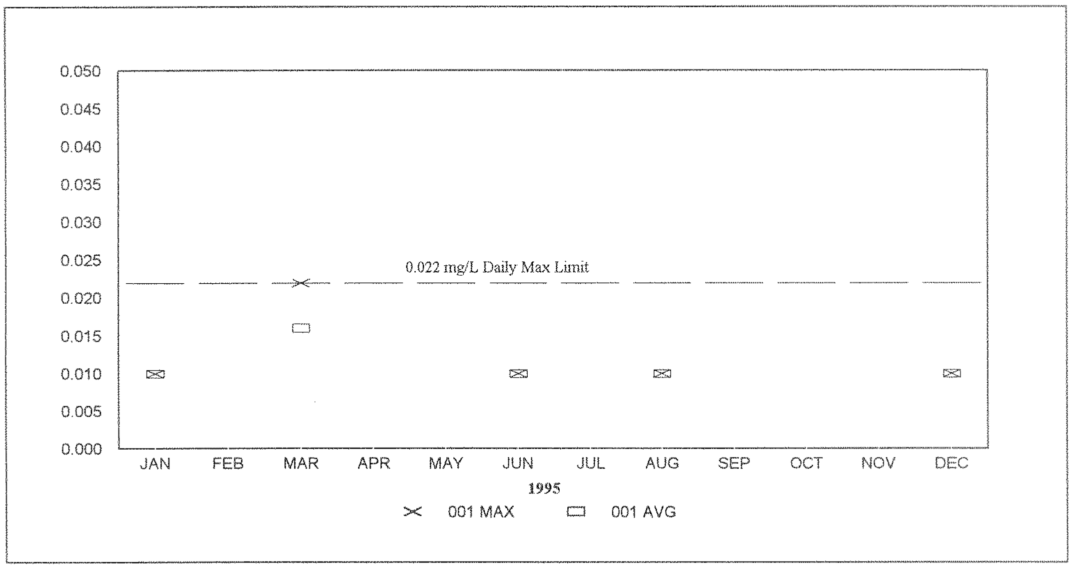


Figure C - 5.12

WATER QUALITY

CYANIDE (mg/L)

Outfall 001

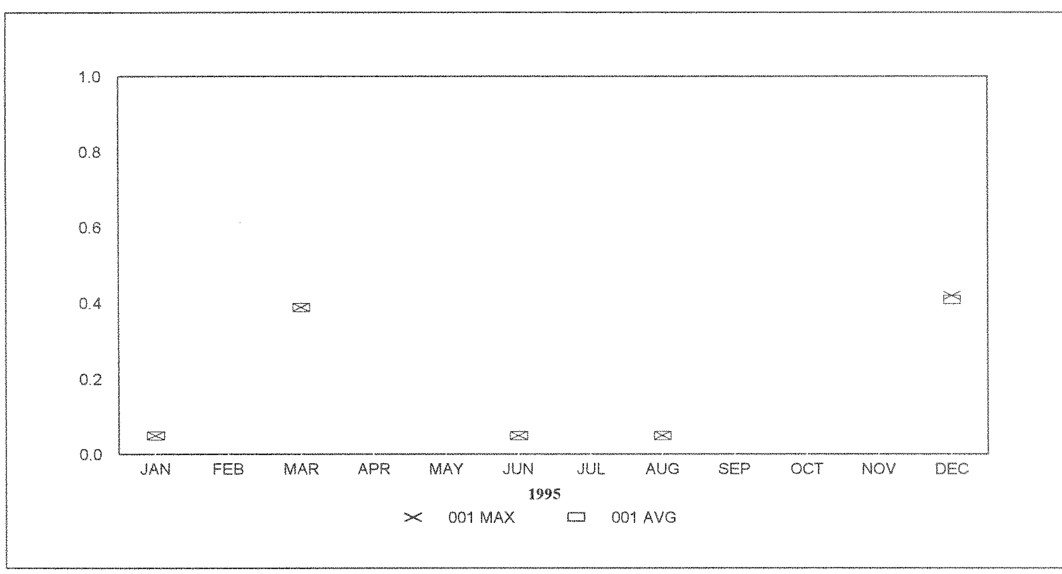


Figure C - 5.13

WATER QUALITY

NITRATE (NO_3-N) (mg/L)

Outfall 001

Figure C - 5.14

WATER QUALITY

NITRITE (NO_2-N) (mg/L)

Outfall 001

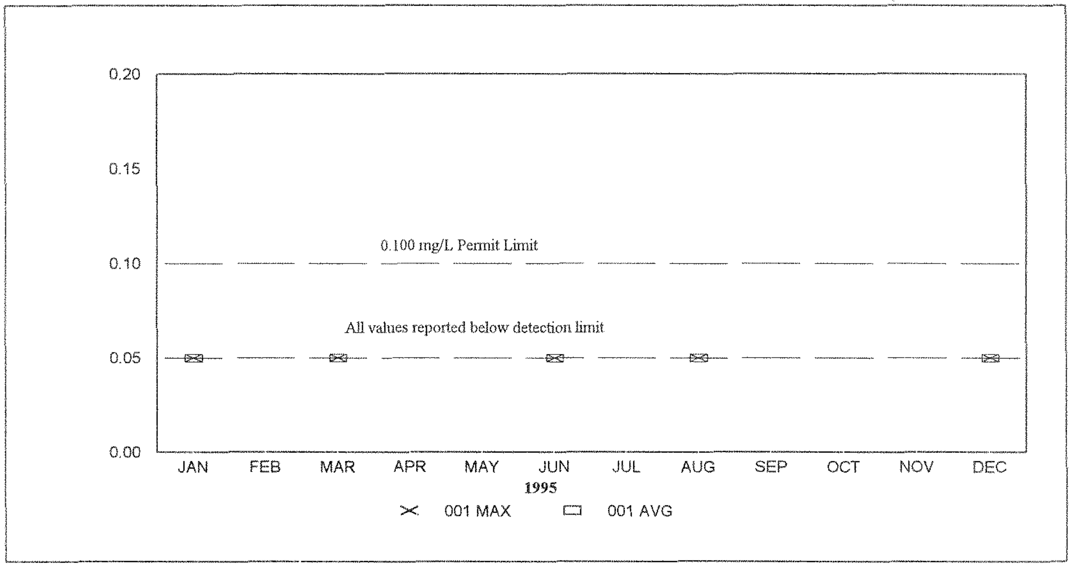


Figure C - 5.15

WATER QUALITY

NITRITE (NO_2-N) (mg/L)

Outfall 007

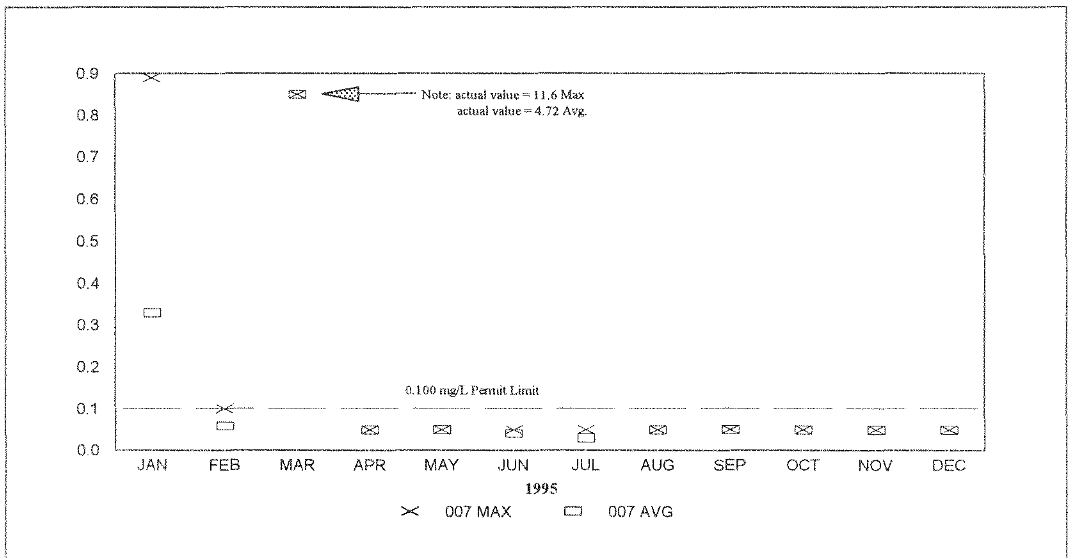
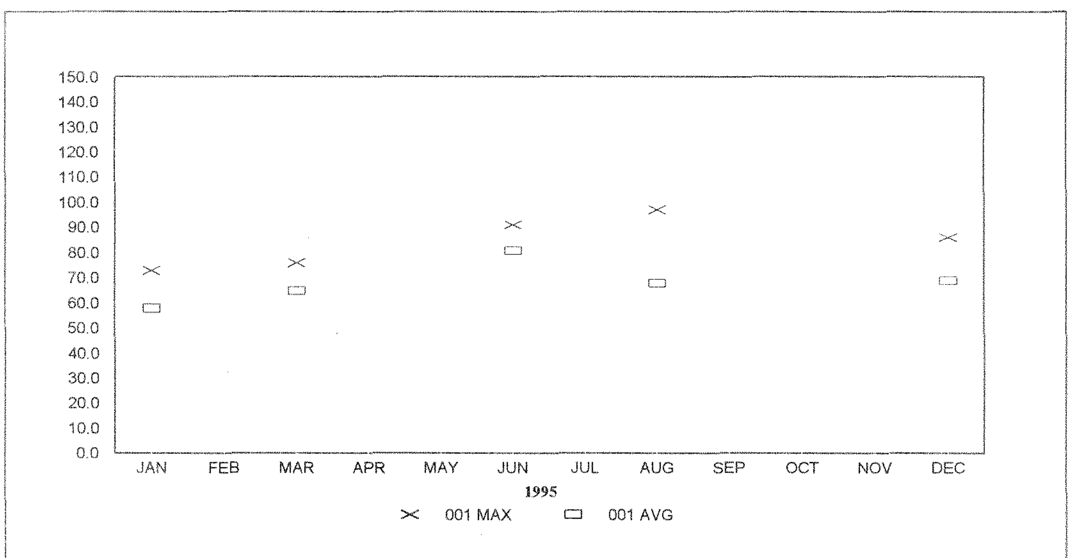


Figure C - 5.16

WATER QUALITY

SULFATE-S (mg/L)

Outfall 001



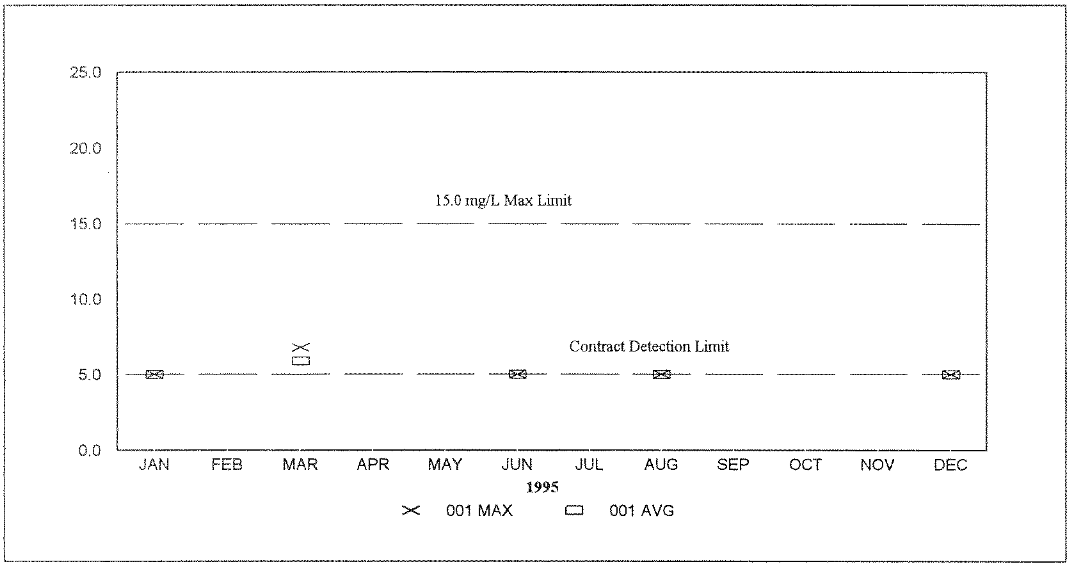


Figure C - 5.17

WATER QUALITY

OIL AND GREASE (mg/L)

Outfall 001

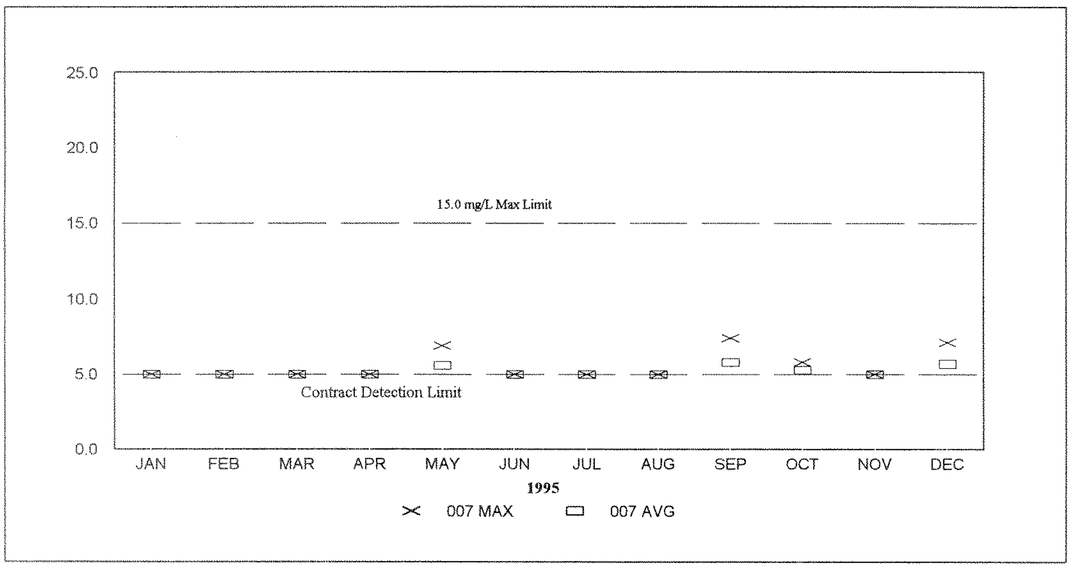


Figure C - 5.18

WATER QUALITY

OIL AND GREASE (mg/L)

Outfall 007

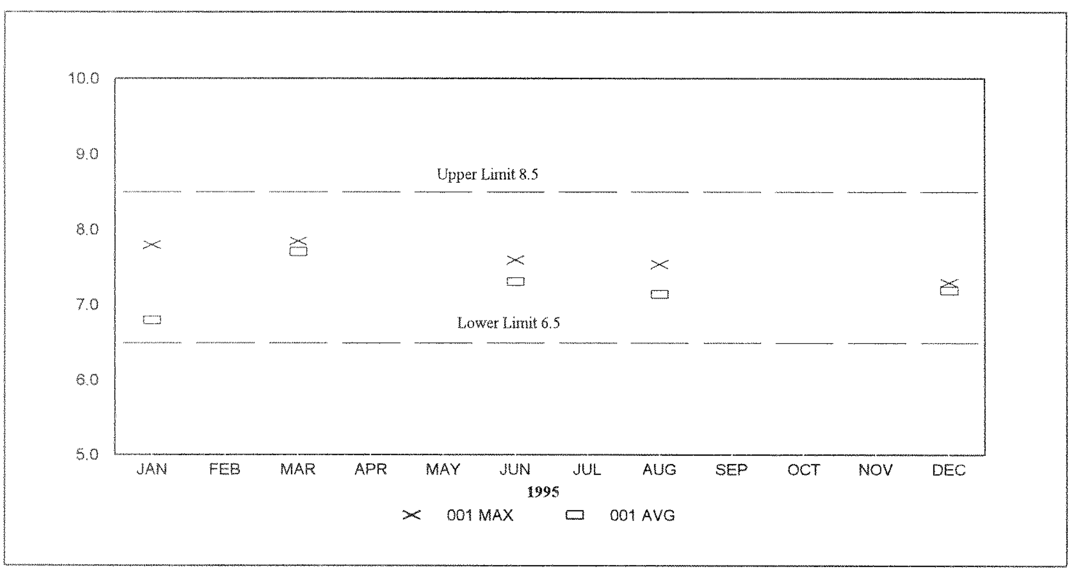


Figure C - 5.19

WATER QUALITY

pH (standard units)

Outfall 001

Figure C - 5.20

WATER QUALITY

pH
(standard units)

Outfalls 007 and 008

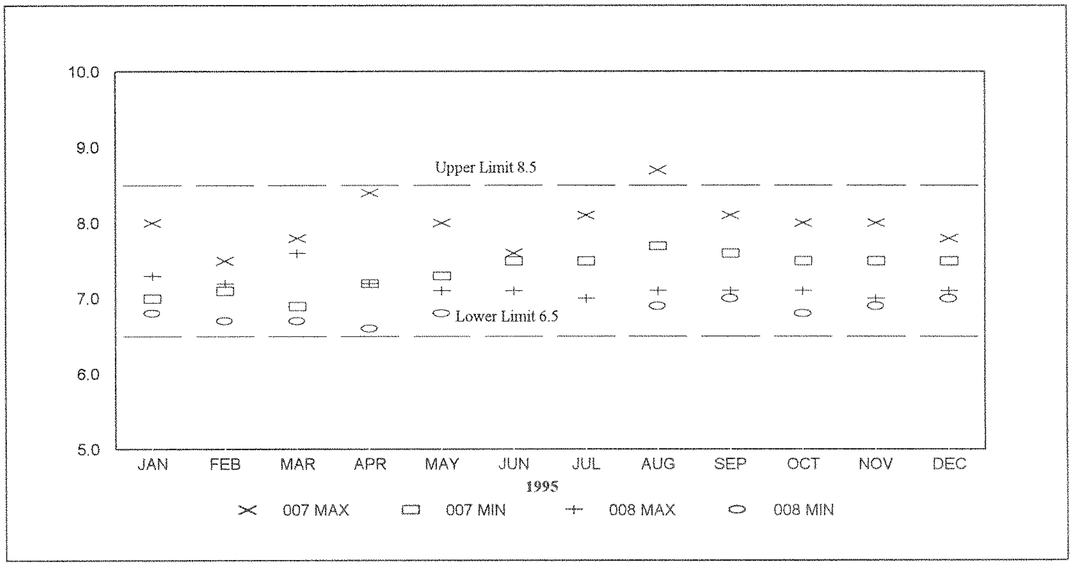


Figure C - 5.21

WATER QUALITY

SURFACTANTS (as LAS)
(mg/L)

Outfall 001

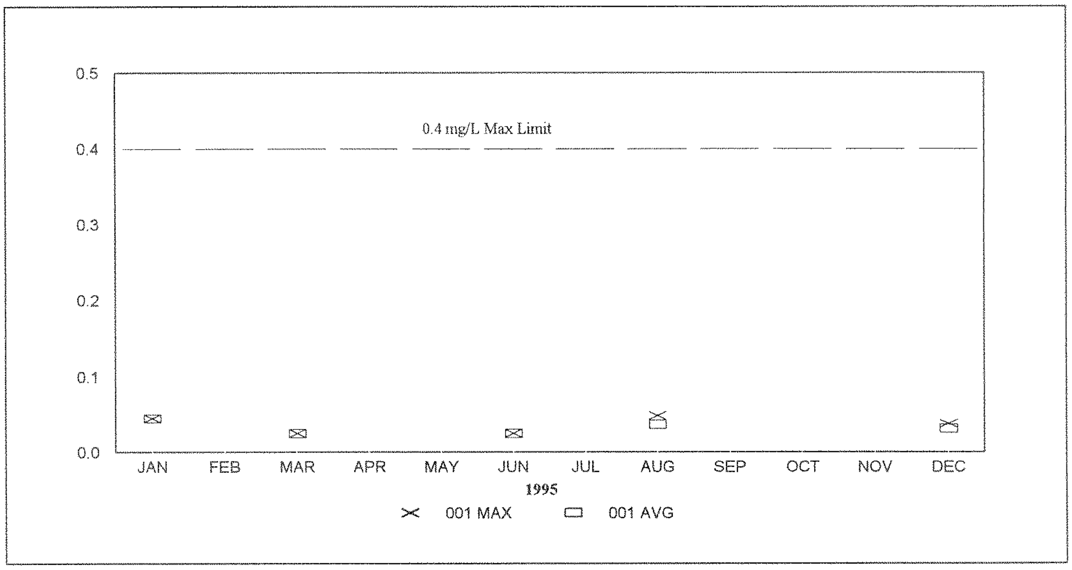
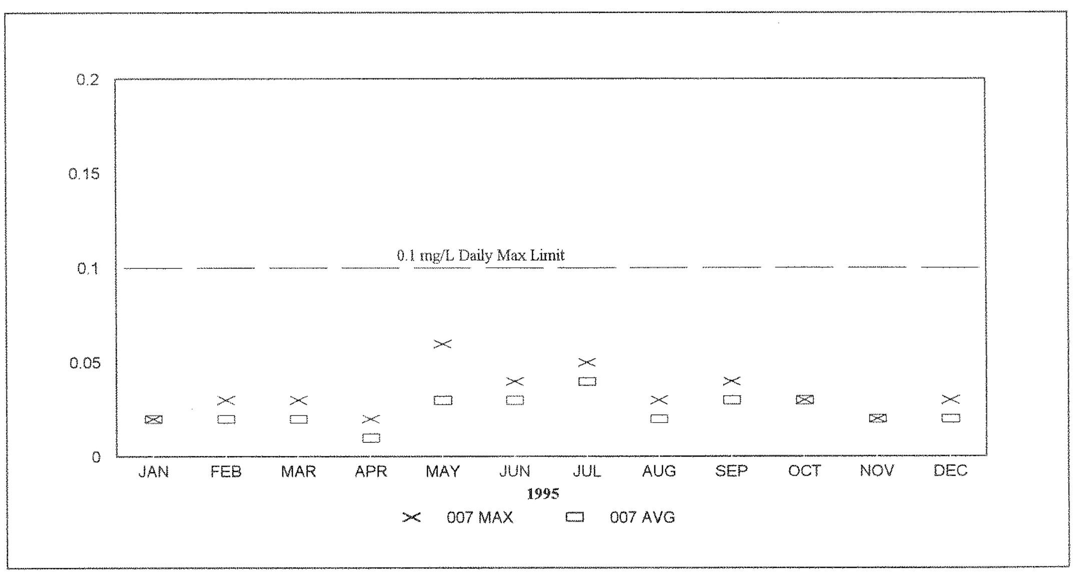


Figure C - 5.22

WATER QUALITY

CHLORINE,
TOTAL RESIDUAL
(mg/L)

Outfall 007



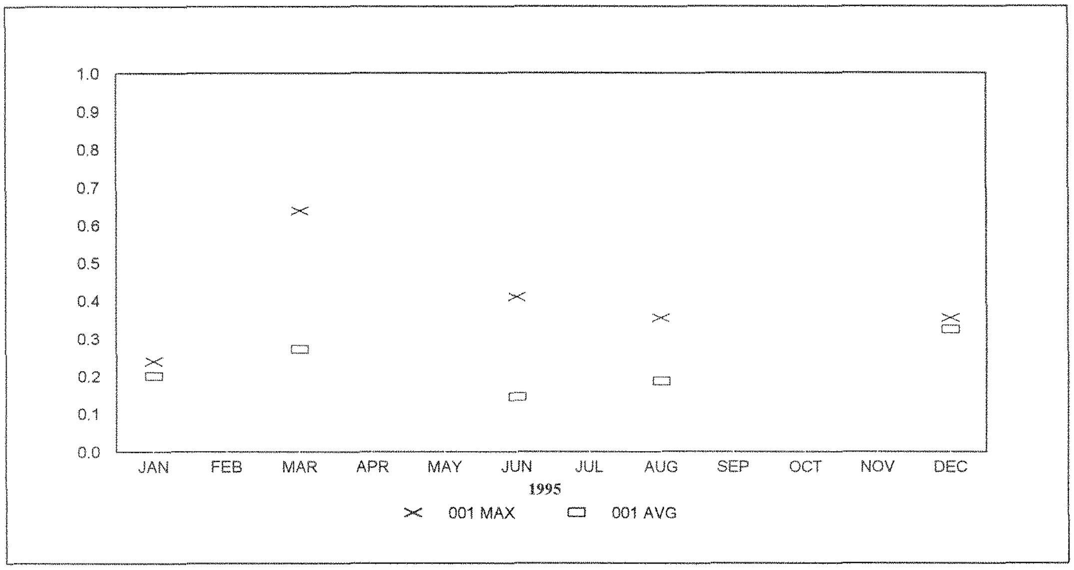


Figure C - 5.23

DISCHARGE RATE
(MGD)

Outfall 001

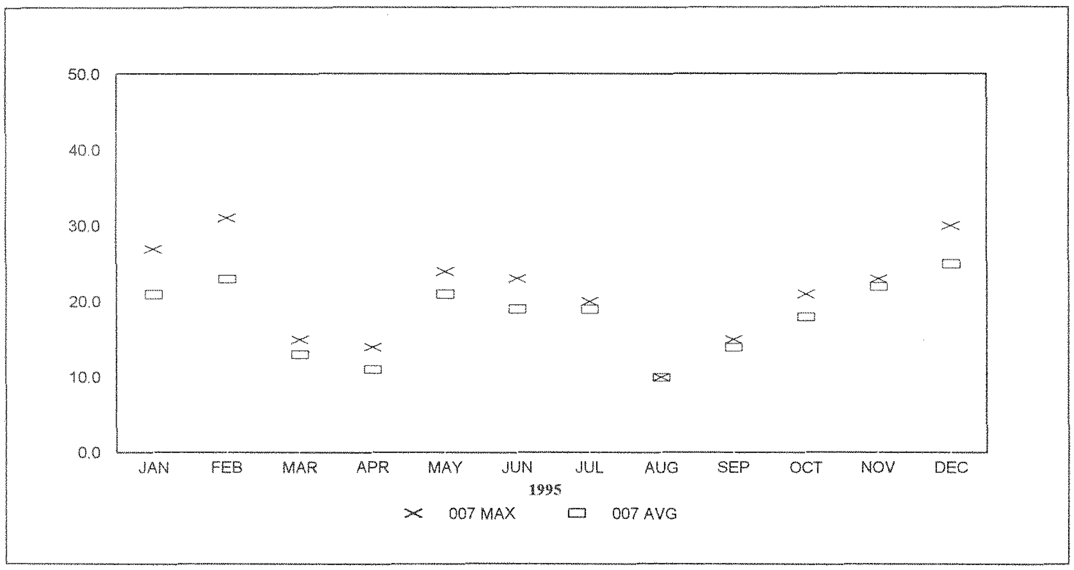


Figure C - 5.24

DISCHARGE RATE
(GPD x 1,000)

Outfall 007

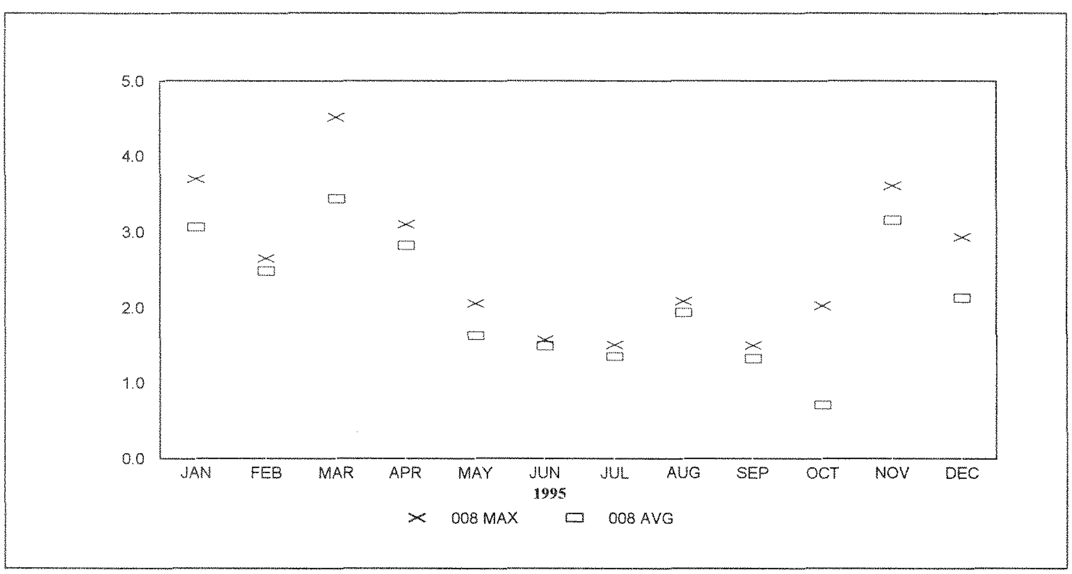


Figure C - 5.25

DISCHARGE RATE
(GPD x 1,000)

Outfall 008

Figure C - 5.26

METALS

ALUMINUM, TOTAL (mg/L)

Outfall 001

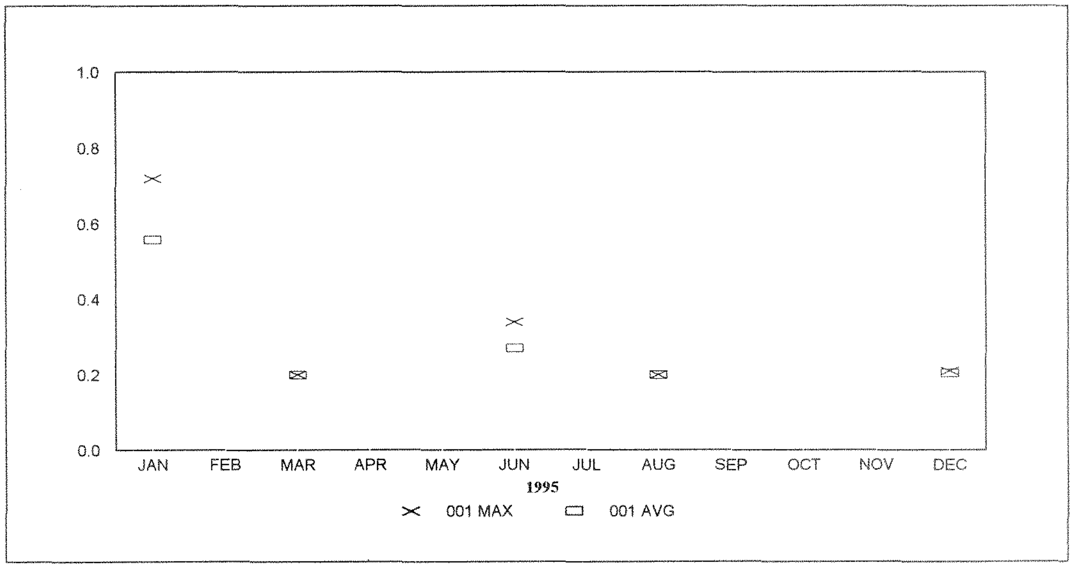


Figure C - 5.27

METALS

ARSENIC, DISSOLVED (mg/L)

Outfall 001

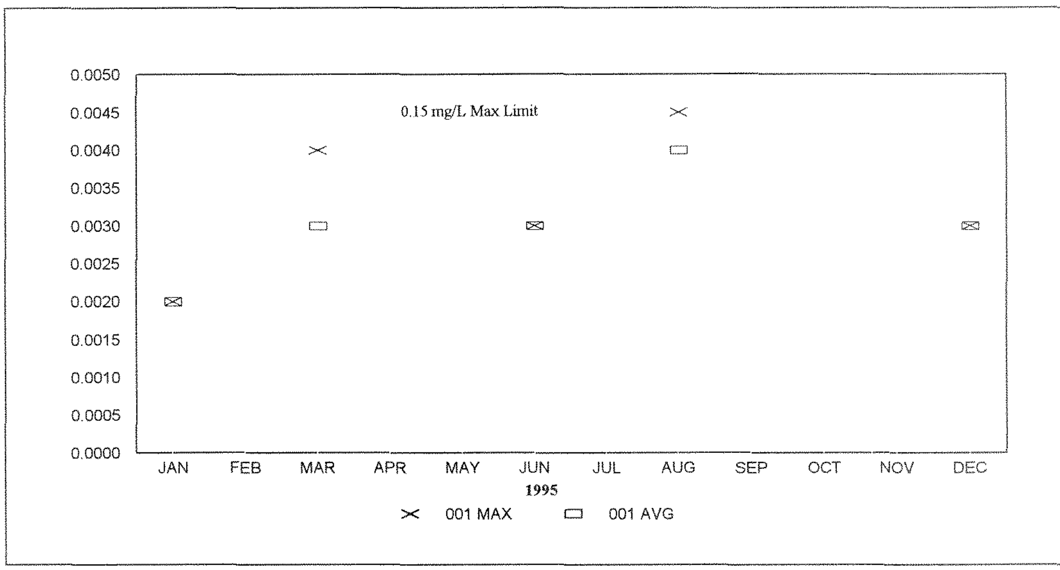
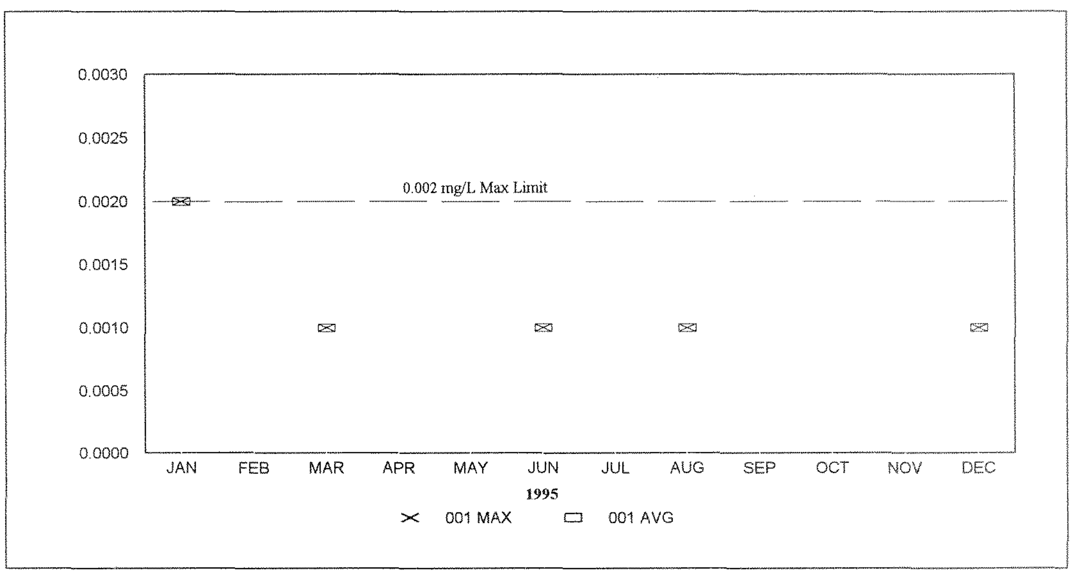


Figure C - 5.28

METALS

CADMIUM, TOTAL RECOVERABLE (mg/L)

Outfall 001



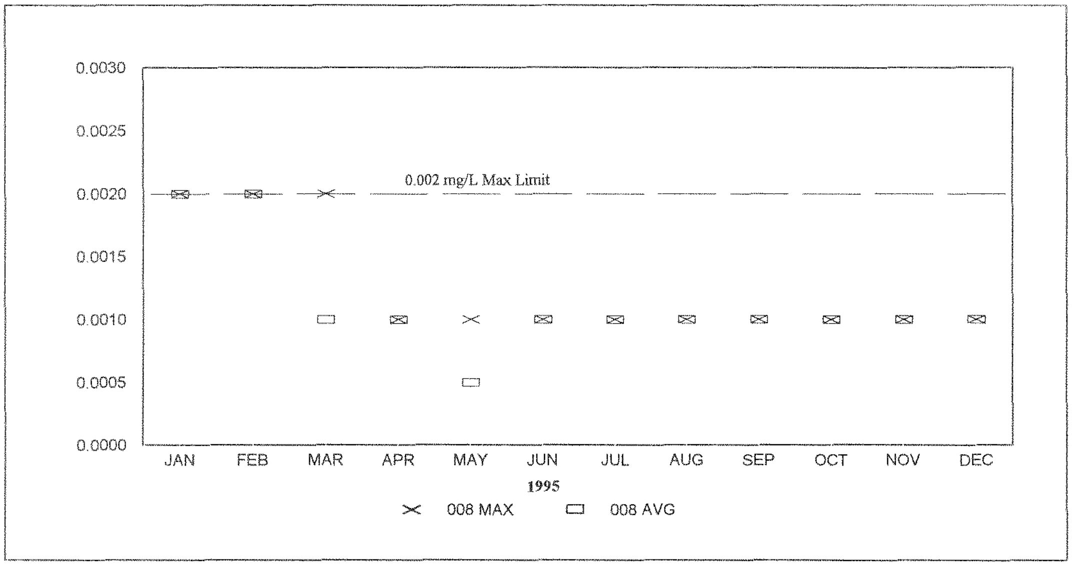


Figure C - 5.29

METALS

CADMIUM,
TOTAL RECOVERABLE
(mg/L)

Outfall 008

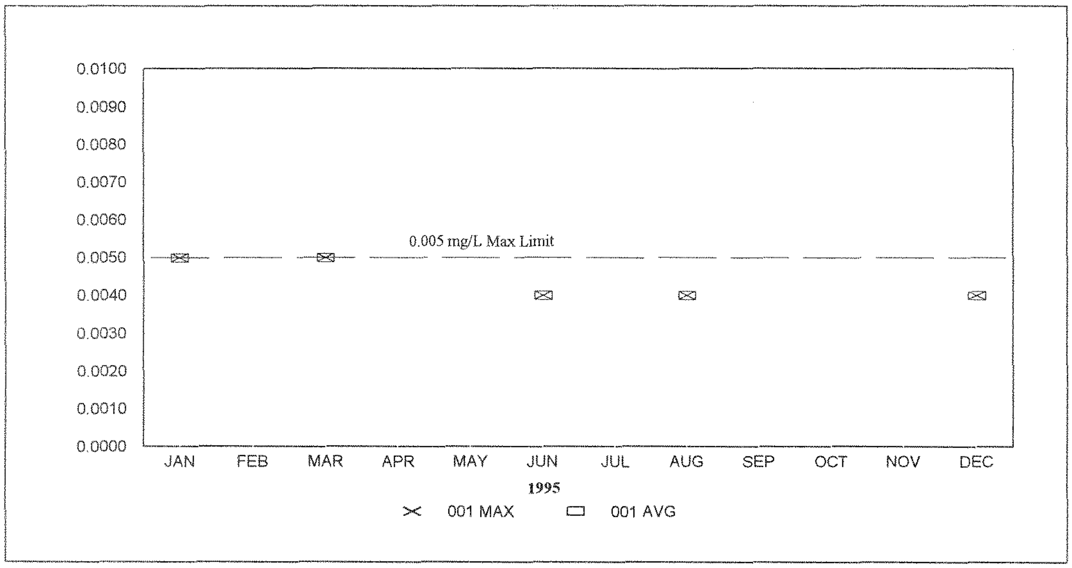


Figure C - 5.30

METALS

COBALT,
TOTAL RECOVERABLE
(mg/L)

Outfall 001

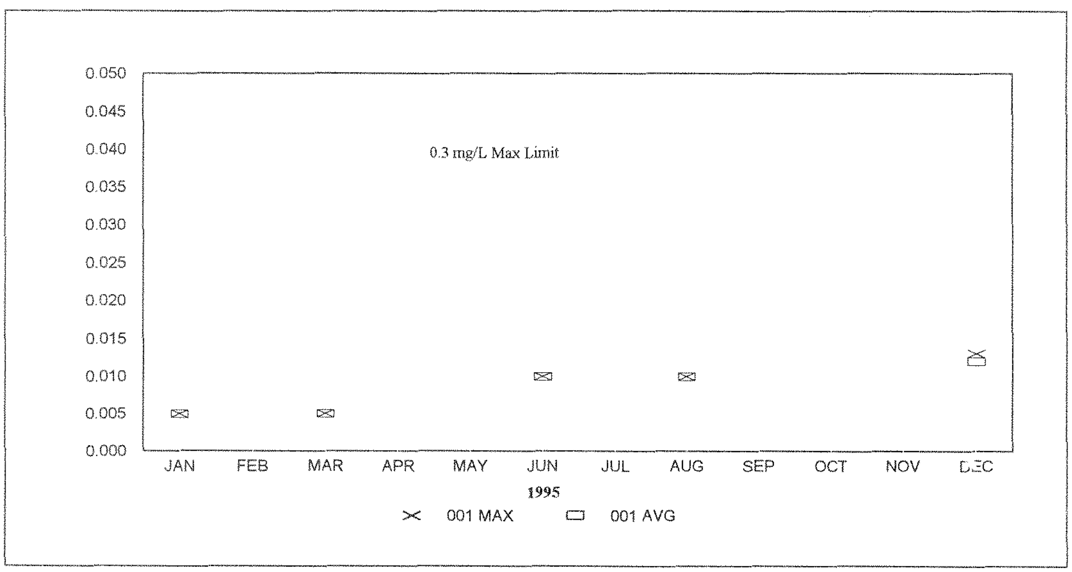


Figure C - 5.31

METALS

CHROMIUM,
TOTAL RECOVERABLE
(mg/L)

Outfall 001

Figure C - 5.32

METALS

CHROMIUM, VI (mg/L)

Outfall 001

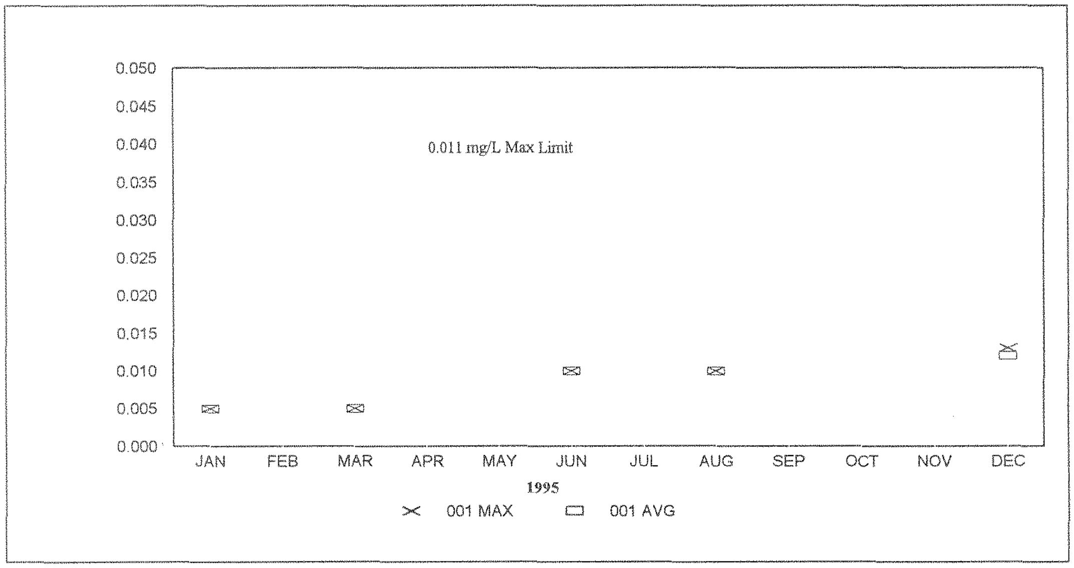


Figure C - 5.33

METALS

COPPER, DISSOLVED (mg/L)

Outfall 001

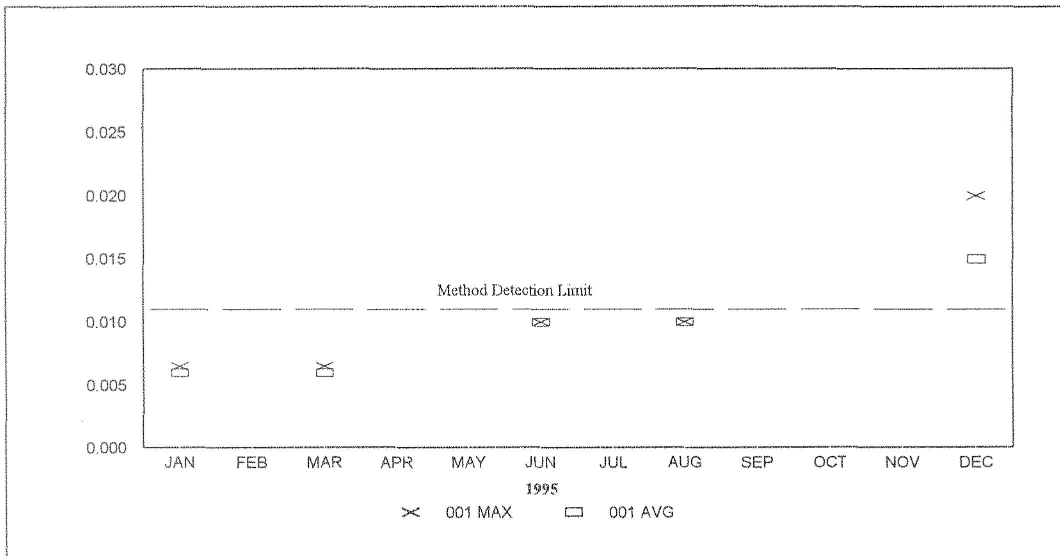
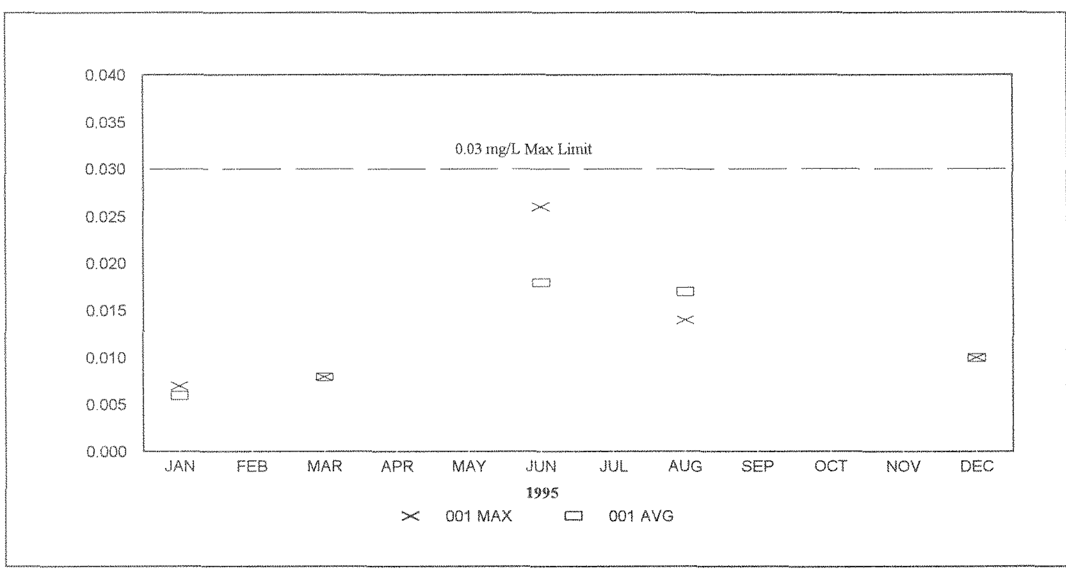


Figure C - 5.34

METALS

COPPER, TOTAL RECOVERABLE (mg/L)

Outfall 001



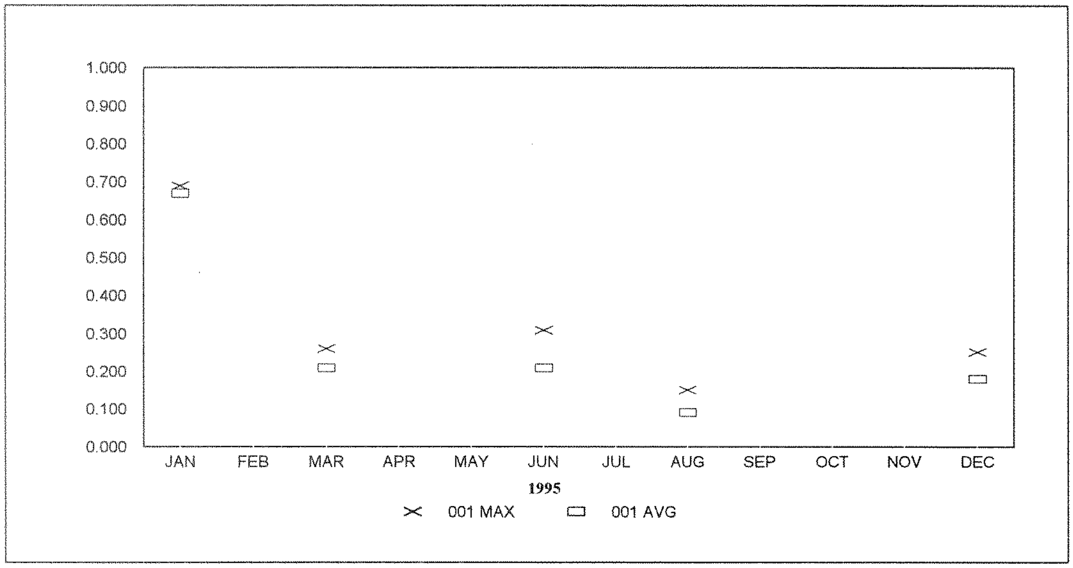


Figure C - 5.35

METALS

IRON, TOTAL (mg/L)

Outfall 001

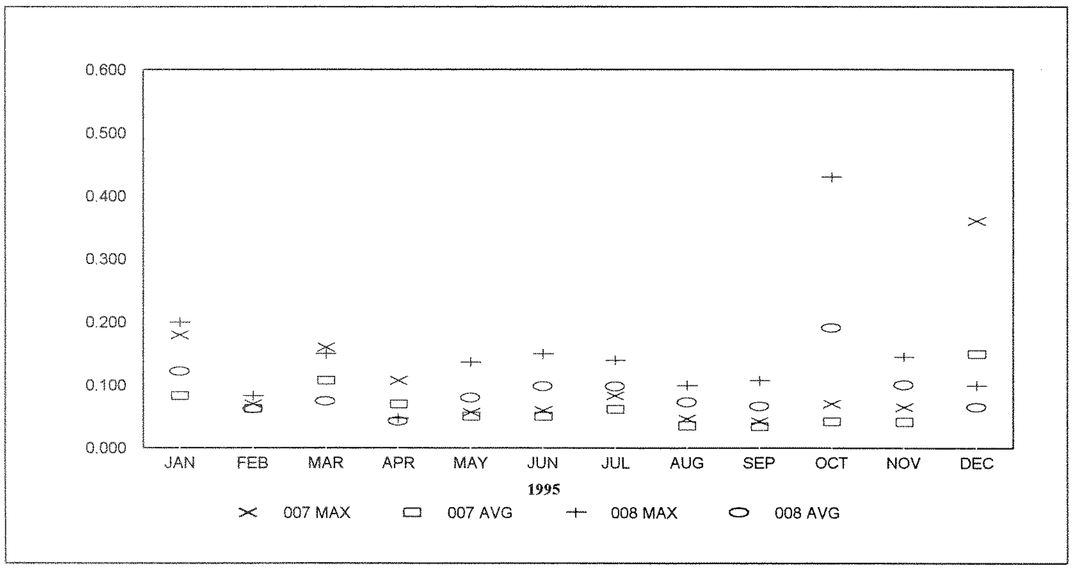


Figure C - 5.36

METALS

IRON, TOTAL (mg/L)

Outfalls 007 and 008

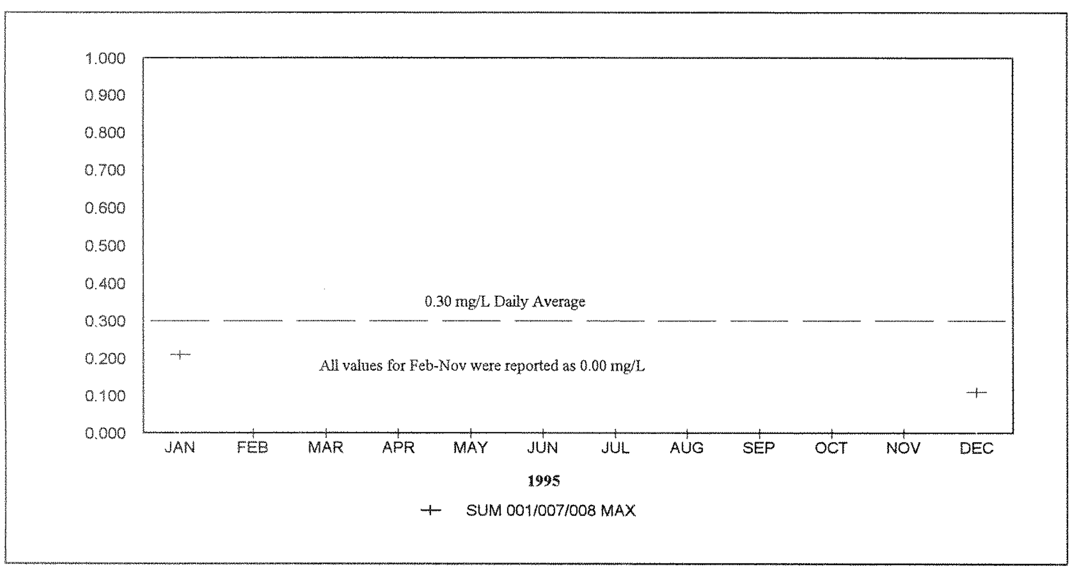


Figure C - 5.37

METALS

FLOW-WEIGHTED AVERAGE

IRON (mg/L)

Sum of Outfalls 001, 007, and 008

Figure C - 5.38

METALS

LEAD, TOTAL RECOVERABLE (mg/L)

Outfall 001

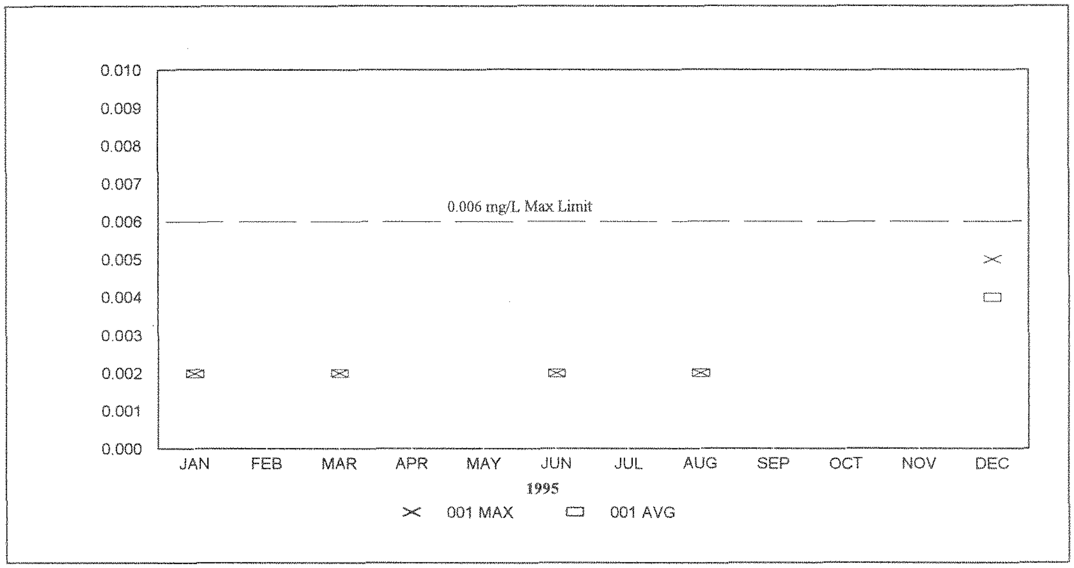


Figure C - 5.39

METALS

LEAD, TOTAL RECOVERABLE (mg/L)

Outfall 008

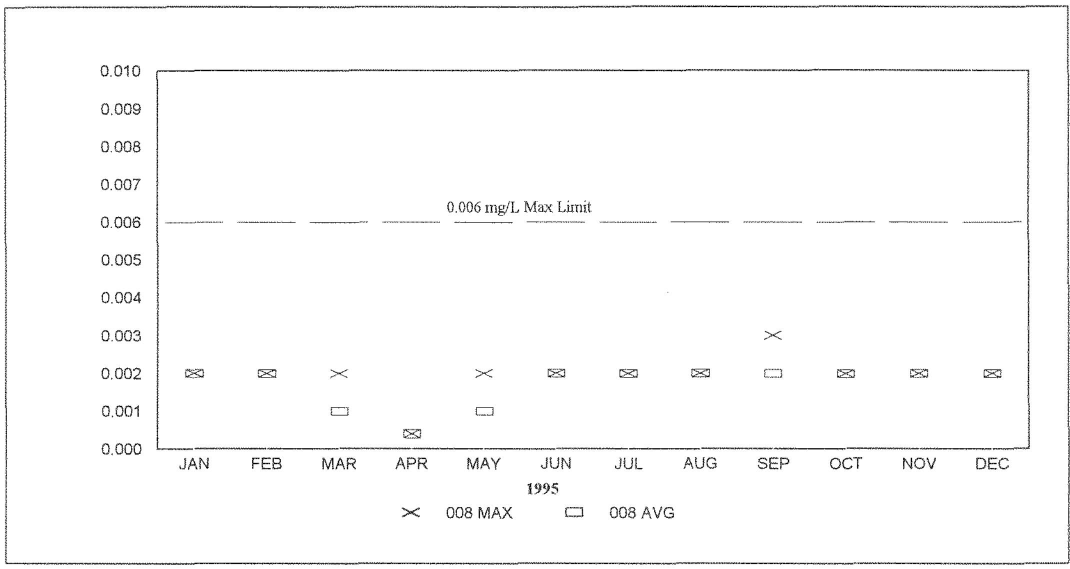
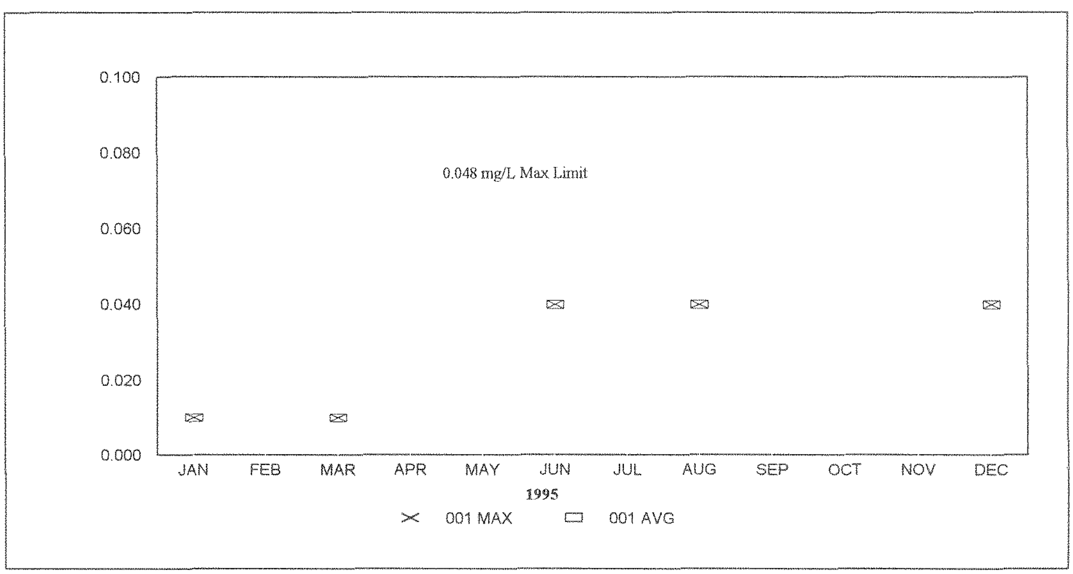


Figure C - 5.40

METALS

NICKEL, TOTAL RECOVERABLE (mg/L)

Outfall 001



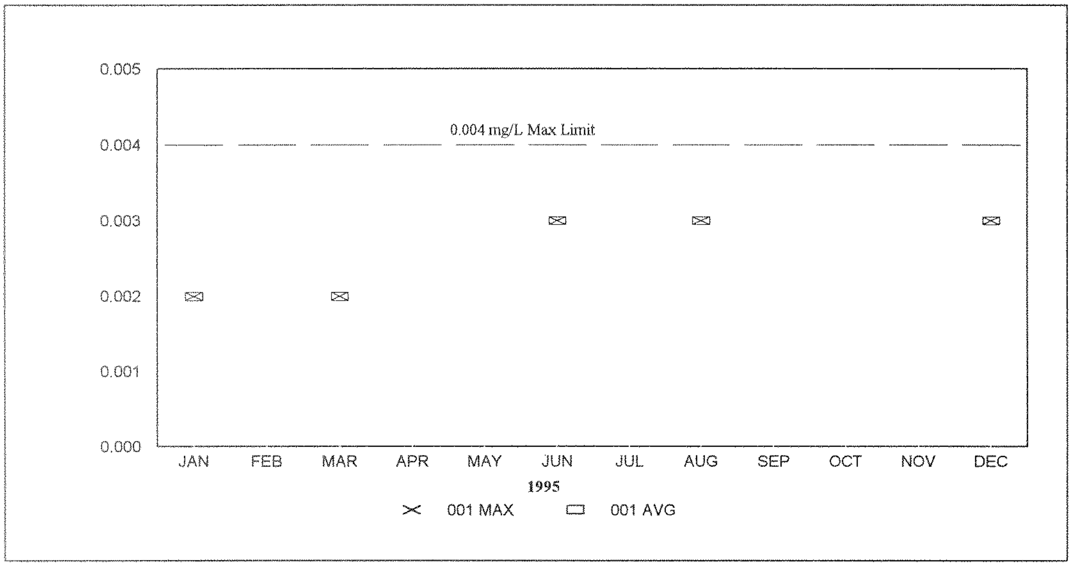


Figure C - 5.41

METALS

SELENIUM,
TOTAL RECOVERABLE
(mg/L)

Outfall 001

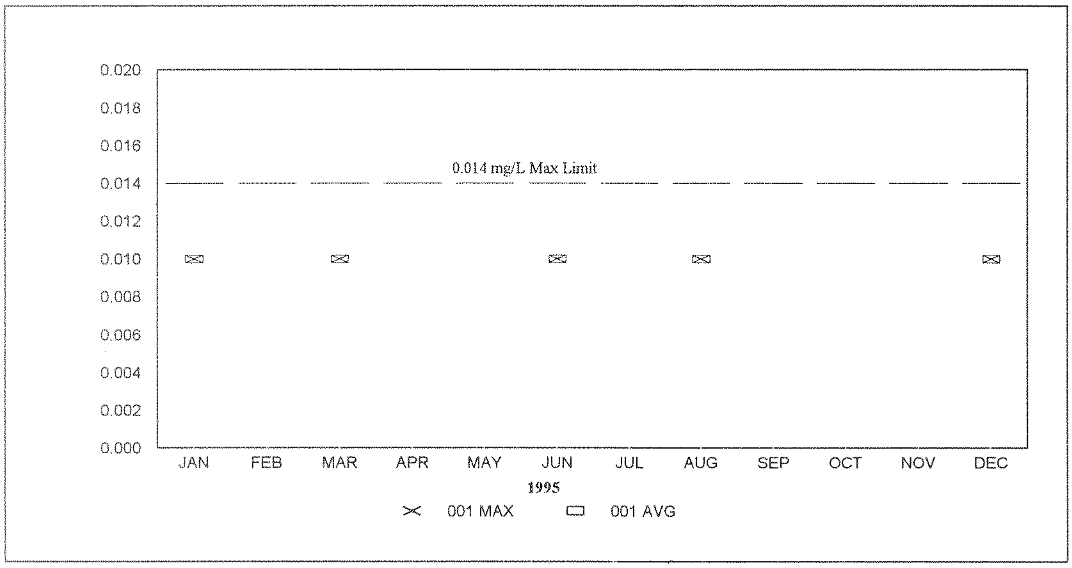


Figure C - 5.42

METALS

VANADIUM,
TOTAL RECOVERABLE
(mg/L)

Outfall 001

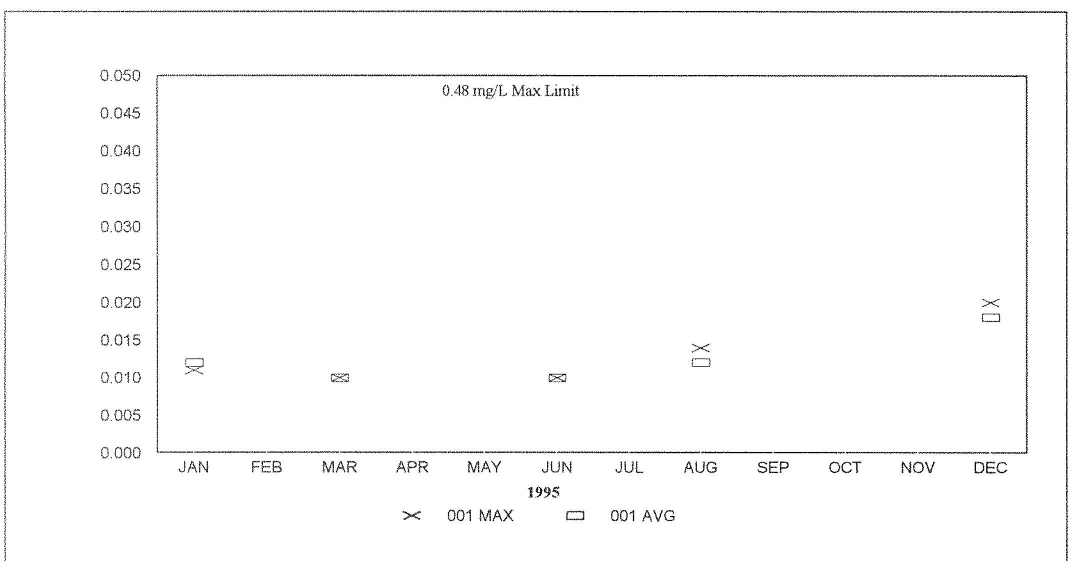


Figure C - 5.43

METALS

ZINC,
TOTAL RECOVERABLE
(mg/L)

Outfall 001

Figure C - 5.44

VOLATILE ORGANIC ANALYSIS

2-BUTANONE (mg/L)

Outfall 001

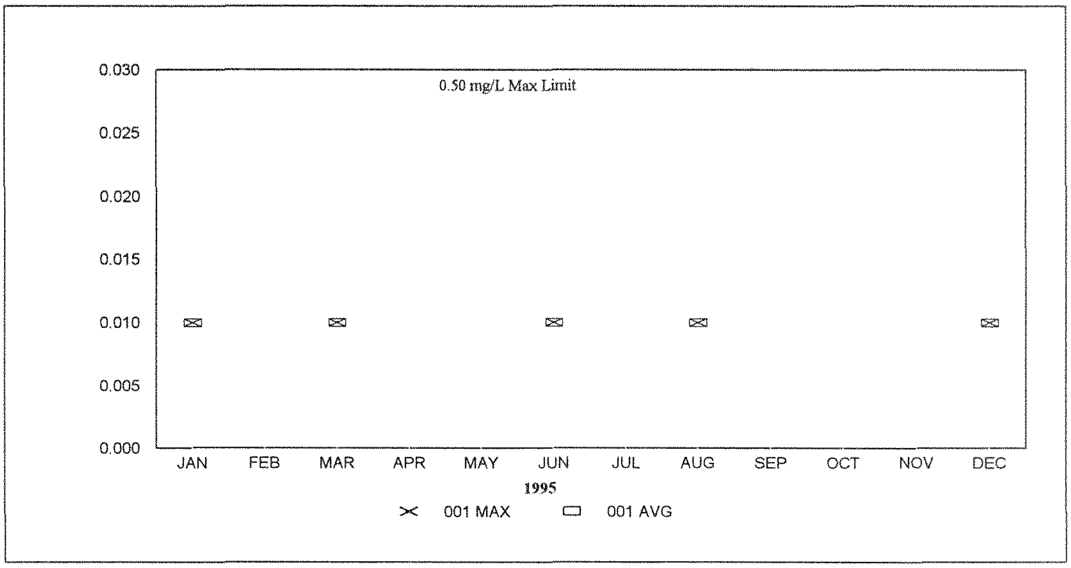


Figure C - 5.45

VOLATILE ORGANIC ANALYSIS

DICHLORODIFLUOROMETHANE (mg/L)

Outfall 001

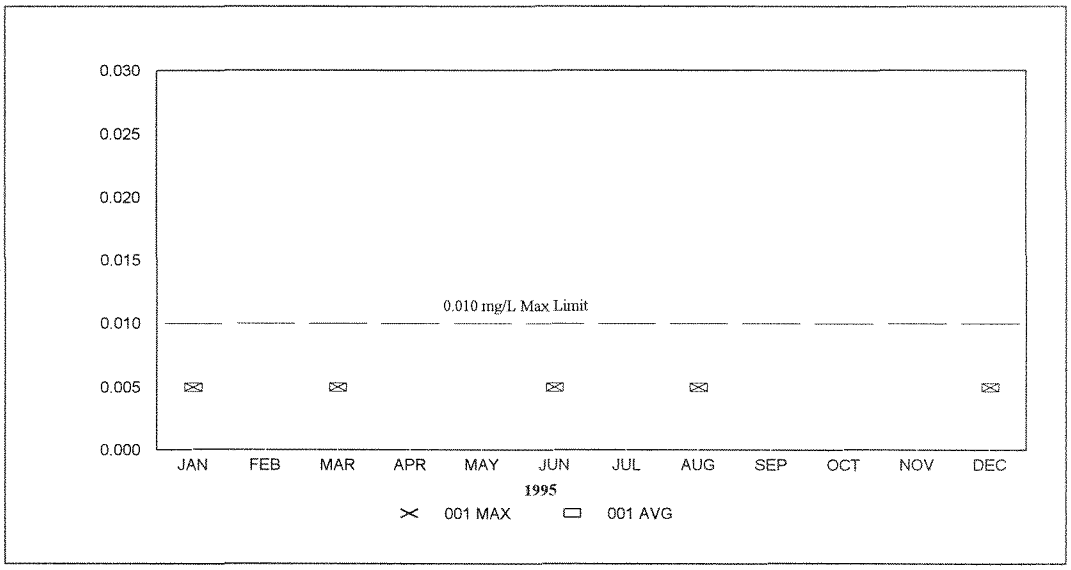


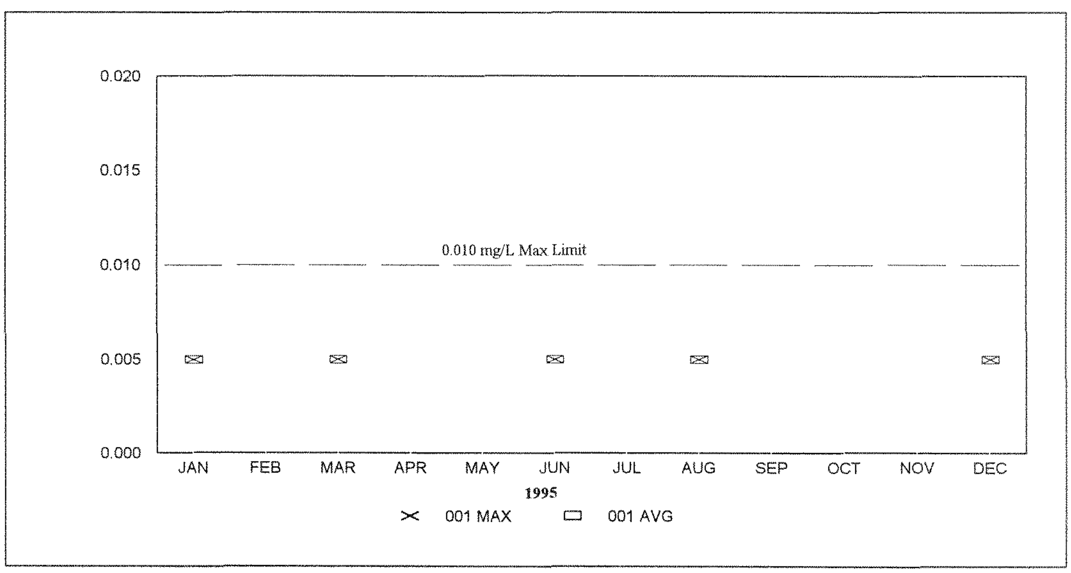
Figure C - 5.46

VOLATILE ORGANIC ANALYSIS

TRICHLOROFLUOROMETHANE

(mg/L)

Outfall 001



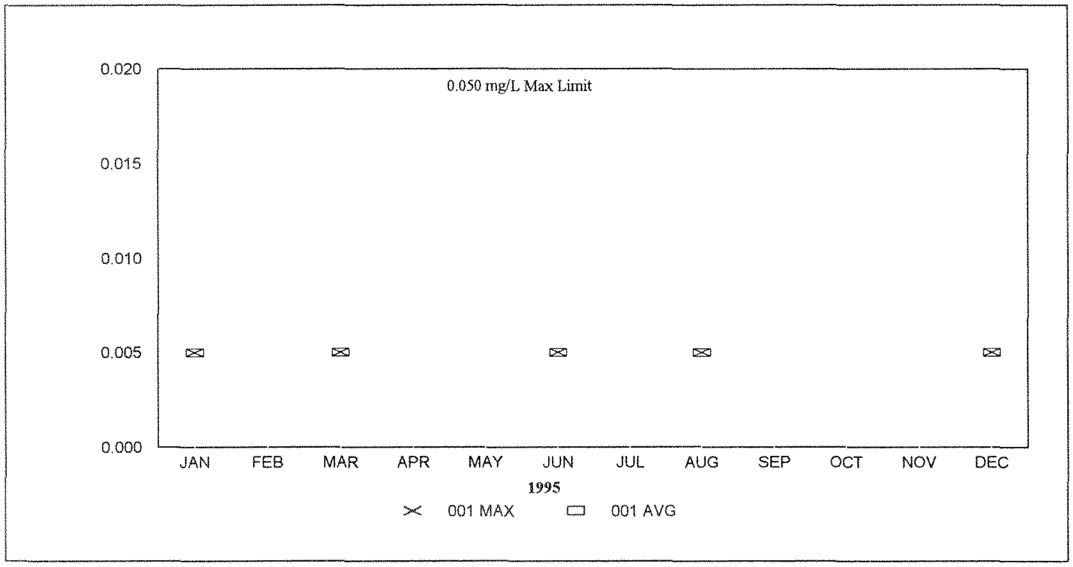


Figure C - 5.47

VOLATILE ORGANIC ANALYSIS

XYLENE, TOTAL (mg/L)

Outfall 001

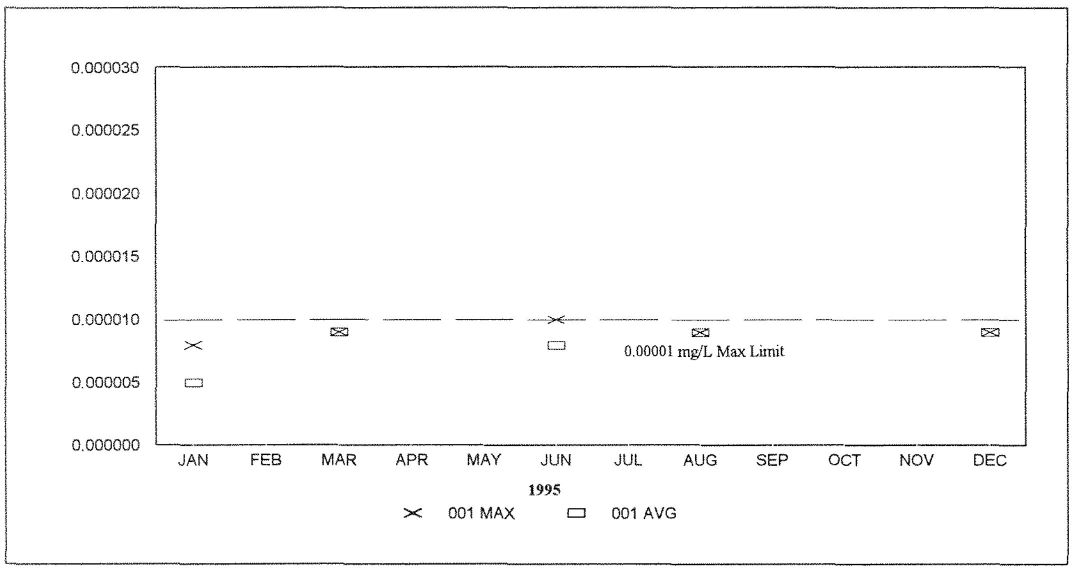


Figure C - 5.48

SEMIVOLATILE ORGANIC ANALYSIS

ALPHA-BHC (mg/L)

Outfall 001

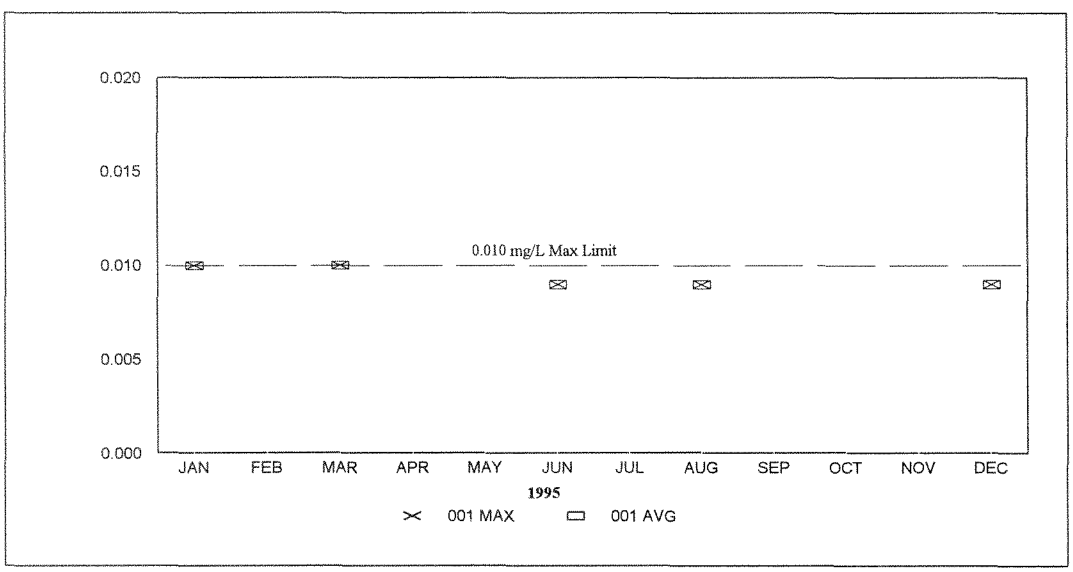


Figure C - 5.49

SEMIVOLATILE ORGANIC ANALYSIS

3,3-DICHLOROBENZIDINE (mg/L)

Outfall 001

Figure C - 5.50

SEMIVOLATILE ORGANIC ANALYSIS

HEPTACHLOR (mg/L)

Outfall 001

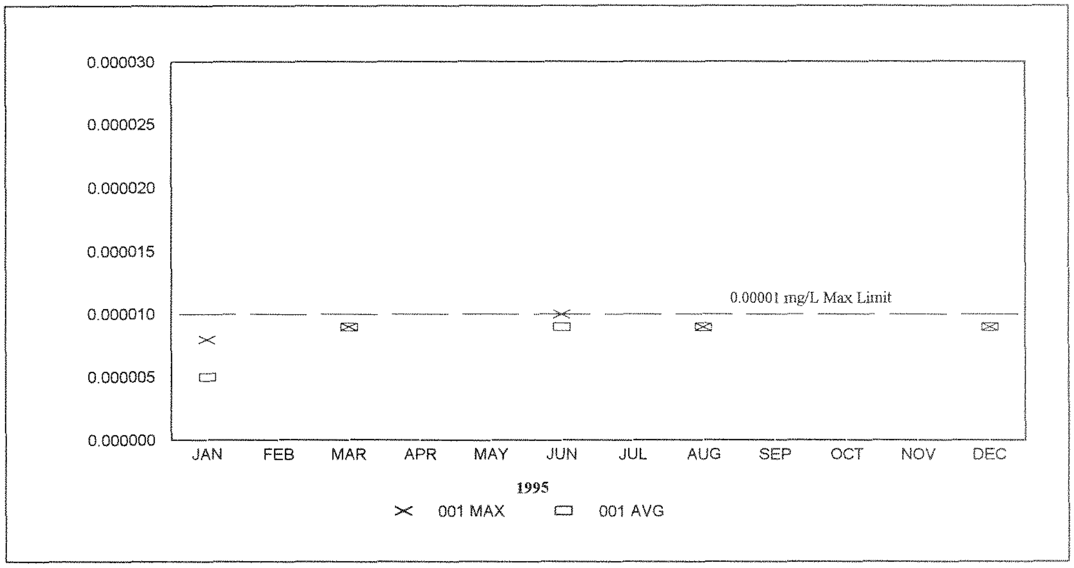


Figure C - 5.51

SEMIVOLATILE ORGANIC ANALYSIS

HEXACHLOROBENZENE (mg/L)

Outfall 001

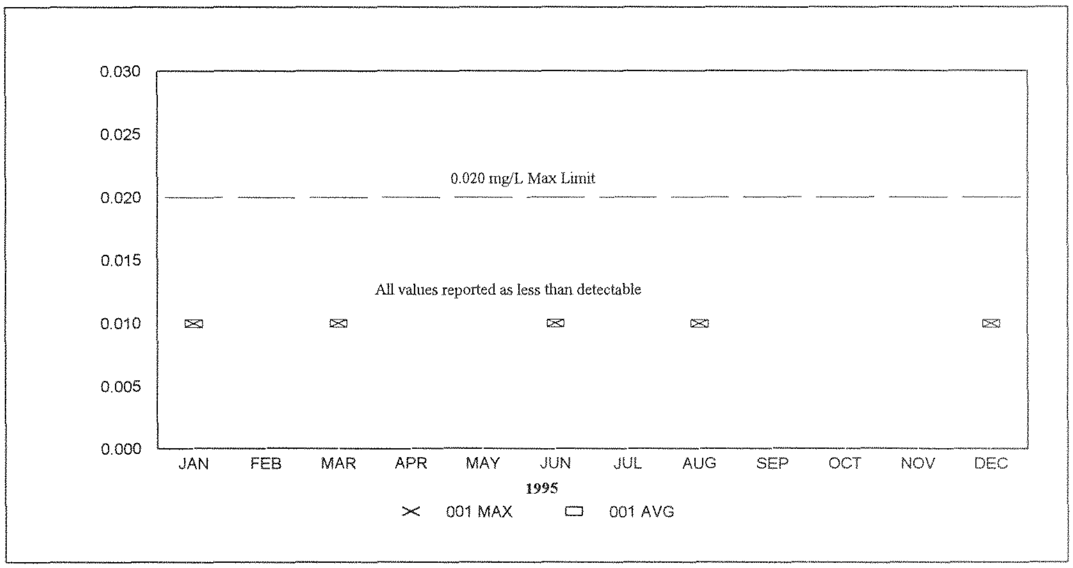
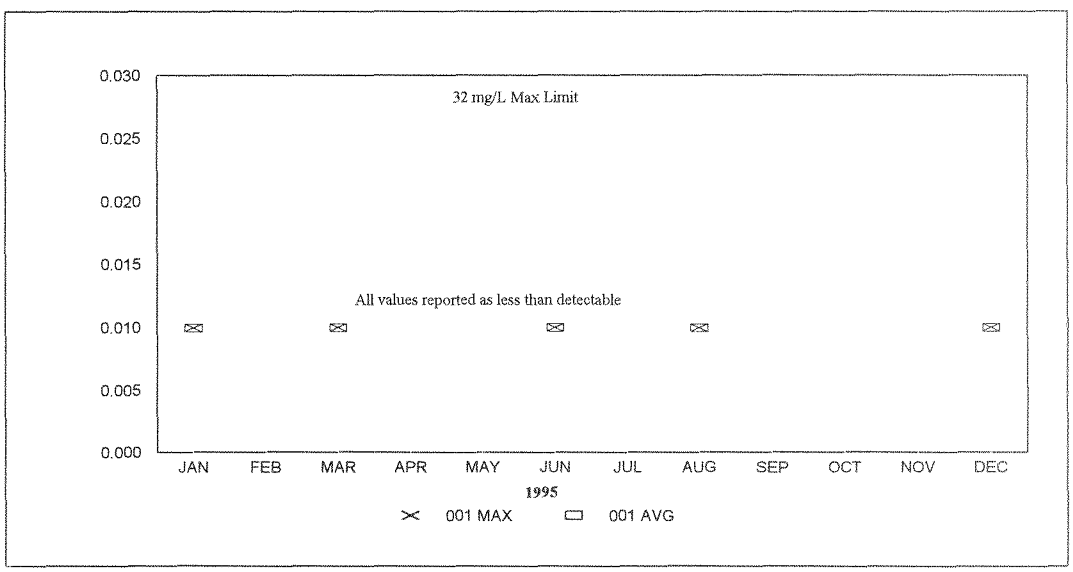


Figure C - 5.52

SEMIVOLATILE ORGANIC ANALYSIS

TRIBUTYL PHOSPHATE (mg/L)

Outfall 001



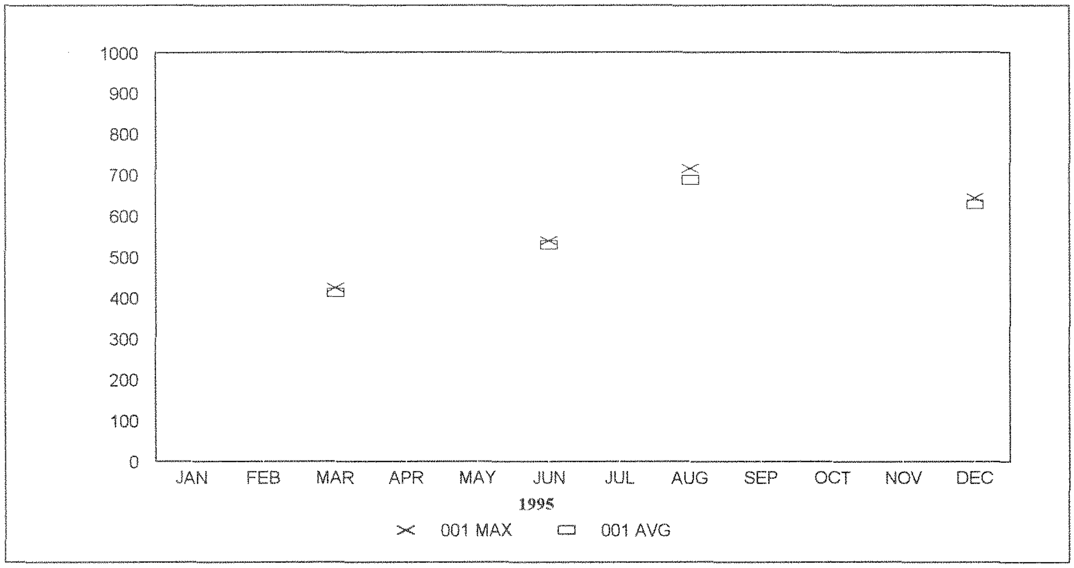


Figure C - 5.53

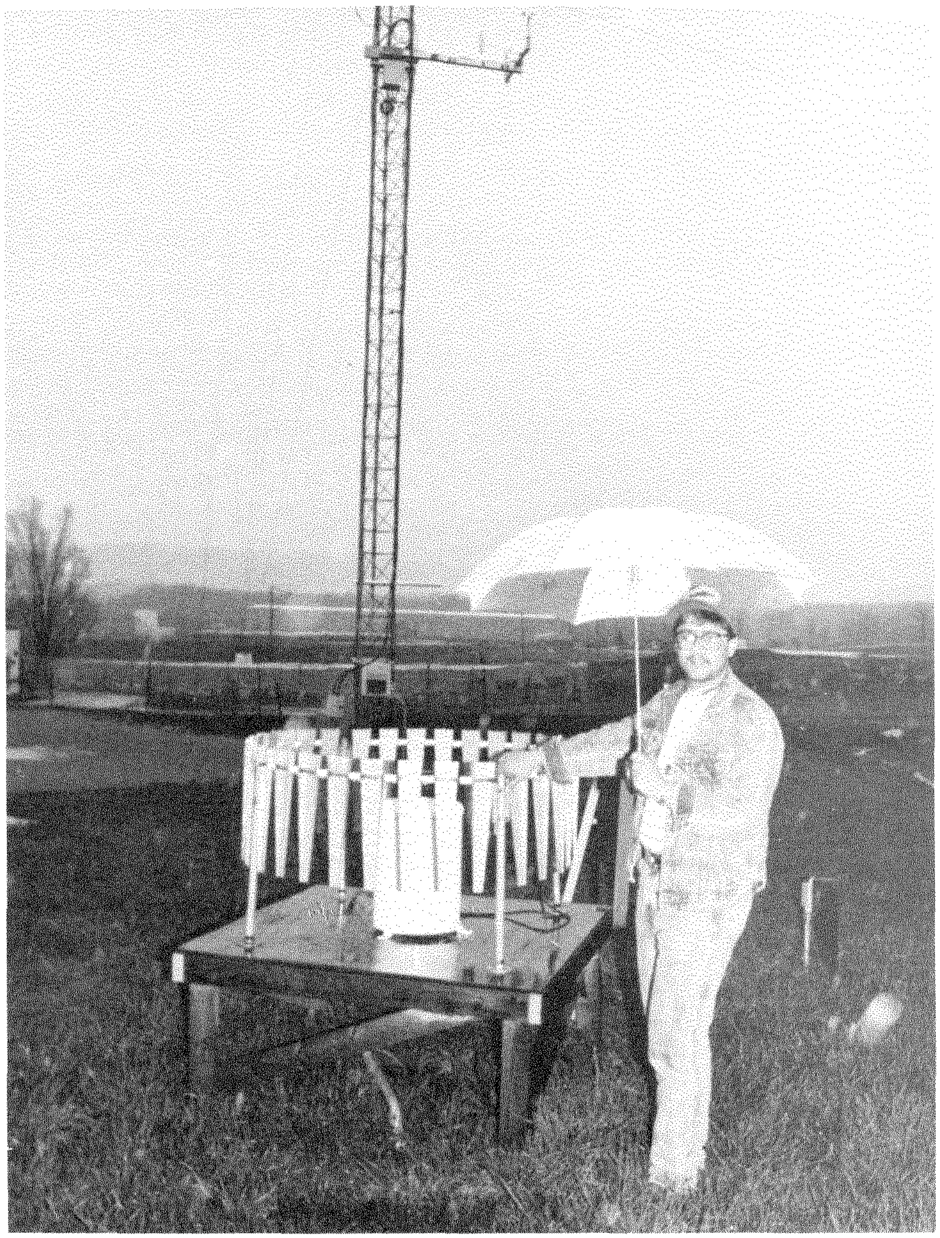
WATER QUALITY

TOTAL DISSOLVED SOLIDS (mg/L)

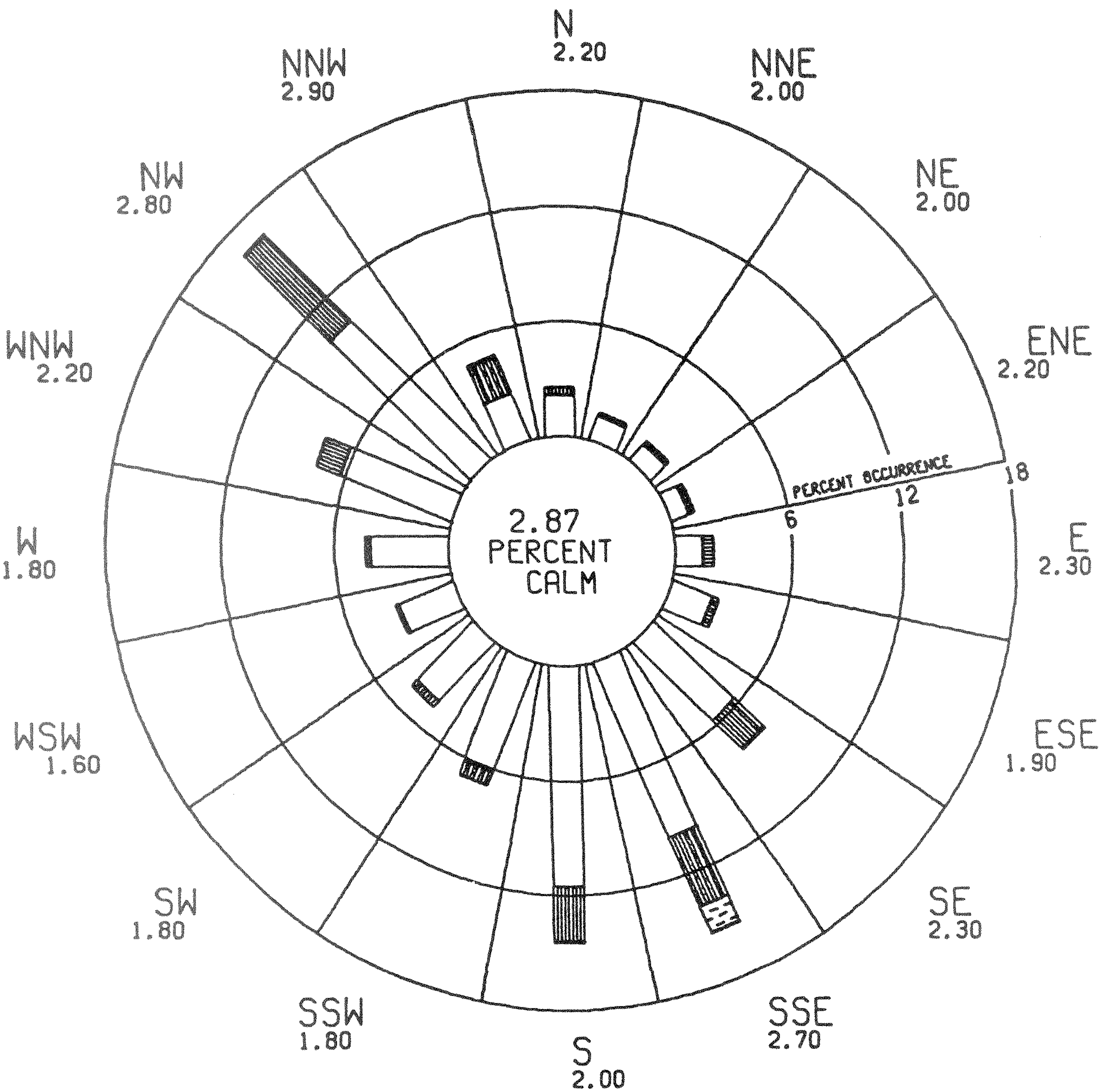
Outfall 001

Appendix C - 6

Summary of Meteorological Data



On-site Meteorological Tower and Rain Gauge



NUMBERS INDICATE SECTOR MEAN WIND SPEED

SECTORS ARE DIRECTIONS FROM WHICH THE WIND IS BLOWING

WIND SPEED RANGE

- 0.5 - 3 M/SEC
- › 3 - 6
- › 6 - 9
- › 9 - 12
- › 12

CALM ‹ 0.5

WEST VALLEY NUCLEAR SERVICES

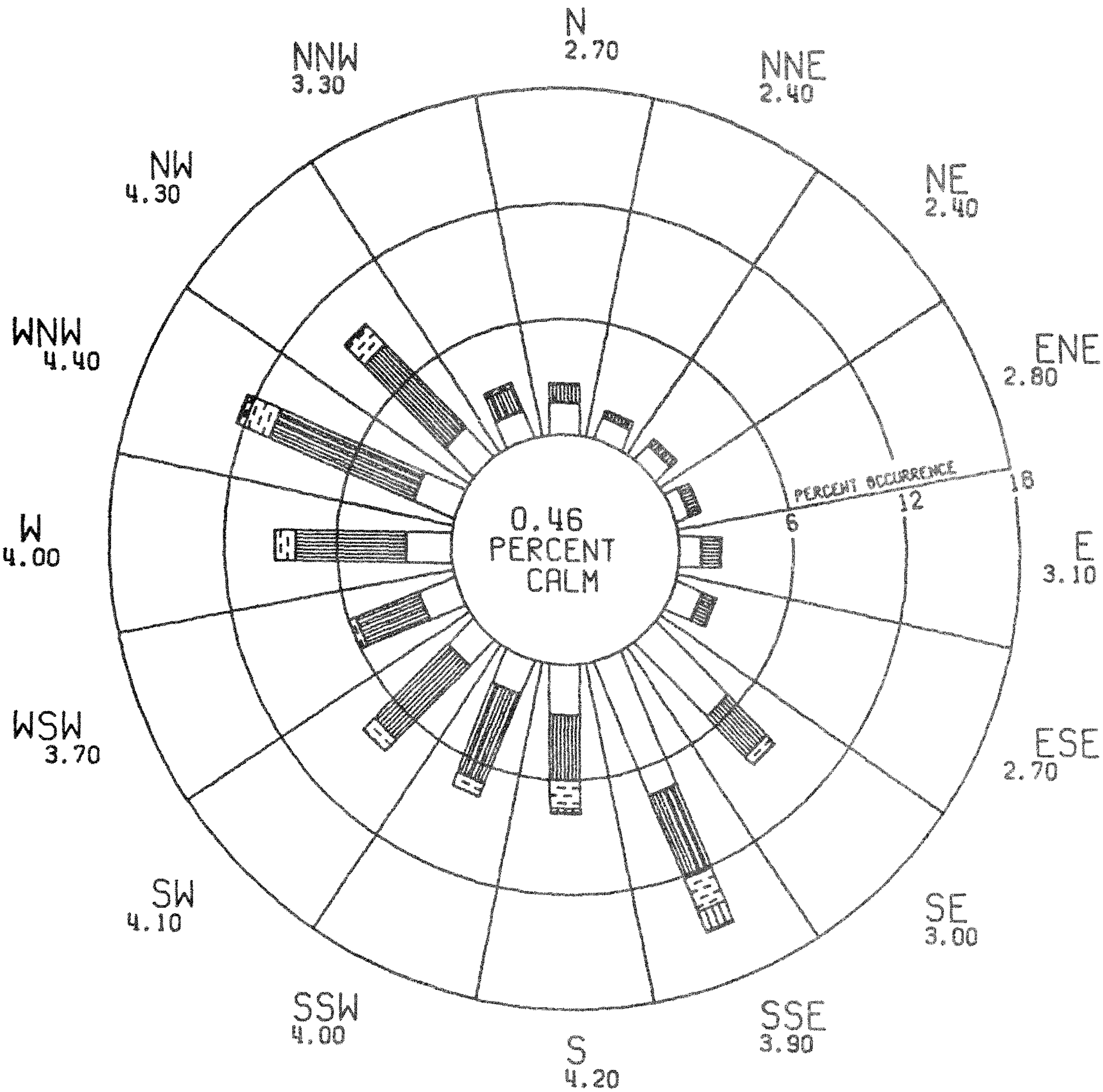
PRIMARY MONITORING STATION

WEST VALLEY, NEW YORK

Figure C-6.1

10.0-METER WIND FREQUENCY ROSE

JANUARY 1, 1995 - DECEMBER 31, 1995



NUMBERS INDICATE SECTOR MEAN WIND SPEED

SECTORS ARE DIRECTIONS FROM WHICH THE WIND IS BLOWING

WIND SPEED RANGE

- 0.5 - 3 M/SEC
- › 3 - 6
- › 6 - 9
- › 9 - 12
- › 12

CALM ‹ 0.5

WEST VALLEY NUCLEAR SERVICES

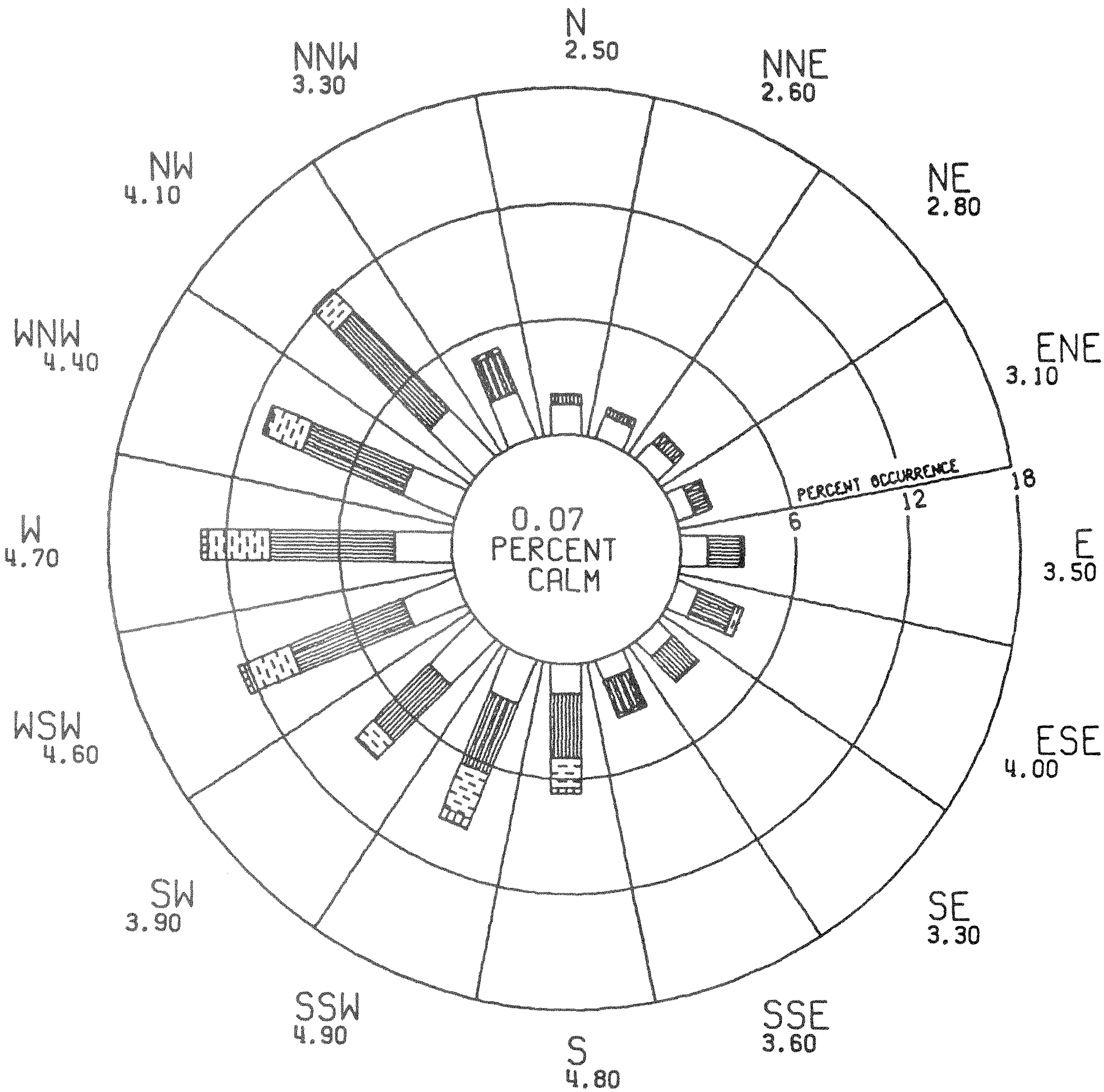
PRIMARY MONITORING STATION

WEST VALLEY, NEW YORK

Figure C-6.2

60.0-METER WIND FREQUENCY ROSE

JANUARY 1, 1995 - DECEMBER 31, 1995



NUMBERS INDICATE SECTOR MEAN WIND SPEED

SECTORS ARE DIRECTIONS FROM WHICH THE WIND IS BLOWING

WIND SPEED RANGE

- 0.5 - 3 M/SEC
- > 3 - 6
- > 6 - 9
- > 9 - 12
- > 12

CALM < 0.5

WEST VALLEY NUCLEAR SERVICES
REGIONAL MONITORING STATION
WEST VALLEY, NEW YORK

Figure C-6.3

10.0-METER WIND FREQUENCY ROSE

JANUARY 1, 1995 - DECEMBER 31, 1995

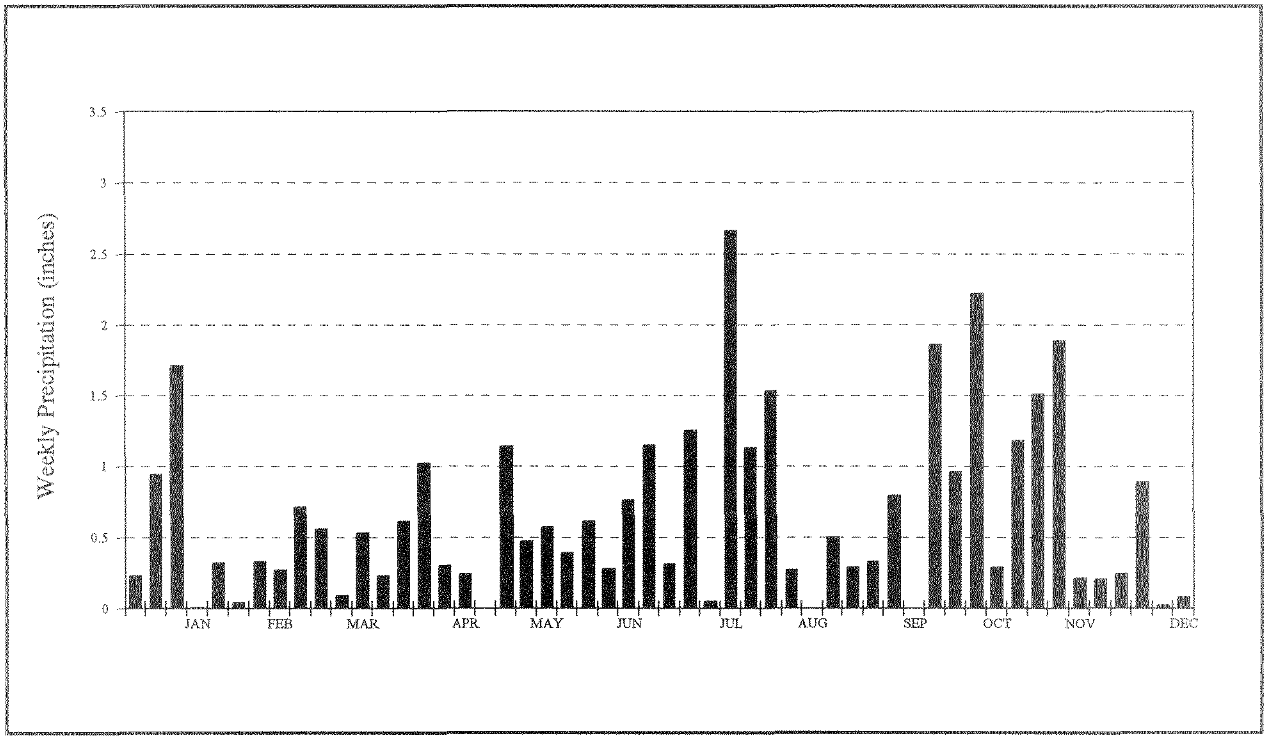


Figure C - 6.4. 1995 Weekly Precipitation

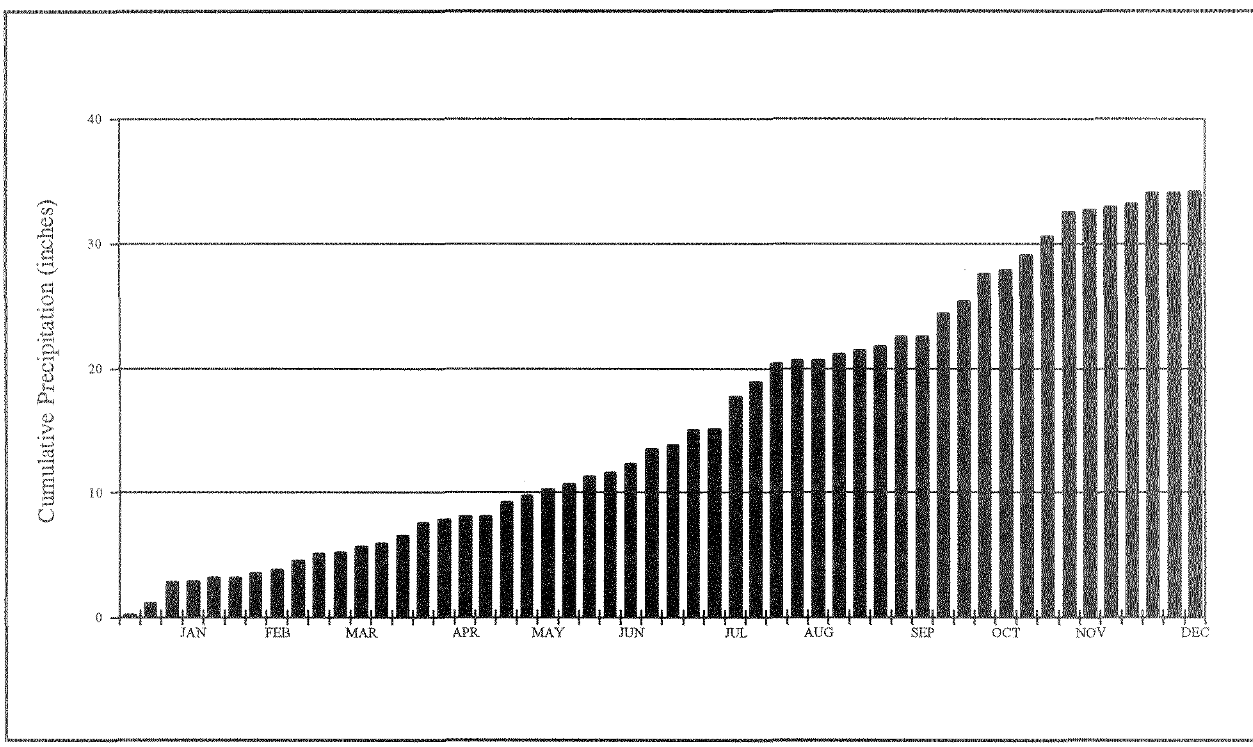


Figure C - 6.5. 1995 Cumulative Precipitation

Table C - 6.1

1995 Site Precipitation Collection Data

Week Ending	Weekly (inches)	Cumulative (inches)	Week Ending	Weekly (inches)	Cumulative (inches)
January 7	0.23	0.23	*July 8*	0.31	13.82
January 14	0.94	1.17	*July 15*	1.25	15.07
January 21	1.71	2.88	*July 22*	0.05	15.12
January 28	0.01	2.89	*July 29*	2.66	17.78
February 4	0.32	3.21	*August 5*	1.13	18.91
February 11	0.04	3.25	*August 12*	1.53	20.44
February 18	0.33	3.58	*August 19*	0.27	20.71
February 25	0.27	3.85	*August 26*	0.00	20.71
March 4	0.71	4.56	*September 2*	0.50	21.21
March 11	0.56	5.12	*September 9*	0.29	21.50
March 18	0.09	5.21	*September 16*	0.33	21.83
March 25	0.53	5.74	*September 23*	0.79	22.62
April 1	0.23	5.97	*September 30*	0.00	22.62
April 8	0.61	6.58	*October 7*	1.86	24.48
April 15	1.02	7.60	*October 14*	0.96	25.44
April 22	0.30	7.90	*Ooctober 21*	2.22	27.66
April 29	0.24	8.14	*October 28*	0.29	27.95
May 6	0.00	8.14	*November 4*	1.18	29.13
May 13	1.14	9.28	*November 11*	1.51	30.64
May 20	0.47	9.75	*November 18*	1.89	32.53
May 27	0.57	10.32	*November 25*	0.21	32.74
June 3	0.39	10.71	*December 2*	0.20	32.94
June 10	0.61	11.32	*December 9*	0.24	33.18
June 17	0.28	11.60	*December 16*	0.89	34.07
June 24	0.76	12.36	*December 23*	0.02	34.09
July 1	1.15	13.51	*December 31*	0.08	34.17

Table C - 6.2

1995 Annual Temperature Summary at the 10-meter Primary Meteorological Tower

Month	Average Temperature		Maximum Temperature		Minimum Temperature	
	°C	°F	°C	°F	°C	°F
January	-1.6	29.1	17.8	64.0	-17.1	1.2
February	-6.0	21.2	9.7	49.5	-21.0	-5.8
March	2.0	35.6	18.7	65.7	-17.7	0.1
April	4.7	40.5	22.2	72.0	-10.0	14.0
May	12.8	55.0	24.9	76.8	-0.8	30.6
June	19.3	66.7	32.9	91.2	5.8	42.4
July	21.1	70.0	32.9	91.2	5.8	42.4
August	21.2	70.2	31.3	88.3	9.5	49.1
September	14.0	57.2	26.3	79.3	-0.3	31.5
October	11.7	53.1	25.1	77.2	-1.1	30.0
November	1.3	34.3	19.0	66.2	-9.5	14.9
December	-4.8	23.4	7.7	45.9	-16.1	3.0
Annual	8.1	46.6	32.9	91.2	-21.0	-5.8

Table C - 6.3

1995 Annual Barometric Pressure Summary (station pressure)

Month	Barometric Pressure (inches of mercury)		
	Average Pressure	**Maximum Pressure**	**Minimum Pressure**
January	28.43	28.89	27.74
February	28.44	28.90	27.91
March	28.59	29.13	27.95
April	28.45	28.81	28.07
May	28.45	28.77	28.03
June	28.51	28.89	28.13
July	28.50	28.79	28.27
August	28.55	28.74	28.26
September	28.59	28.82	28.31
October	28.44	28.81	27.87
November	28.44	28.82	27.77
December	28.50	28.93	27.97
Annual	28.49	29.13	27.74

Appendix D

Summary of Quality Assurance Crosscheck Analyses

Keeping Up With Regulatory Changes

Table D - 1

Comparison of Radiological Results with Known Results of Crosscheck Samples from the DOE Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) 42

Isotope	Matrix	Actual	Reported	Ratio	Accept ?	Analyzed by
Co-60	Air	3.76E+00	2.86E+00	0.76	Pass	EPI
Sr-90	Air	7.39E-01	6.40E-01	0.87	Yes	EPI
Sb-125	Air	9.42E+00	6.36E+00	0.68	Pass	EPI
Cs-137	Air	5.28E+00	4.22E+00	0.80	Pass	EPI
Cs-134	Air	5.75E+00	4.65E+00	0.81	Yes	EPI
Pu-238	Air	1.22E-01	1.40E-01	1.15	Pass	EPI
Pu-239	Air	6.20E-02	7.00E-02	1.12	Yes	EPI
Am-241	Air	1.77E-01	4.40E-01	2.49	No	EPI
U-234	Air	5.90E-02	1.30E-01	2.20	No	EPI
U-238	Air	2.00E-03	6.00E-03	3.00	No	EPI
U (µg)	Air	5.38E-01	8.00E-01	1.49	Pass	EPI
Gross Alpha	Air	3.22E+00	3.10E+00	0.96	Yes	EL
Gross Beta	Air	1.85E+00	2.20E+00	1.19	Yes	EL
K-40	Soil	3.84E+02	4.75E+02	1.24	Yes	EPI
Sr-90	Soil	1.13E+01	1.81E+01	1.60	Pass	EPI
Cs-137	Soil	2.66E+02	2.93E+02	1.10	Yes	EPI
Pu-238	Soil	3.20E+01	3.26E+01	1.02	Yes	EPI
Pu-239	Soil	6.76E+00	7.18E+00	1.06	Yes	EPI
Am-241	Soil	3.20E+00	4.06E+00	1.27	Yes	EPI
U-234	Soil	3.03E+01	2.75E+01	0.91	Yes	EPI
U-238	Soil	3.16E+01	2.66E+01	0.84	Yes	EPI
U (µg)	Soil	2.50E+00	2.29E+00	0.92	Yes	EPI
K-40	Veg	1.03E+03	1.32E+03	1.28	Pass	EPI
Co-60	Veg	9.60E+00	1.03E+01	1.07	Yes	EPI
Sr-90	Veg	5.12E+02	4.74E+02	0.93	Yes	EPI
Cs-137	Veg	1.17E+02	1.38E+02	1.18	Yes	EPI
H-3	Water	6.03E+01	4.40E+01	0.73	Pass	EPI
Co-60	Water	1.96E+02	2.03E+02	1.04	Yes	EPI
Sr-90	Water	2.40E+00	2.03E+00	0.85	Yes	EPI
Cs-134	Water	8.35E+01	8.73E+01	1.05	Yes	EPI
Cs-137	Water	7.68E+01	8.71E+01	1.13	Yes	EPI
Mn-54	Water	4.35E+01	4.82E+01	1.11	Yes	EPI
Pu-239	Water	5.91E-01	7.60E-01	1.29	Pass	EPI
Am-241	Water	1.33E+00	8.00E-01	0.60	Pass	EPI
U-234	Water	3.73E-01	3.00E-01	0.80	Pass	EPI
U (µg)	Water	3.00E-03	5.00E-03	1.73	No	EPI
Gross Alpha	Water	1.34E+03	1.75E+03	1.31	Pass	EPI
Gross Beta	Water	6.53E+02	8.98E+02	1.38	Pass	EPI
H-3	Water	6.03E+01	5.20E+01	0.86	Yes	EL
Co-60	Water	1.96E+02	2.10E+02	1.07	Yes	EL
Sr-90	Water	2.40E+00	3.10E+00	1.29	Pass	EL
Cs-137	Water	7.68E+01	8.30E+01	1.08	Yes	EL
Mn-54	Water	4.35E+01	4.80E+01	1.10	Yes	EL
Gross Alpha	Water	1.34E+03	1.50E+03	1.12	Yes	EL
Gross Beta	Water	6.53E+02	9.50E+02	1.45	Pass	EL

Units for air filters: Bq/filter; soil and vegetation: Bq/kg; water: Bq/L. Values for elemental uranium (listed in the table) reported in µg/filter, µg/g, or µg/mL. Samples analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. ***Yes*** *indicates a ratio within warning limits;* ***Pass*** *indicates a ratio within control limits but outside warning limits;* ***No*** *indicates a ratio outside control limits.*

Table D - 2

Comparison of Radiological Results with Known Results of Crosscheck Samples from the DOE Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) 43

Isotope	Matrix	Actual	Reported	Ratio	Accept ?	Analyzed by
Co-60	Air	3.26E+01	2.79E+01	0.86	Yes	EPI
Sr-90	Air	1.06E+00	1.50E+00	1.42	Yes	EPI
Sb-125	Air	1.14E+01	9.99E+00	0.88	Yes	EPI
Cs-137	Air	7.25E+00	6.43E+00	0.89	Yes	EPI
Cs-134	Air	1.79E+01	1.69E+01	0.94	Yes	EPI
Ru-106	Air	1.70E+01	1.31E+01	0.77	Yes	EPI
Pu-238	Air	9.60E−02	7.10E−02	0.74	Yes	EPI
Pu-239	Air	9.30E−02	8.10E−02	0.87	Yes	EPI
Am-241	Air	1.89E−01	1.81E−01	0.96	Yes	EPI
U-234	Air	5.20E−02	6.50E−02	1.26	Yes	EPI
U-238	Air	5.30E−02	5.00E−02	0.94	Yes	EPI
U	Air	1.07E−01	1.18E−01	1.10	Yes	EPI
Gross Alpha	Air	3.30E+00	3.20E+00	0.97	Yes	EL
Gross Beta	Air	1.12E+00	1.60E+00	1.43	Pass	EL
K-40	Soil	3.77E+02	4.17E+02	1.11	Yes	EPI
Sr-90	Soil	7.81E+00	2.22E+01	2.84	No	EPI
Cs-137	Soil	2.07E+02	2.29E+02	1.11	Yes	EPI
Pu-238	Soil	1.75E+01	1.59E+01	0.91	Yes	EPI
Pu-239	Soil	5.17E+00	4.59E+00	0.89	Yes	EPI
Am-241	Soil	1.76E+00	1.37E+00	0.78	Yes	EPI
U-234	Soil	2.95E+01	3.08E+01	1.04	Yes	EPI
U-238	Soil	3.04E+01	3.02E+01	0.99	Yes	EPI
U	Soil	5.82E+01	6.24E+01	1.07	Pass	EPI
K-40	Veg	3.52E+02	4.06E+02	1.15	Yes	EPI
Co-60	Veg	9.17E+00	7.45E+00	0.81	Pass	EPI
Sr-90	Veg	5.87E+02	7.50E+02	1.28	Pass	EPI
Cs-137	Veg	9.72E+01	1.13E+02	1.16	Yes	EPI
Pu-239	Veg	9.80E−01	1.02E+00	1.04	Yes	EPI
Am-241	Veg	5.34E−01	7.70E−01	1.44	Yes	EPI
H-3	Water	1.68E+02	1.70E+02	1.01	Yes	EPI
Co-60	Water	1.96E+02	2.04E+02	1.04	Yes	EPI
Sr-90	Water	2.00E+00	2.82E+00	1.41	Pass	EPI
Cs-137	Water	7.52E+01	8.17E+01	1.09	Yes	EPI
Mn-54	Water	4.49E+01	4.83E+01	1.08	Yes	EPI
Pu-238	Water	1.41E+00	1.30E+00	0.92	Yes	EPI
Pu-239	Water	2.72E−01	2.58E−01	0.95	Yes	EPI
Am-241	Water	1.95E+00	1.79E+00	0.92	Yes	EPI
U-234	Water	3.06E−01	3.45E−01	1.13	Yes	EPI
U-238	Water	3.11E−01	3.39E−01	1.09	Yes	EPI
U	Water	6.24E−01	6.98E−01	1.12	Yes	EPI
Gross Alpha	Water	1.31E+03	1.21E+03	0.92	Yes	EPI
Gross Beta	Water	4.10E+02	4.26E+02	1.04	Yes	EPI
H-3	Water	1.68E+02	1.50E+02	0.89	Yes	EL
Co-60	Water	1.96E+02	2.10E+02	1.07	Yes	EL
Sr-90	Water	2.00E+00	2.60E+00	1.30	Pass	EL
Cs-137	Water	7.52E+01	7.90E+01	1.05	Yes	EL
Mn-54	Water	4.49E+01	5.00E+01	1.11	Yes	EL
Gross Alpha	Water	1.31E+03	1.30E+03	0.99	Yes	EL
Gross Beta	Water	4.10E+02	5.50E+02	1.34	Yes	EL

Units for air filters: Bq/filter; soil and vegetation: Bq/kg; water: Bq/L. Samples analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI).

Acceptance is based on reported-to-actual ratio, assigned statistically on a case-by-case basis. ***Yes*** *indicates a ratio within warning limits;* ***Pass*** *indicates a ratio within control limits but outside warning limits;* ***No*** *indicates a ratio outside control limits.*

Table D - 3

Comparison of Radiological Results with Known Results of Crosscheck Samples from the EPA National Exposure Research Laboratory, Characterization Research Division (NERL-CRD)

Sample	Analyte	Matrix	Actual	Reported	Accept ?	Analyzed by
PUW (March 1995)	Pu-239	Water	11.1	10.3	Yes	EPI
ABW (January 1995)	Alpha	Water	5.0	5.67	Yes	EL
	Beta	Water	5.0	10.33	Yes	EL
ABW (July 1995)	Alpha	Water	27.5	12.33	No	EL
	Beta	Water	19.4	22.67	Yes	EL
ABW (October 1995)	Alpha	Water	51.2	41.80	Yes	EL
	Beta	Water	24.8	28.67	Yes	EL
TRW (March 1995)	H-3	Water	7435.0	7522.33	Yes	EL
TRW (August 1995)	H-3	Water	4872.0	4846.67	Yes	EL
AF (August 1995)	Alpha	Filter	25.0	25.37	Yes	EPI
	Beta	Filter	86.6	72.67	Pass	EPI
	Sr-90	Filter	30.0	32.00	Yes	EPI
	Cs-137	Filter	25.0	27.33	Yes	EPI
PE-A (April 1995)	Alpha	Water	47.5	39.40	Yes	EL
	Ra-226	Water	14.9	12.90	Yes	EPI
	Ra-228	Water	15.8	19.50	Yes	EPI
	U (Nat)	Water	10.0	11.00	Yes	EPI
PE-B (April 1995)	Beta	Water	86.6	90.17	Yes	EL
	Sr-89	Water	20.0	21.00	Yes	EPI
	Sr-90	Water	15.0	21.33	Pass	EPI
	Co-60	Water	29.0	32.33	Yes	EL
	Cs-134	Water	20.0	18.33	Yes	EL
	Cs-137	Water	11.0	14.00	Yes	EL

Units are as follows: water: pCi/L; air filter: pCi/filter; milk: pCi/L; total K: mg/L.

Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI), as indicated.

Explanation of code(s): PE-A = performance evaluation (alpha); PE-B = performance evaluation (beta); GAM = gamma in water; TRW = tritium in water; AF = air filter; PUW = plutonium in water; Milk = milk sample; ABW = alpha and beta in water.

Acceptance limits are statistically defined by NERL-CRD for individual analytes and matrices. ***Yes*** *indicates a ratio within warning limits;* ***Pass*** *indicates a ratio within control limits but outside warning limits;* ***No*** *indicates a ratio outside control limits.*

Table D - 3 (concluded)

Comparison of Radiological Results with Known Results of Crosscheck Samples from the EPA National Exposure Research Laboratory, Characterization Research Division (NERL-CRD)

Sample	Analyte	Matrix	Actual	Reported	Accept ?	Analyzed by
PE-A (October 1995)	Alpha	Water	99.4	91.40	Yes	EL
	Ra-226	Water	24.8	24.03	Yes	EPI
	Ra-228	Water	20.7	22.03	Yes	EPI
	U (Nat)	Water	27.0	27.50	Yes	EPI
PE-B (October 1995)	Beta	Water	123.5	129.03	Yes	EL
	Sr-89	Water	20.0	26.00	Pass	EPI
	Sr-90	Water	10.0	11.33	Yes	EPI
	Co-60	Water	49.0	53.67	Yes	EL
	Cs-134	Water	40.0	37.00	Yes	EL
	Cs-137	Water	30.0	31.67	Yes	EL
GAM (June 1995)	Co-60	Water	40.0	46.00	Pass	EL
	Zn-65	Water	76.0	82.67	Yes	EL
	Cs-134	Water	50.0	44.00	Pass	EL
	Cs-137	Water	35.0	37.67	Yes	EL
	Ba-133	Water	79.0	71.67	Yes	EL
GAM (November 1995)	Co-60	Water	60.0	63.67	Yes	EL
	Zn-65	Water	125.0	128.67	Yes	EL
	Cs-134	Water	40.0	35.67	Yes	EL
	Cs-137	Water	49.0	52.33	Yes	EL
	Ba-133	Water	99.0	92.33	Yes	EL
Milk (September 1995)	Sr-89	Milk	20.0	18.33	Yes	EPI
	Sr-90	Milk	15.0	14.67	Yes	EPI
	I-131	Milk	99.0	104.00	Yes	EPI
	Cs-137	Milk	50.0	53.00	Yes	EPI
	Total K	Milk	1654.0	NR	NA	EPI

Units are as follows: water: pCi/L; air filter: pCi/filter; milk: pCi/L; total K: mg/L.

Samples were analyzed by the WVDP Environmental Laboratory (EL) or Environmental Physics, Inc. (EPI), as indicated.

Explanation of code(s): PE-A = performance evaluation (alpha); PE-B = performance evaluation (beta); GAM = gamma in water; TRW = tritium in water; AF = air filter; PUW = plutonium in water; Milk = milk sample; ABW = alpha and beta in water. NR = Not reported; NA = Not available.

*Acceptance limits are statistically defined by NERL-CRD for individual analytes and matrices. **Yes** indicates a ratio within warning limits; **Pass** indicates a ratio within control limits but outside warning limits; No indicates a ratio outside control limits.*

Table D - 4

Comparison of the West Valley Demonstration Project's Thermoluminescent Dosimeters (TLDs) with the Co-located Nuclear Regulatory Commission (NRC) TLDs

NRC TLD#	WVDP TLD#	NRC mR/90days	WVDP mR/Qtr	LITCO mR/Qtr	WVDP/NRC Ratio	LITCO/NRC Ratio	WVDP/LITCO Ratio
1st Quarter 1995							
2	22	15.8	17.7	NA	1.12	NA	NA
3	5	17.1	16.7	NA	0.98	NA	NA
4	7	16.0	15.8	NA	0.99	NA	NA
5	9	16.2	16.1	NA	0.99	NA	NA
7	14	*Missing*	18.9	NA	NA	NA	NA
8	15	16.6	16.3	NA	0.98	NA	NA
9	25	30.5	26.2	NA	0.86	NA	NA
11	24	901.0	928.6	NA	1.03	NA	NA
2nd Quarter 1995							
2	22	17.7	17.9	19	1.01	1.07	0.94
3	5	16.8	17.2	17	1.02	1.01	1.01
4	7	17.1	16.3	16	0.95	0.94	1.02
5	9	*Damaged*	17.3	17	NA	NA	1.02
7	14	16.0	17.8	15	1.11	0.94	1.19
8	15	16.7	22.2	17	1.33	1.02	1.31
9	25	31.9	25.2	24	0.79	0.75	1.05
11	24	828.0	795.1	769	0.96	0.93	1.03
3rd Quarter 1995							
2	22	17.7	24.2	23	1.37	1.30	1.05
3	5	19.0	25.4	25	1.34	1.32	1.02
4	7	18.4	20.2	21	1.10	1.14	0.96
5	9	18.0	22.5	21	1.25	1.17	1.07
7	14	19.3	24.1	24	1.25	1.24	1.00
8	15	19.2	23.0	22	1.20	1.15	1.05
9	25	29.4	37.4	34	1.27	1.16	1.10
11	24	767.0	935.3	942	1.22	1.23	0.99
4th Quarter 1995							
2	22	17.7	NA	15	NA	0.85	NA
3	5	16.2	NA	15	NA	0.93	NA
4	7	16.7	NA	15	NA	0.90	NA
5	9	19.5	NA	14	NA	0.72	NA
7	14	*Missing*	NA	15	NA	NA	NA
8	15	15.5	NA	13	NA	0.84	NA
9	25	29.3	NA	22	NA	0.75	NA
11	24	818.0	NA	757	NA	0.93	NA

Ratios of results are listed for each set of co-located TLDs.

"Missing" or "Damaged" indicates that a TLD was no longer in place or damaged so that no analysis could be performed at the time of collection. NA = not available.

During 1995, processing of TLDs by analytical laboratories was changed: For the first three quarters of 1995 TLDs were processed at the WVDP. In the second quarter two sets of TLDs were deployed; the second set was analyzed by LITCO, Inc. an off-site subcontractor. Both WVDP and LITCO results are presented for the second and third quarters of 1995; LITCO results alone are presented for the fourth quarter.

Appendix E

Summary of Groundwater Monitoring Data

Table E - 1
1995 Contamination Indicator Results for the Sand and Gravel Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	H-3 *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
301	UP(1)	7.13	840	3.9	0.020	-5.33±4.67E-09	6.11±4.23E-09	0.00±1.00E-07	0.00±1.66E-08	0.00±2.02E-08
301	UP(2)	7.17	1088	<1.0	0.027	-2.86±1.78E-09	0.27±2.31E-09	0.00±1.00E-07	0.00±1.53E-08	0.00±2.26E-08
301	UP(3)	7.31	986	NS	NS	-0.46±2.44E-09	2.73±2.65E-09	0.28±8.04E-08	NS	NS
301	UP(4)	7.35	511	NS	NS	-2.69±2.34E-09	2.67±2.54E-09	1.51±0.87E-07	NS	NS
401	UP(1)	7.01	2820	<1.0	0.016	-0.62±1.72E-08	1.28±1.19E-08	0.00±1.00E-07	0.00±2.47E-08	0.00±3.13E-08
401	UP(2)	6.87	2490	<1.0	0.016	-1.20±3.32E-09	4.92±4.44E-09	0.00±1.00E-07	0.00±2.16E-08	0.00±2.43E-08
401	UP(3)	7.18	2815	NS	NS	4.60±5.18E-09	1.14±4.62E-09	0.00±1.00E-07	0.00±1.10E-08	0.00±1.22E-08
401	UP(4)	6.81	2540	NS	NS	3.06±3.41E-09	6.94±3.26E-09	1.34±0.85E-07	NS	NS
403	UP(1)	6.72	1289	1.4	0.018	-1.66±5.62E-09	1.19±0.91E-08	2.81±8.10E-08	0.00±1.80E-08	0.00±2.74E-08
403	UP(2)	6.76	1392	2.6	0.036	-0.91±1.86E-09	9.50±4.07E-09	5.24±7.98E-08	0.00±1.37E-08	0.00±1.52E-08
403	UP(3)	6.85	1496	NS	NS	5.02±3.64E-09	7.01±2.51E-09	0.00±1.00E-07	NS	NS
403	UP(4)	6.33	1808	NS	NS	1.25±2.98E-09	1.11±0.26E-08	0.00±1.00E-07	NS	NS
706	UP(1)	6.63	492	2.9	0.015	0.00±3.79E-09	6.82±2.61E-09	0.00±1.00E-07	0.00±2.21E-08	0.00±2.80E-08
706	UP(2)	6.53	533	3.2	0.016	1.28±0.88E-09	8.05±1.58E-09	1.32±7.59E-08	0.00±1.39E-08	0.00±2.43E-08
706	UP(3)	6.29	602	NS	NS	0.80±1.43E-09	6.59±1.56E-09	1.46±8.40E-08	NS	NS
706	UP(4)	6.48	611	NS	NS	0.19±1.40E-09	7.54±1.86E-09	0.00±1.00E-07	NS	NS
NB1S	UP(1)	6.30	614	1.3	0.022	1.10±2.40E-09	0.79±1.77E-09	0.00±1.00E-07	0.00±1.41E-08	0.00±1.68E-08
NB1S	UP(2)	6.00	511	1.6	0.006	-1.96±7.82E-10	-0.22±1.36E-09	2.59±8.29E-08	0.00±1.51E-08	0.00±1.52E-08
201	DOWN - B(1)	6.71	2370	1.4	0.125	0.00±1.63E-08	2.52±1.40E-08	0.00±1.00E-07	0.00±1.52E-08	0.00±1.90E-08
201	DOWN - B(2)	6.27	1765	1.3	0.047	2.05±2.72E-09	5.07±0.45E-08	0.00±1.00E-07	0.00±1.46E-08	0.00±1.58E-08
201	DOWN - B(3)	6.98	2105	NS	NS	2.40±4.22E-09	2.18±0.39E-08	0.00±1.00E-07	NS	NS
201	DOWN - B(4)	6.42	1859	NS	NS	3.20±3.84E-09	3.80±0.42E-08	1.27±0.85E-07	NS	NS
305*	DOWN - B(1)	6.90	3395	1.1	0.042	-1.42±1.70E-08	2.69±1.39E-08	0.00±1.00E-07	0.00±1.60E-08	0.00±1.46E-08
305	DOWN - B(2)	6.96	2350	1.2	0.053	2.18±2.49E-09	8.75±3.22E-09	0.00±1.00E-07	0.00±1.50E-08	0.00±2.44E-08
307*	DOWN - B(1)	7.00	2985	1.6	0.052	0.00±1.94E-08	1.65±1.24E-08	0.00±1.00E-07	0.00±2.30E-08	0.00±2.34E-08
307	DOWN - B(2)	7.04	1472	1.2	0.021	0.00±2.68E-09	6.14±4.39E-09	8.38±5.75E-08	0.00±1.22E-08	0.00±1.52E-08
603*	DOWN - B(1)	6.44	893	<1.0	0.012	-3.92±4.70E-09	8.66±3.76E-09	0.00±1.00E-07	0.00±2.51E-08	0.00±1.85E-08
603	DOWN - B(2)	6.11	696	1.4	0.018	0.20±1.07E-09	8.87±2.22E-09	6.21±8.18E-08	0.00±1.88E-08	0.00±2.54E-08
8613A*	DOWN - B(1)	6.76	513	1.3	0.024	-0.62±3.63E-09	6.03±2.84E-09	0.00±1.00E-07	0.00±2.38E-08	0.00±2.73E-08
8613A	DOWN - B(2)	6.72	838	1.4	0.024	-0.33±1.32E-09	1.56±1.54E-09	8.07±8.09E-08	0.00±1.36E-08	0.00±1.70E-08
8613B*	DOWN - B(1)	6.47	473	5.3	0.067	0.57±2.49E-09	1.69±2.54E-09	0.00±1.00E-07	0.00±2.47E-08	0.00±1.73E-08
8613B	DOWN - B(2)	6.53	842	4.0	0.017	-6.29±9.14E-10	0.93±1.07E-09	5.41±8.24E-08	0.00±2.37E-08	0.00±1.41E-08
8613C*	DOWN - B(1)	7.90	421	1.3	0.012	0.54±2.39E-09	1.68±2.53E-09	0.00±1.00E-07	0.00±1.38E-08	0.00±1.83E-08
8613C	DOWN - B(2)	7.80	602	6.0	0.015	0.12±9.81E-10	2.78±1.53E-09	0.00±1.00E-07	0.00±1.40E-08	0.00±1.76E-08
WNSP008**	DOWN - C(1)	7.04	540	1.8	0.044	-1.53±5.20E-09	2.74±0.98E-08	3.31±0.16E-06	0.00±2.42E-08	0.00±2.22E-08
WNSP008	DOWN - C(2)	6.99	518	1.2	0.038	0.71±1.40E-09	3.73±0.37E-08	4.09±0.18E-06	0.00±2.23E-08	0.00±3.27E-08
103	DOWN - C(1)	10.05	2278	18.4	0.031	0.00±1.22E-08	4.30±1.37E-08	0.00±1.00E-07	0.00±1.10E-08	0.00±1.12E-08
103	DOWN - C(2)	9.94	4970	97.2	0.073	8.79±9.95E-09	8.70±1.17E-08	1.12±0.82E-07	0.00±1.55E-08	0.00±1.53E-08
103	DOWN - C(3)	9.75	3715	NS	NS	2.06±7.47E-09	7.72±1.00E-08	1.22±0.80E-07	NS	NS
103	DOWN - C(4)	9.44	3720	NS	NS	3.33±5.26E-09	1.02±0.08E-07	2.21±0.91E-07	NS	NS
104	DOWN - C(1)	6.56	1272	1.7	<0.010	-0.87±5.72E-09	7.59±0.08E-06	4.50±0.86E-07	0.00±1.28E-08	0.00±1.46E-08
104	DOWN - C(2)	6.91	1241	1.0	0.020	7.65±5.52E-09	8.29±0.07E-06	7.40±0.90E-07	0.00±1.46E-08	0.00±1.19E-08
104	DOWN - C(3)	7.17	1259	NS	NS	0.00±6.23E-09	8.42±0.12E-06	5.64±0.88E-07	NS	NS
104	DOWN - C(4)	7.04	1417	NS	NS	3.98±3.91E-09	1.14±0.01E-05	5.06±0.89E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*
*** Samples analyzed for volatiles only beginning in the third quarter 1995.*

Table E - 1 *(continued)*
1995 Contamination Indicator Results for the Sand and Gravel Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	H-3 *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
111	DOWN - C(1)	6.13	582	8.1	< 0.010	0.00±5.30E-09	6.11±0.10E-06	4.70±0.87E-07	0.00±1.58E-08	0.00±1.65E-08
111	DOWN - C(2)	6.46	397	4.0	< 0.010	0.52±1.02E-08	4.84±0.09E-06	1.90±0.59E-07	0.00±1.48E-08	0.00±1.69E-08
111	DOWN - C(3)	6.40	881	NS	NS	7.95±6.33E-09	8.25±0.08E-06	1.64±0.11E-06	NS	NS
111	DOWN - C(4)	6.57	955	NS	NS	4.34±4.91E-09	9.06±0.12E-06	5.87±0.90E-07	NS	NS
203*	DOWN - C(1)	6.63	3460	1.9	0.038	0.00±1.29E-08	3.47±1.22E-08	0.00±1.00E-07	0.00±2.48E-08	0.00±2.82E-08
203	DOWN - C(2)	6.44	5810	2.1	0.039	3.28±6.03E-09	8.80±0.59E-08	1.08±7.76E-08	0.00±2.08E-08	0.00±2.35E-08
205	DOWN - C(1)	6.67	2060	2.7	0.041	-0.49±1.36E-08	1.67±0.92E-08	0.00±7.07E-08	0.00±1.67E-08	0.00±1.78E-08
205	DOWN - C(2)	6.86	1203	2.7	0.043	0.85±2.13E-09	7.00±3.06E-09	5.12±8.23E-08	0.00±1.68E-08	0.00±2.04E-08
205	DOWN - C(3)	6.77	2005	NS	NS	1.76±3.08E-09	5.64±2.55E-09	0.00±1.00E-07	NS	NS
205	DOWN - C(4)	6.45	2250	NS	NS	3.03±2.58E-09	1.32±0.19E-08	1.84±8.83E-08	NS	NS
207*	DOWN - C(1)	6.49	833	1.6	0.019	-1.26±4.97E-09	3.24±2.73E-09	0.00±1.00E-07	0.00±2.12E-08	0.00±2.99E-08
207	DOWN - C(2)	6.69	860	1.1	0.019	-0.31±1.71E-09	-2.06±2.50E-09	8.85±8.31E-08	0.00±1.49E-08	0.00±1.65E-08
406	DOWN - C(1)	7.31	590	2.5	0.025	-1.74±3.40E-09	1.92±0.51E-08	8.74±0.93E-07	0.00±2.03E-08	0.00±1.73E-08
406	DOWN - C(2)	6.95	635	2.8	0.035	1.53±1.21E-09	9.22±2.23E-09	6.46±0.90E-07	0.00±2.48E-08	0.00±2.22E-08
406	DOWN - C(3)	7.40	608	NS	NS	1.35±1.49E-09	1.46±0.25E-08	3.21±0.95E-07	0.00±1.15E-08	0.00±1.86E-08
406	DOWN - C(4)	7.09	603	NS	NS	-0.51±1.63E-09	1.93±0.27E-08	5.34±0.94E-07	NS	NS
408	DOWN - C(1)	7.45	1737	1.7	< 0.010	0.00±2.00E-07	6.00±0.10E-04	3.00±1.30E-07	2.20±4.00E-09	2.80±3.10E-09
408	DOWN - C(2)	7.44	1606	0.8	0.020	-2.66±0.89E-06	4.46±0.05E-04	2.27±0.38E-06	0.56±2.70E-09	-0.26±2.16E-09
408	DOWN - C(3)	7.54	1666	NS	NS	1.30±2.82E-07	5.70±0.02E-04	0.58±1.08E-07	-2.42±3.12E-09	-0.60±1.83E-09
408	DOWN - C(4)	7.37	1722	NS	NS	-1.25±0.02E-05	5.35±0.01E-04	-0.73±1.16E-07	NS	NS
501	DOWN - C(1)	7.23	1250	1.3	< 0.010	0.00±8.34E-09	1.48±0.00E-04	1.46±0.83E-07	0.00±2.00E-08	0.00±1.36E-08
501	DOWN - C(2)	7.31	1103	0.7	0.030	3.36±6.58E-09	1.20±0.00E-04	2.92±0.84E-07	0.00±1.92E-08	0.00±1.45E-08
501	DOWN - C(3)	7.49	1304	NS	NS	4.71±9.23E-09	1.74±0.01E-04	3.50±0.84E-07	NS	NS
501	DOWN - C(4)	7.41	1393	NS	NS	1.98±3.87E-09	1.67±0.01E-04	3.34±0.86E-07	NS	NS
502	DOWN - C(1)	6.88	1342	1.2	0.014	0.00±8.86E-09	1.21±0.00E-04	1.60±0.83E-07	0.00±1.72E-08	0.00±1.66E-08
502	DOWN - C(2)	7.17	1230	0.8	0.040	2.03±6.90E-09	1.27±0.00E-04	2.48±0.84E-07	0.00±1.94E-08	0.00±1.91E-08
502	DOWN - C(3)	7.44	1252	NS	NS	4.27±8.37E-09	1.17±0.00E-04	4.07±0.89E-07	NS	NS
502	DOWN - C(4)	7.34	1309	NS	NS	3.87±5.36E-09	1.37±0.00E-04	2.02±0.85E-07	NS	NS
602	DOWN - C(1)	6.41	723	3.2	0.052	0.00±4.24E-09	3.15±0.77E-08	6.36±0.24E-06	0.00±2.06E-08	0.00±1.72E-08
602	DOWN - C(2)	6.46	920	4.2	0.031	-1.52±1.82E-09	5.52±0.44E-08	3.70±0.16E-06	0.00±2.22E-08	0.00±1.99E-08
602	DOWN - C(3)	6.66	766	NS	NS	0.25±1.97E-09	1.99±0.34E-08	5.78±0.25E-06	NS	NS
602	DOWN - C(4)	7.75	672	NS	NS	-1.49±2.00E-09	1.12±0.29E-08	8.03±0.30E-06	NS	NS
604	DOWN - C(1)	6.19	740	4.8	0.049	-3.09±3.71E-09	5.23±2.79E-09	0.00±7.07E-08	0.00±1.76E-08	0.00±1.71E-08
604	DOWN - C(2)	6.47	723	3.2	0.029	0.97±9.78E-10	3.56±1.93E-09	0.00±1.00E-07	0.00±2.37E-08	0.00±2.67E-08
604	DOWN - C(3)	6.11	773	NS	NS	1.03±1.12E-09	4.92±1.42E-09	0.00±1.00E-07	NS	NS
604	DOWN - C(4)	6.20	840	NS	NS	-0.73±1.93E-09	5.09±2.08E-09	0.00±1.00E-07	NS	NS
8605	DOWN - C(1)	6.35	892	8.3	0.028	4.14±8.12E-09	2.15±0.02E-05	2.86±0.14E-06	0.00±1.58E-08	0.00±1.27E-08
8605	DOWN - C(2)	6.80	722	6.0	0.020	3.83±5.60E-09	2.14±0.02E-05	2.80±0.14E-06	0.00±1.43E-08	0.00±1.19E-08
8605	DOWN - C(3)	6.86	1052	NS	NS	2.44±1.42E-08	2.27±0.02E-05	1.53±0.11E-06	NS	NS
8605	DOWN - C(4)	7.72	1213	NS	NS	7.00±6.86E-09	1.78±0.02E-05	9.44±0.94E-07	NS	NS
8606*	DOWN - C(1)	6.74	2085	8.8	0.021	0.69±1.20E-08	9.85±9.03E-09	0.00±1.00E-07	0.00±2.39E-08	0.00±3.13E-08
8606	DOWN - C(2)	6.91	1292	2.2	0.046	-0.25±1.63E-09	4.81±2.59E-09	2.52±8.42E-08	0.00±1.93E-08	0.00±2.05E-08
8607	DOWN - C(1)	6.19	803	1.3	0.009	-2.07±2.87E-09	3.39±0.64E-08	8.38±8.13E-08	0.00±1.95E-08	0.00±2.55E-08
8607	DOWN - C(2)	6.21	1052	< 1.0	0.015	0.85±1.16E-09	3.12±0.31E-08	2.08±0.83E-07	0.00±2.14E-08	0.00±1.41E-08
8607	DOWN - C(3)	6.52	1531	NS	NS	1.92±2.49E-09	1.34±0.25E-08	1.20±0.84E-07	NS	NS
8607	DOWN - C(4)	6.36	1307	NS	NS	-0.53±3.08E-09	1.57±0.32E-08	1.43±0.84E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 1 (continued)
1995 Contamination Indicator Results for the Sand and Gravel Unit

Location Code	Hydraulic Position	pH	Conductivity µmhos/cm@25°C	TOC mg/L	TOX mg/L	Gross Alpha µCi/mL	Gross Beta µCi/mL	H-3 µCi/mL	Cs-137 µCi/mL	Co-60 µCi/mL
8608*	DOWN - C(1)	6.74	467	3.7	0.017	0.63±2.77E-09	1.68±0.38E-08	0.00±7.07E-08	0.00±2.24E-08	0.00±1.74E-08
8608	DOWN - C(2)	6.72	601	2.9	0.023	-7.33±8.67E-10	1.40±0.20E-08	0.00±1.00E-07	0.00±1.56E-08	0.00±1.63E-08
8609	DOWN - C(1)	7.25	790	2.0	0.036	2.34±5.41E-09	4.11±0.20E-07	1.21±0.09E-06	0.00±2.46E-08	0.00±2.78E-08
8609	DOWN - C(2)	7.09	764	1.3	0.036	0.70±1.82E-09	3.52±0.10E-07	1.20±0.10E-06	0.00±2.04E-08	0.00±2.34E-08
8609	DOWN - C(3)	7.24	770	NS	NS	-1.16±1.85E-09	3.92±0.11E-07	1.38±0.10E-06	NS	NS
8609	DOWN - C(4)	7.09	768	NS	NS	-2.51±2.04E-09	3.72±0.10E-07	1.33±0.10E-06	NS	NS
WNDMPNE*	DOWN - D(1)	6.16	722	5.6	0.014	-3.64±4.12E-09	1.26±0.05E-06	6.69±8.09E-08	0.00±1.39E-08	0.00±1.65E-08
WNDMPNE	DOWN - D(2)	7.05	334	4.0	0.010	2.73±3.87E-09	5.34±0.21E-07	7.40±8.27E-08	0.00±1.35E-08	0.00±1.02E-08
WNGSEEP	DOWN - D(1)	6.53	704	1.1	0.031	-0.99±2.37E-09	5.74±2.73E-09	7.58±0.65E-07	0.00±2.26E-08	0.00±2.72E-08
WNGSEEP	DOWN - D(2)	6.28	839	1.1	0.031	0.39±1.11E-09	3.66±1.94E-09	1.11±0.10E-06	0.00±1.35E-08	0.00±2.16E-08
WNGSEEP	DOWN - D(3)	6.56	942	NS	NS	0.83±2.02E-09	5.78±2.14E-09	1.06±0.10E-06	NS	NS
WNGSEEP	DOWN - D(4)	6.46	966	NS	NS	-1.83±2.22E-09	6.86±2.76E-09	1.33±0.10E-06	NS	NS
105	DOWN - D(1)	7.05	1245	<1.0	0.032	3.34±8.03E-09	9.02±5.92E-09	8.27±0.89E-07	0.00±2.19E-08	0.00±2.73E-08
105	DOWN - D(2)	7.34	1314	1.2	0.036	-0.83±2.17E-09	1.38±0.43E-08	9.39±0.94E-07	0.00±2.26E-08	0.00±3.44E-08
105	DOWN - D(3)	7.19	1399	NS	NS	1.46±2.55E-09	1.89±0.29E-08	7.83±0.92E-07	NS	NS
105	DOWN - D(4)	6.97	1386	NS	NS	2.49±2.85E-09	2.41±0.37E-08	8.57±0.96E-07	NS	NS
106	DOWN - D(1)	6.77	1136	1.3	0.052	0.68±4.01E-09	2.51±3.58E-09	2.93±0.14E-06	0.00±1.34E-08	0.00±1.56E-08
106	DOWN - D(2)	6.85	1167	<1.0	0.062	-1.51±1.29E-09	0.08±1.88E-09	2.92±0.10E-06	0.00±1.53E-08	0.00±1.48E-08
106	DOWN - D(3)	7.11	1091	NS	NS	0.26±2.20E-09	3.95±1.99E-09	2.97±0.15E-06	NS	NS
106	DOWN - D(4)	6.68	1230	NS	NS	0.09±2.29E-09	5.69±2.40E-09	3.35±0.16E-06	NS	NS
116	DOWN - D(1)	7.16	1052	1.3	0.049	0.00±4.79E-09	1.92±0.15E-07	3.60±0.84E-07	0.00±2.38E-08	0.00±2.54E-08
116	DOWN - D(2)	6.70	1170	<1.0	0.033	-2.36±2.03E-09	1.60±0.05E-07	4.31±0.86E-07	0.00±2.33E-08	0.00±1.97E-08
116	DOWN - D(3)	7.24	1379	NS	NS	4.56±3.16E-09	1.72±0.06E-07	7.21±0.92E-07	NS	NS
116	DOWN - D(4)	7.05	1305	NS	NS	2.98±2.64E-09	1.82±0.06E-07	6.95±0.66E-07	NS	NS
601*	DOWN - D(1)	6.31	538	4.2	0.037	0.66±2.88E-09	1.08±0.08E-07	0.00±1.00E-07	0.00±1.59E-08	0.00±1.97E-08
601	DOWN - D(2)	6.55	539	5.3	0.016	8.26±5.28E-10	1.10±0.03E-07	0.00±1.00E-07	0.00±2.51E-08	0.00±2.10E-08
605	DOWN - D(1)	6.65	547	3.4	0.040	0.61±2.69E-09	1.45±0.10E-07	9.90±8.25E-08	0.00±2.60E-08	0.00±1.99E-08
605	DOWN - D(2)	6.81	568	2.1	0.025	8.52±7.71E-10	1.30±0.05E-07	9.46±8.11E-08	0.00±2.55E-08	0.00±2.53E-08
605	DOWN - D(3)	6.70	665	NS	NS	0.42±1.26E-09	6.16±0.32E-08	7.47±6.12E-08	NS	NS
605	DOWN - D(4)	6.79	733	NS	NS	1.56±1.69E-09	5.32±0.34E-08	5.96±9.08E-08	NS	NS
801	DOWN - D(1)	6.00	1322	3.2	0.014	-5.26±5.95E-09	2.90±0.07E-06	4.71±0.87E-07	0.00±1.36E-08	0.00±1.60E-08
801	DOWN - D(2)	6.78	1448	2.0	0.020	3.74±4.49E-09	3.26±0.07E-06	5.80±0.89E-07	0.00±9.02E-09	0.00±1.10E-08
801	DOWN - D(3)	6.74	1456	NS	NS	2.38±8.10E-09	4.08±0.08E-06	6.07±0.92E-07	NS	NS
801	DOWN - D(4)	6.60	1424	NS	NS	1.60±1.11E-08	4.79±0.09E-06	6.37±0.90E-07	NS	NS
802	DOWN - D(1)	7.10	595	<1.0	0.040	-2.41±4.17E-09	4.17±3.87E-09	2.40±0.85E-07	0.00±1.10E-08	0.00±1.56E-08
802	DOWN - D(2)	6.70	327	<1.0	0.025	0.36±4.80E-10	-6.81±9.28E-10	2.68±0.60E-07	0.00±2.02E-08	0.00±3.21E-08
802	DOWN - D(3)	6.65	425	NS	NS	4.72±9.71E-10	1.44±1.23E-09	1.35±0.84E-07	NS	NS
802	DOWN - D(4)	7.00	967	NS	NS	0.63±1.09E-09	3.38±1.01E-09	5.16±0.89E-07	NS	NS
803	DOWN - D(1)	7.13	1245	<1.0	0.021	1.59±6.97E-09	1.83±7.18E-09	9.15±0.93E-07	0.00±1.65E-08	0.00±1.65E-08
803	DOWN - D(2)	6.94	1334	1.2	0.078	-0.46±2.39E-09	7.16±4.02E-09	7.70±0.91E-07	0.00±1.60E-08	0.00±1.99E-08
803	DOWN - D(3)	6.84	1373	NS	NS	4.98±3.18E-09	7.26±2.56E-09	7.07±0.90E-07	NS	NS
803	DOWN - D(4)	6.89	1328	NS	NS	2.78±2.62E-09	1.20±0.25E-08	8.10±0.93E-07	NS	NS
804	DOWN - D(1)	5.61	781	1.8	0.012	-2.18±4.28E-09	1.22±0.11E-07	1.69±0.83E-07	0.00±2.39E-08	0.00±2.64E-08
804	DOWN - D(2)	6.80	957	1.6	0.030	1.88±1.42E-09	1.18±0.05E-07	1.73±0.82E-07	0.00±2.57E-08	0.00±2.20E-08
804	DOWN - D(3)	6.60	1046	NS	NS	0.88±2.15E-09	1.60±0.06E-07	3.09±0.61E-07	NS	NS
804	DOWN - D(4)	6.52	999	NS	NS	-0.47±2.70E-09	2.02±0.08E-07	3.47±0.88E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 1 *(concluded)*
1995 Contamination Indicator Results for the Sand and Gravel Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	H-3 *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
905	DOWN - D(1)	6.68	1606	<1.0	0.009	6.49±7.94E-09	1.21±0.56E-08	2.48±0.85E-07	0.00±2.18E-08	0.00±3.16E-08
905	DOWN - D(2)	6.85	1655	1.2	0.010	3.40±3.23E-09	6.80±4.04E-09	3.51±0.87E-07	0.00±2.36E-08	0.00±1.70E-08
905	DOWN - D(3)	6.85	1657	NS	NS	9.10±3.45E-09	5.41±2.48E-09	1.26±0.91E-07	0.00±1.31E-08	0.00±1.73E-08
905	DOWN - D(4)	6.88	1654	NS	NS	5.15±3.22E-09	6.55±2.45E-09	3.25±0.89E-07	NS	NS
8603	DOWN - D(1)	7.41	1444	<1.0	0.015	3.45±8.27E-09	2.82±0.19E-07	6.29±0.78E-07	0.00±2.40E-08	0.00±2.54E-08
8603	DOWN - D(2)	7.24	1512	<1.0	0.028	-0.48±2.50E-09	3.61±0.13E-07	7.49±0.90E-07	0.00±2.23E-08	0.00±2.71E-08
8603	DOWN - D(3)	7.14	1519	NS	NS	0.32±2.68E-09	4.60±0.09E-07	7.48±0.91E-07	NS	NS
8603	DOWN - D(4)	7.27	1507	NS	NS	3.10±3.14E-09	5.91±0.10E-07	7.21±0.93E-07	NS	NS
8604	DOWN - D(1)	6.40	1629	1.4	<0.010	-2.22±9.72E-09	2.94±0.02E-05	3.19±0.85E-07	0.00±1.58E-08	0.00±1.81E-08
8604	DOWN - D(2)	6.92	1660	0.8	0.030	-2.67±5.24E-09	3.39±0.02E-05	4.73±0.86E-07	0.00±1.55E-08	0.00±1.59E-08
8604	DOWN - D(3)	7.20	1641	NS	NS	0.59±1.16E-08	3.39±0.02E-05	5.21±0.91E-07	NS	NS
8604	DOWN - D(4)	7.20	1648	NS	NS	9.46±9.27E-09	3.67±0.03E-05	5.80±0.90E-07	NS	NS
8612	DOWN - D(1)	7.46	913	<1.0	0.051	-1.31±4.45E-09	-0.73±3.60E-09	1.36±0.10E-06	0.00±2.38E-08	0.00±2.22E-08
8612	DOWN - D(2)	7.44	938	<1.0	0.037	1.02±1.38E-09	0.85±1.80E-09	1.32±0.10E-06	0.00±1.95E-08	0.00±2.28E-08
8612	DOWN - D(3)	7.39	959	NS	NS	0.02±1.99E-09	1.28±1.88E-09	1.29±0.10E-06	NS	NS
8612	DOWN - D(4)	7.22	969	NS	NS	-1.69±2.43E-09	1.99±2.50E-09	1.34±0.10E-06	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 2
1995 Contamination Indicator Results for the Till-Sand Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25oC*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	Tritium *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
302	UP(1)	6.88	2315	<1.0	0.025	-0.48±1.34E-08	9.90±8.23E-09	0.00±1.00E-07	0.00±2.09E-08	0.00±1.41E-08
302	UP(2)	7.21	2230	<1.0	0.044	0.79±3.21E-09	2.56±3.02E-09	0.00±1.00E-07	0.00±1.68E-08	0.00±1.75E-08
302	UP(3)	7.05	2410	NS	NS	9.16±5.17E-09	3.77±3.29E-09	0.84±7.58E-08	NS	NS
302	UP(4)	7.00	2400	NS	NS	4.91±5.39E-09	4.21±3.20E-09	8.61±8.64E-08	NS	NS
402	UP(1)	7.20	1697	<1.0	0.052	-3.58±9.92E-09	4.17±5.67E-09	7.65±8.55E-08	0.00±2.85E-08	0.00±2.71E-08
402	UP(2)	7.22	1710	<1.0	0.021	2.06±2.43E-09	3.32±2.75E-09	5.54±5.77E-08	0.00±2.24E-08	0.00±3.36E-08
402	UP(3)	7.33	1850	NS	NS	4.05±2.63E-09	4.24±1.83E-09	1.34±6.58E-08	NS	NS
402	UP(4)	7.22	1784	NS	NS	3.72±3.51E-09	3.48±2.48E-09	1.68±0.85E-07	NS	NS
404*	UP(1)	8.11	254	<1.0	0.017	0.00±2.40E-09	2.52±2.00E-09	0.00±1.00E-07	0.00±1.61E-08	0.00±2.24E-08
404	UP(2)	7.99	252	<1.0	0.006	0.91±4.84E-10	2.55±1.25E-09	0.00±1.00E-07	0.00±2.38E-08	0.00±1.72E-08
701*	UP(1)	7.12	1155	<1.0	0.008	1.32±5.76E-09	4.38±3.63E-09	0.00±1.00E-07	0.00±2.12E-08	0.00±2.43E-08
701	UP(2)	7.21	1152	<1.0	<0.005	1.30±1.73E-09	3.60±2.24E-09	0.00±1.00E-07	0.00±1.23E-08	0.00±1.58E-08
202*	DOWN - B(1)	9.83	255	<1.0	0.047	-0.55±1.87E-09	7.05±2.88E-09	0.00±1.00E-07	0.00±1.99E-08	0.00±2.13E-08
202	DOWN - B(2)	10.07	215	<1.0	0.013	5.42±5.93E-10	7.45±1.51E-09	0.00±1.00E-07	0.00±2.27E-08	0.00±3.07E-08
204	DOWN - B(1)	8.26	683	<1.0	0.020	-2.39±4.13E-09	4.48±2.39E-09	0.00±1.00E-07	0.00±2.08E-08	0.00±1.85E-08
204	DOWN - B(2)	7.54	674	<1.0	0.027	0.30±1.00E-09	2.84±1.34E-09	1.34±8.42E-08	0.00±1.90E-08	0.00±1.83E-08
204	DOWN - B(3)	7.77	694	NS	NS	0.33±1.18E-09	1.42±1.37E-09	2.97±7.79E-08	NS	NS
204	DOWN - B(4)	7.98	717	NS	NS	1.25±1.58E-09	1.83±1.35E-09	1.06±0.60E-07	NS	NS
206	DOWN - C(1)	7.73	741	<1.0	0.023	0.00±4.55E-09	3.49±3.83E-09	4.65±8.40E-08	0.00±2.37E-08	0.00±2.98E-08
206	DOWN - C(2)	7.66	724	<1.0	0.015	-1.67±1.44E-09	-0.52±2.20E-09	1.04±0.82E-07	0.00±1.37E-08	0.00±1.40E-08
206	DOWN - C(3)	7.76	769	NS	NS	2.85±9.82E-10	1.96±1.55E-09	2.60±6.51E-08	NS	NS
206	DOWN - C(4)	7.59	767	NS	NS	-2.69±1.80E-09	1.58±1.90E-09	1.22±8.77E-08	NS	NS
208	DOWN - C(1)	7.99	313	1.4	0.008	-0.87±2.41E-09	2.10±1.95E-09	0.00±1.00E-07	0.00±1.36E-08	0.00±1.42E-08
208	DOWN - C(2)	8.00	313	<1.0	0.015	7.77±6.33E-10	1.04±1.17E-09	0.00±1.00E-07	0.00±2.28E-08	0.00±2.42E-08
208	DOWN - C(3)	7.92	314	NS	NS	4.66±8.34E-10	0.36±1.20E-09	0.00±1.00E-07	NS	NS
208	DOWN - C(4)	7.94	307	NS	NS	7.01±8.17E-10	1.61±1.24E-09	0.00±1.00E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 3
1995 Contamination Indicator Results for the Weathered Lavery Till Unit

Location Code	Hydraulic Position	pH	Conductivity *μmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *μCi/mL*	Gross Beta *μCi/mL*	Tritium *μCi/mL*	Cs-137 *μCi/mL*	Co-60 *μCi/mL*
908	UP(1)	6.87	2790	<1.0	0.007	-0.40±1.76E-08	1.69±1.47E-08	0.00±1.00E-07	0.00±2.13E-08	0.00±2.92E-08
908	UP(2)	6.72	2900	<1.0	0.011	1.40±0.66E-08	9.57±4.75E-09	1.14±0.81E-07	0.00±2.38E-08	0.00±2.08E-08
908	UP(3)	6.85	2820	NS	NS	9.25±6.41E-09	1.74±0.53E-08	1.50±0.85E-07	NS	NS
908	UP(4)	6.92	2003	NS	NS	7.05±4.25E-09	1.52±0.48E-08	1.64±0.85E-07	NS	NS
1005	UP(1)	6.95	809	<1.0	0.008	5.52±7.65E-09	2.21±3.57E-09	5.23±7.97E-08	0.00±1.46E-08	0.00±2.10E-08
1005	UP(2)	7.16	769	<1.0	0.034	-0.69±1.77E-09	-0.83±2.54E-09	1.61±7.72E-08	0.00±1.39E-08	0.00±1.97E-08
1005	UP(3)	7.13	793	NS	NS	0.63±2.28E-09	1.12±2.51E-09	5.31±8.54E-08	NS	NS
1005	UP(4)	7.15	819	NS	NS	-2.56±2.08E-09	2.20±2.49E-09	1.70±0.85E-07	NS	NS
1008C	UP(1)	7.78	554	<1.0	0.021	0.00±2.68E-09	1.73±2.20E-09	0.00±1.00E-07	0.00±1.27E-08	0.00±1.82E-08
1008C	UP(2)	7.70	553	<1.0	0.017	1.27±1.22E-09	-0.11±1.40E-09	1.56±7.48E-08	0.00±2.14E-08	0.00±2.54E-08
1008C	UP(3)	7.72	542	NS	NS	1.06±1.38E-09	1.99±1.31E-09	8.34±8.36E-08	NS	NS
1008C	UP(4)	7.50	580	NS	NS	1.11±1.40E-09	2.65±1.59E-09	2.92±8.42E-08	NS	NS
906	DOWN - B(1)	7.58	629	5.7	0.024	0.90±3.93E-09	5.56±3.80E-09	0.00±1.00E-07	0.00±2.58E-08	0.00±2.92E-08
906	DOWN - B(2)	7.47	640	7.5	0.011	2.09±1.18E-09	2.84±1.88E-09	1.34±0.82E-07	0.00±1.24E-08	0.00±1.43E-08
906	DOWN - B(3)	7.32	697	NS	NS	2.19±1.70E-09	1.90±1.85E-09	2.90±8.36E-08	NS	NS
906	DOWN - B(4)	7.22	647	NS	NS	1.08±1.89E-09	3.80±1.99E-09	9.32±8.48E-08	NS	NS
907*	DOWN - B(1)	7.26	782	<1.0	0.006	1.33±5.82E-09	7.31±4.16E-09	5.19±8.34E-08	0.00±2.45E-08	0.00±1.00E-08
907	DOWN - B(2)	7.15	774	<1.0	<0.005	0.82±1.85E-09	-0.30±2.56E-09	1.42±0.82E-07	0.00±1.40E-08	0.00±1.31E-08
1006	DOWN - B(1)	6.98	2330	<1.0	0.006	4.13±8.90E-09	1.00±0.65E-08	0.00±1.00E-07	0.00±1.92E-08	0.00±2.01E-08
1006	DOWN - B(2)	6.90	2300	<1.0	<0.005	3.53±4.00E-09	7.00±4.52E-09	0.00±7.07E-08	0.00±1.71E-08	0.00±1.42E-08
1006	DOWN - B(3)	6.93	2100	NS	NS	6.35±3.41E-09	6.74±3.37E-09	0.00±1.00E-07	NS	NS
1006	DOWN - B(4)	6.86	2280	NS	NS	7.54±5.13E-09	8.56±4.63E-09	2.09±8.60E-08	NS	NS
1007	DOWN - B(1)	7.00	1063	<1.0	0.016	5.91±8.19E-09	6.02±5.52E-09	0.00±1.00E-07	0.00±2.44E-08	0.00±2.96E-08
1007	DOWN - B(2)	6.93	1116	<1.0	0.006	0.04±2.53E-09	5.57±2.95E-09	8.23±8.25E-08	0.00±2.29E-08	0.00±1.72E-08
1007	DOWN - B(3)	7.05	1153	NS	NS	4.10±3.64E-09	4.34±2.83E-09	1.77±0.86E-07	NS	NS
1007	DOWN - B(4)	7.05	1149	NS	NS	6.28±3.22E-09	7.30±2.44E-09	1.40±0.60E-07	NS	NS
WNNDATR	DOWN - C(1)	7.30	809	3.3	0.014	0.00±3.06E-09	2.99±0.12E-07	1.14±0.04E-05	0.00±1.83E-08	0.00±2.20E-08
WNNDATR	DOWN - C(2)	7.58	858	<1.0	0.017	1.92±1.33E-09	1.52±0.06E-07	1.54±0.04E-05	0.00±1.60E-08	0.00±1.76E-08
WNNDATR	DOWN - C(3)	7.41	1066	NS	NS	2.28±2.51E-09	6.08±0.42E-08	2.46±0.08E-05	0.00±1.36E-08	0.00±2.07E-08
WNNDATR	DOWN - C(4)	7.37	1019	NS	NS	2.65±2.43E-09	6.93±0.50E-08	1.83±0.06E-05	NS	NS
909	DOWN - C(1)	5.77	1349	6.7	0.052	3.50±8.40E-09	1.63±0.21E-07	2.00±0.12E-06	0.00±2.45E-08	0.00±2.24E-08
909	DOWN - C(2)	6.70	1326	5.6	0.038	1.73±2.72E-09	1.08±0.08E-07	1.76±0.12E-06	0.00±2.03E-08	0.00±3.06E-08
909	DOWN - C(3)	6.62	1434	NS	NS	1.24±0.45E-08	2.30±0.07E-07	2.76±0.14E-06	0.00±1.49E-08	0.00±1.93E-08
909	DOWN - C(4)	6.55	1447	NS	NS	4.44±3.32E-09	2.23±0.07E-07	1.96±0.12E-06	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 4

1995 Contamination Indicator Results for the Unweathered Lavery Till Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	Tritium *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
405	UP(1)	7.33	1052	1.7	0.018	4.16±7.20E-09	6.29±4.77E-09	0.00±1.00E-07	0.00±2.03E-08	0.00±2.55E-08
405	UP(2)	7.51	998	1.8	0.026	-0.61±1.93E-09	1.45±2.70E-09	1.27±0.82E-07	0.00±1.47E-08	0.00±1.60E-08
405	UP(3)	7.39	1191	NS	NS	-0.65±2.41E-09	5.79±2.82E-09	0.00±1.00E-07	NS	NS
405	UP(4)	7.23	1267	NS	NS	-2.67±3.24E-09	8.27±2.94E-09	1.06±0.83E-07	NS	NS
109*	DOWN - B(1)	7.58	565	<1.0	0.008	1.39±3.34E-09	0.18±2.83E-09	1.19±0.10E-06	0.00±2.15E-08	0.00±2.64E-08
109	DOWN - B(2)	7.65	554	<1.0	0.024	1.54±0.66E-09	3.29±0.95E-09	1.39±0.10E-06	0.00±2.47E-08	0.00±2.98E-08
110	DOWN - B(1)	7.56	597	<1.0	<0.005	1.39±3.33E-09	3.88±2.83E-09	1.34±0.10E-06	0.00±2.33E-08	0.00±2.44E-08
110	DOWN - B(2)	7.60	576	<1.0	0.017	1.78±1.00E-09	3.31±1.36E-09	1.55±0.11E-06	0.00±1.88E-08	0.00±2.21E-08
110	DOWN - B(3)	7.31	542	NS	NS	0.71±1.45E-09	1.11±1.32E-09	1.61±0.11E-06	NS	NS
110	DOWN - B(4)	7.37	542	NS	NS	1.60±1.36E-09	3.46±1.62E-09	1.70±0.11E-06	NS	NS
115*	DOWN - B(1)	7.65	483	<1.0	0.017	0.00±2.21E-09	0.77±2.43E-09	9.70±0.91E-07	0.00±2.11E-08	0.00±2.97E-09
115	DOWN - B(2)	7.24	473	<1.0	0.015	1.23±0.84E-09	2.36±1.27E-09	1.13±0.10E-06	0.00±1.33E-08	0.00±1.77E-08
702*	DOWN - B(1)	7.28	914	<1.0	0.006	0.56±4.76E-09	5.66±2.40E-09	0.00±1.00E-07	0.00±2.20E-08	0.00±2.73E-08
702	DOWN - B(2)	7.53	922	1.0	0.012	3.79±1.60E-09	3.54±1.96E-09	0.00±1.00E-07	0.00±2.58E-08	0.00±2.21E-08
703*	DOWN - B(1)	7.36	748	<1.0	0.007	-0.84±2.87E-09	4.84±3.53E-09	0.00±1.00E-07	0.00±1.56E-08	0.00±1.66E-08
703	DOWN - B(2)	7.59	720	<1.0	0.015	2.56±1.26E-09	3.65±1.94E-09	0.00±1.00E-07	0.00±2.20E-08	0.00±1.99E-08
704	DOWN - B(1)	6.32	989	27.5	0.054	-3.56±5.24E-09	1.73±0.61E-08	0.00±1.00E-07	0.00±2.05E-08	0.00±2.39E-08
704	DOWN - B(2)	6.46	942	24.5	0.035	-1.79±2.15E-09	1.46±0.33E-08	0.00±1.00E-07	0.00±1.33E-08	0.00±1.70E-08
704	DOWN - B(3)	6.71	992	NS	NS	-1.20±2.70E-09	1.64±0.34E-08	0.00±1.00E-07	NS	NS
704	DOWN - B(4)	6.62	936	NS	NS	-1.59±3.04E-09	1.46±0.32E-08	0.00±1.00E-07	NS	NS
705*	DOWN - B(1)	7.33	491	1.7	0.017	2.14±2.97E-09	7.49±2.83E-09	0.00±7.07E-08	0.00±2.25E-08	0.00±2.63E-08
705	DOWN - B(2)	7.55	468	<1.0	0.013	7.36±7.52E-10	2.95±1.31E-09	0.00±1.00E-07	0.00±2.46E-08	0.00±1.72E-08
707	DOWN - B(1)	6.34	356	1.8	0.011	0.86±2.05E-09	5.69±2.59E-09	0.00±1.00E-07	0.00±1.28E-08	0.00±1.50E-08
707	DOWN - B(2)	6.63	277	2.3	0.016	2.39±4.81E-10	4.36±1.35E-09	0.00±1.00E-07	0.00±1.04E-08	0.00±8.72E-09
707	DOWN - B(3)	6.92	549	NS	NS	0.34±1.31E-09	5.77±1.51E-09	1.55±8.92E-08	NS	NS
707	DOWN - B(4)	6.82	298	NS	NS	0.45±1.24E-09	5.48±1.72E-09	3.60±8.66E-08	NS	NS
904*	DOWN - B(1)	7.55	851	<1.0	<0.005	3.36±6.58E-09	4.04±3.70E-09	0.00±1.00E-07	0.00±2.13E-08	0.00±1.86E-08
904	DOWN - B(2)	7.45	812	1.2	0.022	1.67±0.85E-09	3.03±1.35E-09	5.84±8.06E-08	0.00±2.53E-08	0.00±1.72E-08
107	DOWN - C(1)	7.28	866	<1.0	0.008	1.05±3.25E-09	3.19±2.65E-09	1.05±0.07E-06	0.00±1.42E-08	0.00±1.43E-08
107	DOWN - C(2)	7.42	819	<1.0	0.017	-0.08±1.71E-09	2.29±2.38E-09	1.11±0.10E-06	0.00±2.09E-08	0.00±1.72E-08
107	DOWN - C(3)	7.20	794	NS	NS	1.22±2.18E-09	3.46±2.29E-09	1.61±0.11E-06	NS	NS
107	DOWN - C(4)	7.23	862	NS	NS	0.39±1.54E-09	3.61±1.80E-09	1.47±0.11E-06	NS	NS
108	DOWN - C(1)	7.62	652	<1.0	<0.005	1.50±3.21E-09	5.19±2.64E-09	0.00±1.00E-07	0.00±2.48E-08	0.00±1.73E-08
108	DOWN - C(2)	7.20	639	<1.0	0.014	2.36±0.82E-09	2.77±1.32E-09	0.00±1.00E-07	0.00±2.04E-08	0.00±1.98E-08
108	DOWN - C(3)	7.15	622	NS	NS	1.74±1.42E-09	4.45±1.96E-09	6.24±8.61E-08	NS	NS
108	DOWN - C(4)	7.35	606	NS	NS	2.69±1.46E-09	2.78±1.58E-09	4.11±8.48E-08	NS	NS
114*	DOWN - C(1)	7.19	709	<1.0	0.014	0.00±3.61E-09	1.16±3.67E-09	2.75±0.86E-07	0.00±2.24E-08	0.00±1.99E-08
114	DOWN - C(2)	7.28	656	<1.0	0.006	1.46±1.22E-09	-0.34±1.71E-09	3.59±0.86E-07	0.00±1.58E-08	0.00±1.88E-08
409	DOWN - C(1)	8.13	373	<1.0	<0.005	1.02±2.45E-09	4.56±2.60E-09	0.00±1.00E-07	0.00±1.43E-08	0.00±1.63E-08
409	DOWN - C(2)	7.91	370	<1.0	<0.005	8.86±6.89E-10	4.38±1.37E-09	1.63±0.83E-07	0.00±1.25E-08	0.00±1.45E-08
409	DOWN - C(3)	8.05	378	NS	NS	5.93±5.74E-10	4.84±0.98E-09	0.00±1.00E-07	NS	NS
409	DOWN - C(4)	8.03	355	NS	NS	1.66±0.93E-09	6.58±1.49E-09	3.32±8.71E-08	NS	NS
910	DOWN - C(1)	6.38	1667	<1.0	0.007	0.42±1.02E-08	1.95±1.02E-08	0.00±1.00E-07	0.00±2.48E-08	0.00±2.98E-08
910	DOWN - C(2)	7.07	1655	2.1	0.011	2.70±2.74E-09	1.66±0.09E-07	1.47±8.46E-08	0.00±2.02E-08	0.00±2.54E-08
910	DOWN - C(3)	7.15	1616	NS	NS	2.50±2.60E-09	2.71±0.31E-08	0.00±1.00E-07	NS	NS
910	DOWN - C(4)	7.08	1722	NS	NS	5.15±3.51E-09	2.28±0.30E-08	0.00±1.00E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 5
1995 Contamination Indicator Results for the Kent Recessional Sequence

Location Code	Hydraulic Position	pH	Conductivity *μmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *μCi/mL*	Gross Beta *μCi/mL*	Tritium *μCi/mL*	Cs-137 *μCi/mL*	Co-60 *μCi/mL*
901	UP(1)	7.84	376	<1.0	0.014	1.73±2.89E-09	4.03±2.50E-09	0.00±1.00E-07	0.00±2.07E-08	0.00±2.06E-08
901	UP(2)	7.70	366	<1.0	0.008	4.61±8.24E-10	1.77±1.44E-09	0.00±1.00E-07	0.00±2.12E-08	0.00±2.88E-08
901	UP(3)	7.77	423	NS	NS	5.97±9.46E-10	3.97±1.36E-09	0.00±1.00E-07	NS	NS
901	UP(4)	7.83	394	NS	NS	1.36±1.00E-09	4.02±1.38E-09	3.77±8.37E-08	NS	NS
902*	UP(1)	7.36	464	<1.0	0.044	0.00±2.69E-09	3.61±2.56E-09	1.13±8.12E-08	0.00±1.74E-08	0.00±2.92E-08
902	UP(2)	7.82	454	<1.0	0.010	0.72±1.02E-09	-0.44±1.36E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.54E-08
1001*	UP(1)	7.57	444	<1.0	0.032	0.62±2.73E-09	4.19±2.60E-09	5.04±8.10E-08	0.00±2.48E-08	0.00±2.21E-08
1001	UP(2)	7.87	441	<1.0	0.034	8.87±9.80E-10	1.57±1.45E-09	0.00±1.00E-07	0.00±2.56E-08	0.00±3.15E-08
1008B	UP(1)	8.11	324	<1.0	0.013	0.00±2.31E-09	2.78±2.42E-09	0.00±1.00E-07	0.00±1.37E-08	0.00±1.70E-08
1008B	UP(2)	7.78	307	<1.0	0.014	-2.91±8.49E-10	1.32±1.44E-09	0.00±1.00E-07	0.00±1.37E-08	0.00±1.18E-08
1008B	UP(3)	7.91	482	NS	NS	1.13±1.09E-09	4.29±1.39E-09	1.26±9.06E-08	NS	NS
1008B	UP(4)	7.69	316	NS	NS	2.45±8.40E-10	2.35±1.29E-09	0.00±7.07E-08	NS	NS
903	DOWN - B(1)	7.67	799	<1.0	0.006	-1.02±4.48E-09	4.94±3.77E-09	0.00±7.07E-08	0.00±1.98E-08	0.00±1.87E-08
903	DOWN - B(2)	8.18	685	<1.0	<0.005	1.30±1.21E-09	2.76±1.90E-09	0.00±1.00E-07	0.00±1.42E-08	0.00±1.95E-08
903	DOWN - B(3)	7.77	733	NS	NS	0.79±1.63E-09	3.49±1.95E-09	0.00±7.07E-08	NS	NS
903	DOWN - B(4)	7.55	826	NS	NS	-2.48±1.88E-09	2.65±1.97E-09	7.65±8.55E-08	NS	NS
1002*	DOWN - B(1)	7.54	1229	<1.0	0.033	0.00±6.70E-09	0.97±4.44E-09	0.00±1.00E-07	0.00±2.16E-08	0.00±2.01E-08
1002	DOWN - B(2)	7.36	1238	<1.0	0.011	0.93±2.29E-09	3.80±3.79E-09	0.00±1.00E-07	0.00±2.16E-08	0.00±2.60E-08
1003*	DOWN - B(1)	7.98	448	<1.0	0.006	1.96±3.38E-09	2.81±2.45E-09	0.00±1.00E-07	0.00±1.98E-08	0.00±3.38E-08
1003	DOWN - B(2)	7.64	441	<1.0	0.009	3.09±9.23E-10	2.20±1.49E-09	0.00±1.00E-07	0.00±1.18E-08	0.00±1.31E-08
1004*	DOWN - B(1)	7.90	457	<1.0	<0.005	1.41±3.38E-09	2.83±2.47E-09	0.00±1.00E-07	0.00±2.17E-08	0.00±2.33E-08
1004	DOWN - B(2)	7.69	449	<1.0	0.013	1.16±1.05E-09	0.18±1.39E-09	0.00±1.00E-07	0.00±1.99E-08	0.00±2.62E-08
8610	DOWN - B(1)	8.46	837	<1.0	0.036	-0.97±3.28E-09	7.48±4.05E-09	0.00±1.00E-07	0.00±2.70E-08	0.00±3.00E-08
8610	DOWN - B(2)	8.20	826	<1.0	<0.005	0.82±1.12E-09	3.17±1.92E-09	0.00±1.00E-07	0.00±1.13E-08	0.00±1.74E-08
8610	DOWN - B(4)	8.22	903	NS	NS	-0.44±1.10E-09	7.50±1.56E-09	0.00±1.00E-07	NS	NS
8611	DOWN - B(1)	7.98	999	<1.0	0.027	-1.13±3.85E-09	3.38±4.55E-09	0.00±1.00E-07	0.00±1.61E-08	0.00±1.32E-08
8611	DOWN - B(2)	7.86	956	2.0	0.023	-0.31±1.73E-09	0.53±2.65E-09	0.00±1.00E-07	0.00±2.20E-08	0.00±2.80E-08
8611	DOWN - B(3)	7.70	1006	NS	NS	2.00±2.26E-09	3.62±2.62E-09	0.00±1.00E-07	NS	NS
8611	DOWN - B(4)	7.74	998	NS	NS	-0.25±1.63E-09	4.98±1.86E-09	0.00±1.00E-07	NS	NS

NS - No longer sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.
** Sampling of well discontinued third quarter 1995.*

Table E - 6
1995 Groundwater Quality Results (mg/L) for the Sand and Gravel Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
301	UP(2)	181	13.9	2.5	<0.05	188	<1.0	0.065	2.9	<0.10
401	UP(2)	661	23.4	12	<0.05	155	<1.0	0.098	3.8	<0.10
403	UP(2)	252	32.4	17	4.10	110	<1.0	0.16	2.4	<0.10
706	UP(2)	15.0	110	0.87	<0.05	144	<1.0	0.063	1.6	<0.10
NB1S	UP(2)	68.0	16.2	8.8	<0.05	76.0	<1.0	0.021	3.0	<0.10
201	DOWN - B(2)	445	38.8	1.7	<0.05	116	<1.0	<0.010	1.5	<0.10
305	DOWN - B(2)	614	28.9	0.26	0.31	224	<1.0	0.030	3.3	<0.10
307	DOWN - B(2)	372	31.4	0.61	<0.05	160	<1.0	0.22	2.8	<0.10
603	DOWN - B(2)	25.0	130	1.6	<0.05	171	<1.0	0.017	2.2	<0.10
8613A	DOWN - B(2)	139	21.3	2.7	<0.05	106	<1.0	0.14	2.1	<0.10
8613B	DOWN - B(2)	154	34.5	3.0	<0.05	88.0	<1.0	0.66	1.3	<0.10
8613C	DOWN - B(2)	53.1	34.7	1.5	<0.05	202	<1.0	0.62	2.2	<0.10
WNSP008	DOWN - C(2)	116	53.0	0.42	<0.05	240	<10.0	<0.010	2.1	<0.10
103	DOWN - C(2)	979	38.3	0.05	3.80	<10.0	1060	2.3	430	0.10
104	DOWN - C(2)	220	28.0	2.7	<0.05	190	<5.0	<0.050	10	< 1.0
111	DOWN - C(2)	4.0	33.0	1.1	<0.05	140	<5.0	0.020	6.0	< 1.0
203	DOWN - C(2)	1710	69.9	3.2	<0.05	197	<1.0	0.028	1.4	<0.10
205	DOWN - C(2)	203	111	1.5	<0.05	158	<1.0	0.11	0.75	<0.10
207	DOWN - C(2)	2.3	23.6	0.25	<0.05	428	<1.0	0.014	5.5	<0.10
406	DOWN - C(2)	48.8	62.7	0.11	0.24	179	<1.0	<0.010	3.4	<0.10
408	DOWN - C(2)	370	38.0	3.1	<0.05	190	<5.0	0.030	10	< 1.0
501	DOWN - C(2)	190	31.0	6.2	<0.05	160	<5.0	0.050	10	< 1.0
502	DOWN - C(2)	220	32.0	6.8	<0.05	170	<5.0	0.10	10	< 1.0
602	DOWN - C(2)	104	42.4	0.07	0.06	336	<1.0	0.071	2.2	<0.10
604	DOWN - C(2)	63.5	74.2	< 0.05	1.10	402	<10.0	0.048	2.6	<0.10
8605	DOWN - C(2)	26.0	65.0	0.02	0.74	250	<5.0	0.070	7.0	< 1.0
8606	DOWN - C(2)	253	86.4	1.4	<0.05	154	<1.0	0.013	0.69	<0.10
8607	DOWN - C(2)	187	66.2	3.4	<0.05	98.0	<1.0	<0.010	2.0	<0.10
8608	DOWN - C(2)	63.7	58.9	0.55	0.24	138	<1.0	<0.010	2.0	<0.10
8609	DOWN - C(2)	55.7	37.8	7.4	<0.05	244	<1.0	<0.010	5.0	<0.10
WNDMPNE	DOWN - D(2)	38.0	13.0	0.57	<0.05	64.0	<5.0	0.030	3.0	< 1.0
WNGSEEP	DOWN - D(2)	121	47.8	0.60	<0.05	132	<1.0	<0.010	1.8	<0.10
105	DOWN - D(2)	232	36.4	1.7	<0.05	200	<5.5	0.070	4.4	<0.10

** as mg$CaCO_3$/L*
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 6 (continued)
1995 Groundwater Quality Results (mg/L) for the Sand and Gravel Unit

Location Code	Hydraulic Position	Calcium Total	Calcium Diss.	Magnesium Total	Magnesium Diss.	Sodium Total	Sodium Diss.	Potassium Total	Potassium Diss.	Iron Total	Iron Diss.	Manganese Total	Manganese Diss.	Aluminum Total	Aluminum Diss.
301	UP(2)	123	132	11.5	11.3	50.9	57.0	2.40	1.20	32.3	0.091	0.450	0.064	4.40	<0.090
401	UP(2)	246	252	24.6	23.0	183	177	2.00	2.00	1.90	0.120	0.055	0.025	0.340	<0.090
403	UP(2)	156	153	11.2	10.2	69.4	57.9	3.60	3.80	2.40	0.072	0.130	0.017	0.890	0.095
706	UP(1)	73.4	79.1	11.4	11.2	3.20	3.80	3.10	1.70	9.00	<0.013	0.190	0.003	5.70	0.050
706	UP(2)	88.4	90.9	17.2	12.9	4.50	3.80	4.40	1.10	28.2	0.790	0.670	0.011	15.9	1.20
NB1S	UP(1)	30.5	33.1	3.80	<0.15	47.8	48.3	1.10	1.10	0.370	0.024	0.007	<0.002	0.170	<0.045
NB1S	UP(2)	43.2	48.4	5.60	6.00	34.0	37.1	1.20	1.10	0.960	<0.040	0.016	<0.005	0.670	<0.090
201	DOWN - B(2)	152	158	13.3	13.9	153	163	4.10	4.20	0.390	0.280	0.750	0.850	<0.090	<0.090
305	DOWN - B(2)	143	157	15.0	16.1	266	283	3.50	3.70	0.400	<0.040	2.50	2.70	0.180	<0.090
307	DOWN - B(2)	73.6	90.0	7.80	9.70	210	211	2.10	1.90	1.90	0.051	0.280	0.140	0.610	<0.090
603	DOWN - B(2)	111	113	15.5	16.0	9.30	9.20	1.30	1.20	0.380	<0.040	0.073	0.050	0.130	<0.090
8613A	DOWN - B(2)	91.7	93.9	14.2	14.2	35.8	37.5	2.80	2.80	3.20	0.280	0.240	0.011	1.30	0.460
8613B	DOWN - B(2)	106	85.9	11.8	11.6	47.8	49.7	2.80	2.50	12.7	0.220	0.270	0.090	1.30	0.210
8613C	DOWN - B(2)	110	68.8	21.9	12.1	19.6	21.7	3.50	2.80	11.3	0.250	1.50	0.054	5.30	0.310
WNSP008	DOWN - C(2)	115	120	15.1	15.4	58.0	59.6	1.20	1.30	0.110	<0.040	0.650	0.680	<0.090	<0.090
103	DOWN - C(2)	121	92.1	4.00	2.30	934	13.5	1.40	1.40	1.40	0.690	0.340	0.240	0.860	0.350
104	DOWN - C(2)	120	120	16.0	16.0	78.0	83.0	2.10	2.10	<0.050	<0.050	0.110	0.130	<0.200	0.210
111	DOWN - C(2)	55.0	57.0	7.60	7.90	5.80	6.00	3.50	3.60	NR	<0.050	1.40	1.30	<0.200	0.039
203	DOWN - C(2)	401	415	34.7	35.4	647	667	3.40	<0.400	3.40	0.210	0.086	0.056	0.470	<0.090
205	DOWN - C(2)	40.9	40.9	4.50	4.70	185	197	2.00	1.90	2.00	0.140	0.032	0.010	0.280	<0.090
207	DOWN - C(2)	142	142	24.6	23.9	7.60	5.40	0.980	0.910	0.150	0.054	0.950	0.940	<0.090	<0.090
406	DOWN - C(2)	93.0	92.4	12.1	11.6	19.1	16.6	2.00	1.90	0.350	0.042	6.30	5.00	0.260	<0.090
408	DOWN - C(2)	160	160	25.0	24.0	120	110	3.70	3.30	NR	NR	0.200	0.200	0.830	0.060
501	DOWN - C(2)	120	110	16.0	14.0	69.0	66.0	2.10	2.20	NR	<0.050	0.094	0.007	0.910	<0.200
502	DOWN - C(2)	140	130	18.0	18.0	72.0	70.0	2.10	2.10	NR	NR	0.310	0.009	0.140	<0.200
502	DOWN - C(3)	NS	NS	NS	NS	NS	NS	NS	NS	24.0	NS	0.140	NS	0.160	NS
502	DOWN - C(4)	NS	NS	NS	NS	NS	NS	NS	NS	22.0	NS	0.140	NS	0.210	NS
602	DOWN - C(2)	109	110	12.8	12.6	65.1	67.3	2.10	<0.400	2.60	0.049	5.90	2.80	2.00	<0.090
604	DOWN - C(2)	88.5	96.6	14.2	14.7	11.6	11.3	1.00	1.00	7.25	7.65	24.2	26.4	<0.090	<0.090
8605	DOWN - C(2)	80.0	80.0	13.0	13.0	37.0	36.0	5.80	6.10	NR	NR	8.30	8.10	<0.200	<0.200
8606	DOWN - C(2)	47.6	48.9	5.65	5.40	194	202	2.25	2.10	0.140	0.046	0.011	<0.005	<0.090	<0.090
8607	DOWN - C(2)	103	104	13.8	13.9	66.8	67.7	2.20	2.20	<0.040	<0.040	0.045	0.051	<0.090	<0.090
8608	DOWN - C(2)	77.0	82.2	9.50	9.90	17.1	17.2	2.70	2.80	1.10	0.120	5.90	6.30	0.100	<0.090
8609	DOWN - C(2)	109	123	15.1	16.2	17.3	17.4	1.80	<0.400	0.250	<0.040	0.025	0.008	0.200	<0.090
WNDMPNE	DOWN - D(2)	36.0	36.0	4.80	4.70	16.0	15.0	1.80	1.60	NR	NR	0.270	0.230	0.740	0.250
WNGSEEP	DOWN - D(2)	89.0	106	14.2	15.4	31.7	34.1	1.50	<0.400	0.089	<0.040	<0.005	<0.005	<0.090	<0.090
105	DOWN - D(2)	154	157	25.0	24.8	63.0	63.2	1.40	1.30	15.0	0.120	3.85	3.70	<0.090	<0.090

NA - Not available.
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
NS - Not sampled.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 6 (continued)
1995 Groundwater Quality Results (mg/L) for the Sand and Gravel Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
106	DOWN - D(2)	179	39.9	0.11	<0.05	246	<1.0	0.14	3.3	<0.10
116	DOWN - D(2)	407	48.5	2.2	<0.05	123	<10.0	0.14	3.2	<0.10
601	DOWN - D(2)	63.4	52.7	0.35	<0.05	86.0	<1.0	<0.010	1.1	<0.10
605	DOWN - D(2)	74.2	41.7	0.48	<0.05	685	<10.0	<0.010	1.1	<0.10
801	DOWN - D(2)	300	30.0	2.8	<0.05	160	<5.0	0.090	7.0	< 1.0
802	DOWN - D(2)	38.2	28.3	<0.05	<0.05	101	<10.0	0.060	4.3	<0.10
803	DOWN - D(2)	162	184	0.41	<0.05	311	<1.0	<0.010	5.0	<0.10
804	DOWN - D(2)	155	99.8	0.47	<0.05	129	<1.0	0.20	1.5	<0.10
905	DOWN - D(2)	8.7	802	<0.05	0.07	393	<1.0	<0.010	5.8	<0.10
8603	DOWN - D(2)	322	32.9	3.2	<0.05	201	<10.0	<0.010	5.8	<0.10
8604	DOWN - D(2)	360	29.0	3.1	<0.05	200	<5.0	<0.050	12	0.24
8612	DOWN - D(2)	95.0	71.5	<0.05	<0.05	272	<1.0	<0.010	5.4	<0.10

** as mg$CaCO_3$/L*
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 6 *(concluded)*
1995 Groundwater Quality Results (mg/L) for the Sand and Gravel Unit

Location Code	Hydraulic Position	Calcium Total	Calcium Diss.	Magnesium Total	Magnesium Diss.	Sodium Total	Sodium Diss.	Potassium Total	Potassium Diss.	Iron Total	Iron Diss.	Manganese Total	Manganese Diss.	Aluminum Total	Aluminum Diss.
106	DOWN - D(2)	142	141	24.1	20.8	56.7	59.3	3.60	1.20	13.5	0.084	4.90	4.40	7.60	<0.090
116	DOWN - D(2)	230	242	30.0	29.9	58.8	61.8	3.10	1.90	14.7	0.200	0.870	0.059	4.80	<0.090
601	DOWN - D(2)	59.7	61.3	10.1	7.80	46.1	29.2	3.30	<0.400	14.9	0.110	0.032	<0.005	9.80	<0.090
605	DOWN - D(2)	60.1	64.6	7.70	8.20	27.3	29.2	1.10	1.10	0.620	<0.040	0.015	<0.005	0.360	<0.090
801	DOWN - D(2)	150	150	20.0	19.0	86.0	85.0	2.50	1.90	NR	NR	0.620	0.550	1.60	<0.200
802	DOWN - D(2)	46.5	48.6	4.70	4.60	14.2	13.7	0.930	0.590	1.20	0.043	0.230	0.082	0.940	<0.090
803	DOWN - D(2)	190	199	37.0	38.2	33.2	33.0	1.50	1.40	0.300	0.075	0.600	0.640	<0.090	<0.090
804	DOWN - D(2)	95.3	104	12.2	12.4	45.4	48.2	1.80	1.40	4.70	<0.040	0.190	<0.005	2.10	<0.090
905	DOWN - D(2)	256	268	84.2	85.8	16.6	16.0	3.90	4.00	2.00	1.70	0.560	0.580	0.160	<0.090
8603	DOWN - D(2)	164	173	27.0	28.2	74.6	77.6	2.30	2.40	0.040	<0.040	0.015	0.012	<0.090	<0.090
8604	DOWN - D(2)	170	180	27.0	27.0	92.0	93.0	2.90	3.20	<0.050	<0.050	0.029	0.028	<0.200	<0.200
8612	DOWN - D(2)	128	134	28.6	29.6	19.6	18.2	1.40	0.630	1.75	0.630	0.125	0.130	<0.090	<0.090

NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 7
1995 Groundwater Quality Results (mg/L) for the Till-Sand Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
302	UP(2)	492	31.1	0.98	<0.05	253	<1.0	<0.010	5.7	<0.10
402	UP(2)	366	27.2	<0.05	<0.05	223	<1.0	<0.010	6.0	<0.10
404	UP(2)	<1.0	22.2	<0.05	<0.05	106	<1.0	0.020	4.5	<0.10
701	UP(2)	<1.0	441	<0.05	0.14	151	<10.0	0.092	5.8	<0.10
202	DOWN - B(2)	24.6	38.3	0.18	0.22	<1.0	20.0	<0.010	4.7	<0.10
204	DOWN - B(2)	96.2	28.4	<0.05	0.13	150	<1.0	0.037	5.4	<0.10
206	DOWN - C(2)	101	29.6	<0.05	0.08	177	<1.0	0.17	5.1	<0.10
208	DOWN - C(2)	<1.0	32.6	<0.05	0.13	131	<1.0	0.010	4.3	<0.10

Location Code	Hydraulic Position	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
		Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
302	UP(2)	227	231	26.6	27.4	163	161	2.20	2.10	0.071	<0.040	0.062	0.020	<0.090	<0.090
402	UP(2)	202	220	36.9	38.9	63.4	66.4	2.10	2.00	1.60	1.60	0.170	0.170	<0.090	<0.090
404	UP(2)	41.5	37.6	5.70	5.70	22.0	8.20	0.860	0.920	0.290	0.360	0.052	0.011	NR	NR
701	UP(2)	197	197	35.2	34.3	19.6	17.7	2.70	1.30	7.60	0.840	0.500	0.420	4.40	<0.090
202	DOWN - B(2)	191	30.4	NR	NR	23.5	19.8	13.3	7.50	0.110	<0.040	0.011	<0.005	0.270	<0.090
204	DOWN - B(2)	89.4	91.6	19.2	19.9	13.6	12.8	1.95	<0.400	1.95	0.250	0.150	0.110	1.20	<0.090
206	DOWN - C(2)	106	108	22.5	22.7	13.3	13.4	1.40	1.00	2.90	0.054	0.260	0.210	1.00	<0.090
208	DOWN - C(2)	38.4	39.1	9.00	9.20	15.3	15.2	0.860	0.800	0.150	<0.040	0.036	0.035	<0.090	<0.090

** as mg$CaCO_3$/L*
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 8
1995 Groundwater Quality Results (mg/L) for the Weathered Lavery Till Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
908	UP(2)	7.8	1640	0.19	<0.05	302	<10.0	<0.010	4.2	<0.10
1005	UP(2)	2.2	78.1	<0.05	<0.05	368	<1.0	0.040	5.5	<0.10
1008C	UP(2)	32.7	24.6	<0.05	<0.05	216	<1.0	<0.010	5.0	<0.10
906	DOWN - B(2)	5.0	108	0.67	<0.05	223	<1.0	0.080	3.9	<0.10
907	DOWN - B(2)	2.6	92.4	0.05	<0.05	334	<1.0	<0.010	5.0	<0.10
1006	DOWN - B(2)	6.2	1320	<0.05	<0.05	326	<1.0	0.016	6.0	<0.10
1007	DOWN - B(2)	3.0	90.3	<0.05	<0.05	514	<10.0	0.14	6.3	<0.10
WNNDATR	DOWN - C(2)	57.9	124	0.32	<0.05	146	<1.0	0.011	2.4	<0.10
909	DOWN - C(2)	18.5	200	<0.05	0.36	570	<5.0	0.057	7.5	<0.10

Location	Hydraulic	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
Code	Position	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
908	UP(2)	472	516	171	178	24.5	26.0	6.00	5.40	8.80	0.094	0.380	0.006	4.40	<0.090
1005	UP(2)	108	113	36.4	37.4	11.3	9.50	1.50	1.50	0.210	<0.040	0.011	0.006	0.093	<0.090
1008C	UP(2)	73.3	80.0	19.1	20.2	13.7	13.9	1.00	0.830	0.046	<0.040	0.052	0.055	<0.090	<0.090
906	DOWN - B(2)	61.1	72.1	21.2	25.0	24.6	24.4	2.20	<0.400	1.80	0.190	0.042	<0.005	1.40	0.250
907	DOWN - B(2)	103	108	38.2	39.7	10.1	9.60	1.70	1.70	0.074	<0.040	0.034	0.032	<0.090	<0.090
1006	DOWN - B(2)	355	395	138	149	22.3	21.8	3.20	3.30	0.360	0.120	0.350	0.450	<0.090	<0.090
1007	DOWN - B(2)	159	161	60.4	17.9	17.7	17.9	7.00	6.60	16.7	0.130	0.610	0.088	6.90	<0.090
WNNDATR	DOWN - C(2)	91.6	95.4	23.1	23.8	48.4	49.4	3.10	3.00	0.250	0.085	0.009	<0.005	0.210	0.140
909	DOWN - C(2)	210	216	54.6	54.2	13.5	12.8	2.60	2.60	2.40	2.00	3.00	2.90	0.180	<0.090

* *as* $mgCaCO_3/L$
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 9
1995 Groundwater Quality Results (mg/L) for the Unweathered Lavery Till Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
405	UP(2)	170	74.9	0.20	<0.05	191	<1.0	0.017	2.1	<0.10
109	DOWN - B(2)	1.9	70.8	0.13	<0.05	218	<1.0	0.060	4.3	<0.10
110	DOWN - B(2)	<1.0	73.5	0.06	<0.05	234	<1.0	<0.010	4.5	<0.10
115	DOWN - B(2)	5.0	74.1	<0.05	<0.05	145	<1.0	0.060	3.1	<0.10
702	DOWN - B(2)	<1.0	272	0.25	<0.05	208	<1.0	0.15	3.8	<0.10
703	DOWN - B(2)	1.2	253	0.16	<0.05	178	<1.0	<0.010	3.5	<0.10
704	DOWN - B(2)	<1.0	82.9	<0.05	0.33	428	<1.0	<0.010	1.7	<0.10
705	DOWN - B(2)	12.4	35.3	<0.05	<0.05	190	<1.0	0.049	3.2	<0.10
707	DOWN - B(2)	8.8	30.5	0.30	<0.05	91.0	<1.0	<0.010	1.1	<0.10
904	DOWN - B(2)	6.2	149	0.17	<0.05	251	<1.0	<0.010	3.7	<0.10
107	DOWN - C(2)	3.2	150	0.07	<0.05	288	<1.0	<0.010	3.9	<0.10
108	DOWN - C(2)	1.3	136	0.54	<0.05	202	<1.0	0.025	3.6	<0.10
114	DOWN - C(2)	24.6	65.4	2.2	<0.05	239	<1.0	0.025	4.3	<0.10
409	DOWN - C(2)	<1.0	46.7	0.10	<0.05	130	<1.0	0.030	3.8	<0.10
910	DOWN - C(2)	<1.0	682	0.11	0.22	345	<1.0	0.12	4.0	<0.10

Location Code	Hydraulic Position	Calcium Total	Calcium Diss.	Magnesium Total	Magnesium Diss.	Sodium Total	Sodium Diss.	Potassium Total	Potassium Diss.	Iron Total	Iron Diss.	Manganese Total	Manganese Diss.	Aluminum Total	Aluminum Diss.
405	UP(2)	120	126	19.8	20.7	77.2	73.4	2.10	2.10	0.730	0.140	0.140	0.018	0.130	<0.090
109	DOWN - B(2)	81.6	76.0	21.4	18.7	20.6	18.5	3.00	1.20	10.0	<0.040	0.300	0.008	6.00	<0.090
110	DOWN - B(2)	71.3	73.9	21.7	21.8	22.4	22.9	1.40	1.40	0.074	<0.040	0.160	0.009	<0.090	<0.090
115	DOWN - B(2)	54.0	67.1	10.5	11.9	12.5	16.0	1.80	1.20	5.60	0.280	0.079	0.009	3.00	0.170
702	DOWN - B(2)	118	122	27.9	28.9	45.5	39.3	2.20	1.90	1.90	0.080	0.130	0.012	0.810	<0.090
703	DOWN - B(2)	113	107	23.4	22.4	19.9	18.7	1.40	1.40	0.250	<0.040	0.024	0.010	0.160	<0.090
704	DOWN - B(2)	168	163	23.5	22.0	7.80	2.20	3.00	2.10	0.210	<0.040	10.2	11.4	0.096	<0.090
705	DOWN - B(2)	79.8	78.0	13.3	12.3	53.7	5.90	2.20	0.880	5.40	<0.040	0.210	0.055	3.80	<0.090
707	DOWN - B(2)	40.0	43.0	6.50	6.60	5.00	4.50	1.10	<0.400	0.760	<0.040	0.014	<0.005	0.690	<0.090
904	DOWN - B(2)	117	101	34.5	31.7	21.5	22.2	2.80	<0.400	9.10	0.160	0.280	0.062	4.40	0.200
107	DOWN - C(2)	121	129	26.9	28.2	19.8	19.0	1.90	2.00	0.310	<0.040	0.038	<0.005	0.130	<0.090
108	DOWN - C(2)	86.2	82.8	22.6	22.0	20.7	21.4	1.60	1.50	0.220	<0.040	0.010	0.010	0.180	<0.090
114	DOWN - C(2)	106	108	14.9	15.6	11.8	10.8	1.30	1.20	3.20	1.30	0.180	0.260	0.440	<0.090
409	DOWN - C(2)	40.2	38.5	9.80	9.40	21.4	20.4	4.40	3.60	0.880	<0.040	0.078	<0.005	0.450	<0.090
910	DOWN - C(2)	203	210	89.2	93.4	38.2	38.2	6.00	6.10	2.50	0.054	0.180	0.190	1.20	<0.090

** as mgCaCO₃/L*

Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 10
1995 Groundwater Quality Results (mg/L) for the Kent Recessional Sequence

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phosphate	Silica	Sulfide
901	UP(2)	11.7	6.1	<0.05	0.44	175	<1.0	0.049	4.2	<0.10
902	UP(2)	24.0	7.1	<0.05	0.44	199	<1.0	0.020	5.1	<0.10
1001	UP(2)	32.9	5.8	<0.05	0.51	175	<1.0	0.048	4.8	<0.10
1008B	UP(2)	41.9	9.0	<0.05	0.38	164	<1.0	0.043	4.6	<0.10
903	DOWN - B(2)	1.4	155	<0.05	0.20	284	<1.0	0.049	5.5	<0.10
1002	DOWN - B(2)	<1.0	282	<0.05	0.68	463	<1.0	0.011	7.6	<0.10
1003	DOWN - B(2)	10.6	12.2	<0.05	0.39	213	<1.0	0.062	4.2	<0.10
1004	DOWN - B(2)	1.1	20.6	<0.05	0.27	225	<1.0	0.010	5.8	<0.10
8610	DOWN - B(2)	<1.0	216	<0.05	0.21	224	<1.0	0.22	5.2	<0.10
8611	DOWN - B(2)	1.1	293	<0.05	<0.05	269	<1.0	<0.010	5.3	<0.10

Location Code	Hydraulic Position	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
		Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
901	UP(2)	36.4	36.7	9.50	9.70	31.2	32.0	3.30	3.40	0.670	0.100	0.110	0.100	0.230	<0.090
902	UP(2)	45.0	47.6	14.0	14.5	31.2	32.0	2.10	2.10	0.860	0.660	0.080	0.082	<0.090	<0.090
1001	UP(2)	37.0	33.5	9.20	8.40	47.3	46.4	2.40	2.10	1.10	0.430	0.064	0.043	0.280	<0.090
1008B	UP(2)	49.8	43.5	10.1	9.50	55.5	43.9	2.50	2.60	0.700	0.610	0.095	0.085	<0.090	<0.090
903	DOWN - B(2)	82.7	83.9	37.4	37.8	43.7	44.0	3.00	3.00	0.750	0.250	0.140	0.130	0.180	<0.090
1002	DOWN - B(2)	151	156	62.4	63.9	38.4	38.8	2.40	2.50	2.40	1.90	0.120	0.120	0.120	<0.090
1003	DOWN - B(2)	31.4	32.6	8.30	8.90	56.2	58.6	1.90	2.00	0.300	<0.040	0.120	0.120	0.092	<0.090
1004	DOWN - B(2)	44.8	46.9	17.1	18.2	29.4	29.9	1.50	1.50	0.310	0.170	0.070	0.060	<0.090	<0.090
8610	DOWN - B(2)	50.9	44.2	43.5	42.3	72.5	75.0	4.00	4.00	3.30	<0.040	0.120	0.038	1.00	<0.090
8611	DOWN - B(2)	97.9	93.0	35.6	36.7	70.6	74.4	2.80	3.00	1.80	<0.040	0.090	0.013	0.260	<0.090

** as mgCaCO$_3$/L*
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Table E - 11

Modified Practical Quantitation Limits (PQLs) in $\mu g/L$ for Appendix IX Parameters

COMPOUND	PQL	COMPOUND	PQL
Appendix IX Volatiles		*Appendix IX Volatiles*	
Acetone	10	Methacrylonitrile	5
Acetonitrile	100	Methyl ethyl ketone	10
Acrolein	5	Methyl iodide	5
Acrylonitrile	5	Methyl methacrylate	10
Allyl chloride	100	4-Methyl-2-pentanone	10
Benzene	5	Methylene bromide	5
Bromodichloromethane	5	Methylene chloride	5
Bromoform	5	Pentachloroethane	5
Bromomethane	10	Propionitrile	50
Carbon disulfide	10	Styrene	5
Carbon tetrachloride	5	1,1,1,2-Tetrachloroethane	5
Chlorobenzene	5	1,1,2,2-Tetrachloroethane	5
Chloroethane	10	Tetrachloroethylene	5
Chloroform	5	Toluene	5
Chloromethane	10	1,1,1-Trichloroethane	5
Chloroprene	5	1,1,2-Trichloroethane	5
1,2-Dibromo-3-chloropropane	5	1,2,3-Trichloropropane	5
Dibromochloromethane	5	Vinyl acetate	10
1,2-Dibromoethane	5	Vinyl chloride	10
Dichlorodifluoromethane	5	Xylene (total)	5
1,1-Dichloroethane	5	cis-1,3-Dichloropropene	5
1,2-Dichloroethane	5	trans-1,2-Dichloroethylene	5
1,1-Dichloroethylene	5	trans-1,3-Dichloropropene	5
1,2-Dichloropropane	5	trans-1,4-Dichloro-2-butene	5
Ethyl benzene	5	Trichloroethylene	5
Ethyl methacrylate	5	Trichlorofluoromethane	5
2-Hexanone	10	1,2-Dichloroethylene (total)	5
Isobutyl alcohol	100		

Note: Specific quantitation limits are highly matrix-dependent and may not always be achievable.

Table E - 11 *(continued)*

Modified Practical Quantitation Limits (PQLs) in µg/L for Appendix IX Parameters

COMPOUND	PQL	COMPOUND	PQL
Appendix IX Semivolatiles		*Appendix IX Semivolatiles*	
Acenaphthene	10	2,4-Dinitrophenol	25
Acenaphthylene	10	2,4-Dinitrotoluene	10
Acetophenone	10	2,6-Dinitrotoluene	10
2-Acetylaminofluorene	10	Diphenylamine	10
4-Aminobiphenyl	10	Ethyl methanesulfonate	10
Aniline	10	Famphur	10
Anthracene	10	Fluoranthene	10
Aramite	10	Fluorene	10
Benzo[a]anthracene	10	Hexachlorobenzene	10
Benzo[a]pyrene	10	Hexachlorobutadiene	10
Benzo[b]fluoranthene	10	Hexachlorocyclopentadiene	10
Benzo[ghi]perylene	10	Hexachloroethane	10
Benzo[k]fluoranthene	10	Hexachloropropene	10
Benzyl alcohol	10	Indeno(1,2,3-cd)pyrene	10
Bis(2-chlorethyl)ether	10	Isodrin	10
Bis(2-chloroethoxy)methane	10	Isophorone	10
Bis(2-ethylhexyl)phthalate	10	Isosafrole	10
Bis(2-chloro-1- methlethyl) ether	10	Kepone	10
4-Bromophenyl phenyl ether	10	Methapyrilene	10
Butyl benzyl phthalate	10	Methyl methanesulfonate	10
Carbazole	10	3-Methylcholanthrene	10
Chlorobenzilate	10	2-Methylnaphthalene	10
2-Chloronaphthalene	10	1,4-Naphthoquinone	10
2-Chlorophenol	10	1-Naphthylamine	10
4-Chlorophenyl phenyl ether	10	2-Naphthylamine	10
Chrysene	10	Nitrobenzene	10
Di-n-butyl phthalate	10	5-Nitro-o-toluidine	10
Di-n-octyl phthalate	10	4-Nitroquinoline 1-oxide	10
Diallate	10	N-Nitrosodi-n-butylamine	10
Dibenz[a,h]anthracene	10	N-Nitrosodiethylamine	10
Dibenzofuran	10	N-Nitroso-di-N-propylamine	10
3,3-Dichlorobenzidine	10	N-Nitrosodimethylamine	10
2,4-Dichlorophenol	10	N-Nitrosodipropylamine	10
2,6-Dichlorophenol	10	N-Nitrosodiphenylamine	10
Diethyl phthalate	10	N-Nitrosomethylethylamine	10
Dimethoate	10	N-Nitrosomorpholine	10
7,12-Dimethylbenz[a]anthracen	10	N-Nitrosopiperidine	10
3,3-Dimethylbenzidine	20	N-Nitrosopyrrolidine	10
2,4-Dimethlyphenol	10	Naphthalene	10
Dimethyl Phthalate	10	0,0,0-Triethyl phosphorothioate	10
4,6-Dinitro-o-cresol	25	0,0-Diethyl 0-2-pyrazinyl-phospho	10

Note: Specific quantitation limits are highly matrix-dependent and may not always be achievable.

Table E - 11 *(continued)*

Modified Practical Quantitation Limits (PQLs) in μg/L for Appendix IX Parameters

COMPOUND	PQL	COMPOUND	PQL
Appendix IX Semivolatiles		*Appendix IX Semivolatiles*	
p-(Dimethylamino)azobenzene	10	2,3,4,6-Tetrachlorophenol	10
p-Chloroaniline	10	Tetraethyl dithiopyrophosphate	10
p-Chloro-m-cresol	10	1,2,4-Trichlorobenzene	10
p-Cresol	10	2,4,5-Trichlorophenol	25
p-Dichlorobenzene	10	2,4,6-Trichlorophenol	10
p-Nitroaniline	25	alpha,alpha-Dimethylphenethylamine	10
p-Nitrophenol	25	m-Cresol	10
p-Phenylenediamine	10	m-Dichlorobenzene	10
Parathion	10	m-Dinitrobenzene	10
Pentachlorobenzene	10	m-Nitroaniline	25
Pentachloronitrobenzene	10	o-Cresol	10
Pentachlorophenol	25	o-Dichlorobenzene	10
Phenacetin	10	o-Nitroaniline	25
Phenanthrene	10	o-Nitrophenol	10
Phenol	10	o-Toluidine	10
Pronamide	10	sym-Trinitrobenzene	10
Pyrene	10	2-Picoline	10
Safrole	10	Pyridine	10
1,2,4,5-Tetrachlorobenzene	10	1,4-Dioxane	10
Pesticides and PCBs		*Pesticides and PCBs*	
Aldrin	0.1	Methoxychlor	1
alpha Chlordane	0.5	Methyl parathion	10
gamma Chlordane	0.5	PCB-1242	1
Chlordane (total)	0.5	PCB-1254	1
2,4-D	10	PCB-1221	1
4,4-DD	0.1	PCB-1232	1
4,4-DDE	0.1	PCB-1248	1
4,4-DDT	0.1	PCB-1260	1
Dieldrin	0.1	PCB-1016	1
Dinoseb	10	Phorate	10
Disulfoton	10	Silvex	2
Endosulfan I	0.1	2,4,5-T	2
Endosulfan II	0.1	Toxaphene	1
Endosulfan sulfate	0.1	alpha-BHC	0
Endrin	0.1	beta-BHC	0
Endrin aldehyde	0.2	delta-BHC	0
Hepatachlor	0.1	gamma-BHC (Lindane)	0
Hepatachlor epoxide	0		

Note: Specific quantitation limits are highly matrix-dependent and may not always be achievable.

Table E - 11 *(concluded)*

Modified Practical Quantitation Limits (PQLs) in µg/L for Appendix IX Parameters

COMPOUND	PQL	COMPOUND	PQL
Metals		*Metals*	
Antimony*	60	Mercury*	0.2
Arsenic*	10	Nickel*	40
Barium*	200	Selenium*	5
Beryllium*	5	Silver*	10
Cadmium*	5	Thallium*	10
Chromium*	10	Tin	3,000
Cobalt	50	Vanadium	50
Copper	25	Zinc	20
Lead*	3		

* *These parameters comprise the WVDP sampling list for metals from RCRA Part 261, Appendix VIII, Hazardous Constituents List.*

Note: Specific quantitation limits are highly matrix-dependent and may not always be achievable.

Table E - 12

1,1,1-Trichloroethane (1,1,1-TCA), 1,1-Dichloroethane (1,1-DCA), and Dichlorodifluoromethane (DCDFMeth) Sampling Results for 1995 at Selected Groundwater Monitoring Locations

Location	Date	1,1,1-TCA (μg/L)	1,1-DCA (μg/L)	DCDFMeth (μg/L)
WNGSEEP	12/01/94	<5.0	<5.0	<5.0
	03/06/95	<5.0	<5.0	<5.0
	09/07/95	<5.0	<5.0	<5.0
8609	12/07/94	<5.0	3.0*	<5.0
	03/06/95	<5.0	2.0*	<5.0
8612	12/01/94	2.5*	36.5	8.0
	03/01/95	3.0*	41.0	6.5
	06/15/95	3.0*	44.0	5.5
	09/07/95	3.25*	41.0	7.5
803	12/01/94	<5.0	<5.0	4.0*
	03/14/95	<5.0	<5.0	4.5*
	06/08/95	<5.0	<5.0	<5.0
	09/07/95	<5.0	<5.0	<5.0

** Compound was detected below the practical quantitation limit (PQL).*

Table E - 13

Tributyl Phosphate Sampling Results for 1995 at Selected Groundwater Monitoring Locations

Location	Date	Tributyl Phosphate* (μg/L)
111	06/14/95	54
	09/13/95	36
8605	06/14/95	510
	09/13/95	500

** Detection limit for TBP is 10 μg/L.*

Table E - 14
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Sand and Gravel									
301	UP(3)	<5.00	<2.50	151	<1.50	<5.00	755	NA	NA
301	UP(4)	<4.00	<4.00	133	<2.00	<5.00	169	NA	NA
401	UP(3)	<15.0	9.50	474	<1.50	<5.00	1620	NA	NA
401	UP(4)	<4.00	<4.00	499	<2.00	<5.00	618	NA	NA
403	UP(3)	<15.0	<2.00	248	<1.50	<5.00	99.5	NA	NA
403	UP(4)	19.0	3.00	284	<1.00	<5.00	3130	NA	NA
706	UP(1)	NA	4.30	150	NA	<1.70	10.0	NA	NA
706	UP(2)	NA	12.0	210	NA	<5.00	28.0	NA	NA
706	UP(3)	<2.50	3.00	143	<1.50	<5.00	7.50	NA	NA
706	UP(4)	<3.00	<4.00	127	<2.00	<5.00	<10.0	NA	NA
NB1S	UP(1)	NA	<2.00	66.0	NA	<0.20	18.0	NA	NA
NB1S	UP(2)	NA	34.0	86.0	NA	<5.00	46.0	NA	NA
201	DOWN - B(3)	<2.50	2.00	304	<1.50	<5.00	80.0	NA	NA
103	DOWN - C(3)	32.5	26.5	24.0	<1.50	<5.00	5.25	NA	NA
104	DOWN - C(3)	<60.0	<5.00	150	<5.00	<5.00	4.90	NA	NA
111	DOWN - C(3)	<60.0	<5.00	90.0	<5.00	<5.00	<10.0	<50.0	<20.0
205	DOWN - C(3)	2.50	14.0	108	<1.50	<5.00	364	NA	NA
406	DOWN - C(3)	<2.50	2.50	120	<1.50	<5.00	5.00	NA	NA
406	DOWN - C(4)	<4.00	<4.00	92.0	<2.00	<5.00	<10.0	NA	NA
408	DOWN - C(3)	<60.0	<5.00	310	<5.00	<5.00	370	NA	NA
408	DOWN - C(4)	<60.0	<5.00	340	<5.00	<5.00	310	NA	NA
501	DOWN - C(3)	<60.0	<5.00	290	<5.00	<5.00	24.0	NA	NA
502	DOWN - C(3)	<60.0	<5.00	380	<5.00	<5.00	2000	<50.0	15.0
502	DOWN - C(4)	<60.0	<5.00	390	2.88	<5.00	2500	20.0	18.0
602	DOWN - C(3)	<5.00	5.50	187	<1.50	<5.00	15.0	NA	NA
602	DOWN - C(4)	<4.00	<4.00	381	<2.00	<5.00	<10.0	NA	NA
604	DOWN - C(3)	<5.00	14.7	101	2.70	<5.00	<5.00	NA	NA
604	DOWN - C(4)	<4.00	6.00	144	<2.00	<5.00	<10.0	NA	NA
8605	DOWN - C(3)	<60.0	11.0	110	<5.00	<5.00	5.10	<50.0	<20.0
8607	DOWN - C(3)	<2.50	<2.00	94.5	<1.50	<5.00	<5.00	NA	NA
8607	DOWN - C(4)	<4.00	<4.00	70.0	<2.00	<5.00	<10.0	NA	NA
8609	DOWN - C(3)	<2.50	<2.00	179	<1.50	<5.00	<5.00	NA	NA
8609	DOWN - C(4)	<4.00	<4.00	183	<2.00	<5.00	<10.0	NA	NA
WNGSEEP	DOWN - D(3)	<15.0	<2.00	170	<1.50	<5.00	<5.00	NA	NA
105	DOWN - D(3)	<5.00	13.8	228	<1.50	<5.00	12.0	NA	NA
106	DOWN - D(3)	<5.00	<2.50	133	<1.50	<5.00	52.5	NA	NA

NA - Not available.

Table E - 14 (continued)
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
Sand and Gravel										
301	UP(3)	<1.50	<0.20	366	<2.50	<0.50	<2.50	NA	NA	NA
301	UP(4)	2.00	<0.20	311	<4.00	<0.50	<4.00	NA	NA	NA
401	UP(3)	14.0	<0.20	498	<1.50	<0.50	<2.00	NA	NA	NA
401	UP(4)	18.0	<0.20	512	<4.00	<0.50	<4.00	NA	NA	NA
403	UP(3)	2.00	<0.20	13.5	<1.50	<0.50	<2.00	NA	NA	NA
403	UP(4)	<1.00	<0.20	3230	<1.50	<0.25	<1.50	NA	NA	NA
706	UP(1)	9.00	<0.20	NA	<1.70	<0.17	NA	NA	NA	NA
706	UP(2)	35.0	<0.19	NA	<2.50	<5.00	NA	NA	NA	NA
706	UP(3)	9.00	<0.20	<10.0	<1.50	<0.25	<2.00	NA	NA	NA
706	UP(4)	4.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
NB1S	UP(1)	1.00	<0.20	NA	<1.50	NR	NA	NA	NA	NA
NB1S	UP(2)	17.0	<0.19	NA	24.0	<5.00	NA	NA	NA	NA
201	DOWN - B(3)	1.50	<0.20	232	<1.50	<0.25	<2.00	NA	NA	NA
103	DOWN - C(3)	1.75	0.22	16.0	<1.50	<0.50	<1.50	NA	NA	NA
104	DOWN - C(3)	<3.00	<0.10	<40.0	<5.00	<10.0	<10.0	NA	NA	NA
111	DOWN - C(3)	2.70	<0.10	<40.0	<5.00	10.0	<10.0	<100	<50.0	14.0
205	DOWN - C(3)	18.5	<0.20	83.0	7.00	7.90	3.00	NA	NA	NA
406	DOWN - C(3)	3.00	<0.20	27.5	<1.50	<0.50	<1.50	NA	NA	NA
406	DOWN - C(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
408	DOWN - C(3)	3.40	<0.10	240	<5.00	<10.0	3.00	NA	NA	NA
408	DOWN - C(4)	<3.00	0.10	380	<5.00	<10.0	<10.0	NA	NA	NA
501	DOWN - C(3)	1.40	0.055	33.0	<5.00	5.50	<10.0	NA	NA	NA
502	DOWN - C(3)	1.90	<0.10	81.0	2.80	<10.0	<10.0	NA	7.80	19.0
502	DOWN - C(4)	<3.00	0.071	110	<5.00	<10.0	<10.0	NA	6.15	9.90
602	DOWN - C(3)	2.70	<0.20	11.6	<2.50	<0.50	5.40	NA	NA	NA
602	DOWN - C(4)	34.0	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
604	DOWN - C(3)	1.60	<0.20	<10.0	2.70	<0.50	<2.50	NA	NA	NA
604	DOWN - C(4)	7.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
8605	DOWN - C(3)	2.50	0.054	<40.0	<5.00	<10.0	<10.0	<100	<50.0	21.0
8607	DOWN - C(3)	<1.50	<0.20	<10.0	<1.50	<0.50	<1.50	NA	NA	NA
8607	DOWN - C(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
8609	DOWN - C(3)	<1.50	<0.20	<10.0	<1.50	<0.50	<1.50	NA	NA	NA
8609	DOWN - C(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
WNGSEEP	DOWN - D(3)	<1.00	<0.20	<10.0	<1.50	<0.50	<2.00	NA	NA	NA
105	DOWN - D(3)	<1.50	<0.20	17.0	4.10	<0.50	6.00	NA	NA	NA
106	DOWN - D(3)	5.60	<0.20	76.7	<2.50	<0.50	<2.50	NA	NA	NA

NA - Not available.
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.

Table E - 14 (continued)
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Sand and Gravel									
116	DOWN - D(3)	18.0	<2.50	178	<1.50	<5.00	1920	NA	NA
605	DOWN - D(3)	48.9	<2.50	191	<1.50	<5.00	2940	NA	NA
605	DOWN - D(4)	<4.00	<4.00	142	<2.00	<5.00	1580	NA	NA
801	DOWN - D(3)	<60.0	3.90	210	<5.00	<5.00	25.0	NA	NA
802	DOWN - D(3)	<5.00	<2.50	508	<1.50	<5.00	7.00	NA	NA
803	DOWN - D(3)	<2.50	2.50	276	<1.50	<5.00	8.50	<15.0	5.50
804	DOWN - D(3)	<2.50	2.00	132	<1.50	<5.00	25.0	NA	NA
905	DOWN - D(3)	<15.0	3.25	<15.0	<1.50	<5.00	<5.00	NA	NA
905	DOWN - D(4)	<4.00	<4.00	<20.0	<2.00	<5.00	<10.0	NA	NA
8603	DOWN - D(3)	<2.50	<2.00	224	<1.50	<5.00	<5.00	NA	NA
8604	DOWN - D(3)	<60.0	<5.00	305	<5.00	<5.00	<10.0	NA	NA
8612	DOWN - D(3)	<15.0	<2.00	198	<1.50	<5.00	<5.00	<15.0	5.00
Till-Sand									
302	UP(3)	<5.00	<2.50	586	<1.50	<5.00	6.75	NA	NA
302	UP(4)	<4.00	<4.00	567	<2.00	<5.00	<10.0	NA	NA

NA - Not available.

Table E - 14 (continued)
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
Sand and Gravel										
116	DOWN - D(3)	5.20	<0.20	101	<2.50	<0.50	<2.50	NA	NA	NA
605	DOWN - D(3)	6.20	<0.20	2370	<2.50	<0.50	<2.50	NA	NA	NA
605	DOWN - D(4)	4.00	<0.20	1100	<4.00	<0.50	<4.00	NA	NA	NA
801	DOWN - D(3)	6.80	0.069	18.0	<5.00	7.30	<10.0	NA	NA	NA
802	DOWN - D(3)	<1.50	<0.20	36.7	2.50	<0.50	<2.50	NA	NA	NA
803	DOWN - D(3)	2.00	<0.20	34.5	<1.50	<0.50	<2.00	<1250	<5.00	29.0
804	DOWN - D(3)	3.00	<0.20	26.0	<1.50	<0.50	<1.50	NA	NA	NA
905	DOWN - D(3)	1.00	<0.20	11.0	1.50	<0.50	<2.00	NA	NA	NA
905	DOWN - D(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
8603	DOWN - D(3)	<1.50	<0.20	<10.0	<1.50	<0.50	<1.50	NA	NA	NA
8604	DOWN - D(3)	<3.00	0.084	<40.0	<5.00	7.95	<10.0	NA	NA	NA
8612	DOWN - D(3)	3.50	<0.20	<10.0	<1.50	<0.50	<1.50	<1250	<5.00	12.0
Till-Sand										
302	UP(3)	<1.50	<0.20	<10.0	<2.50	<0.50	<2.50	NA	NA	NA
302	UP(4)	6.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA

NA - Not available.

Table E - 14 (continued)
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Unweathered Till									
110	DOWN - B(3)	<5.00	<2.50	185	<1.50	<5.00	<5.00	NA	NA
704	DOWN - B(3)	<15.0	2.00	78.0	<1.50	<5.00	<5.00	NA	NA
707	DOWN - B(3)	<15.0	135	118	<1.50	<5.00	135	NA	NA
707	DOWN - B(4)	<4.00	<4.00	220	<2.00	<5.00	108	NA	NA
107	DOWN - C(3)	<5.00	<2.50	45.4	<1.50	<5.00	5.50	NA	NA
108	DOWN - C(3)	<5.00	<2.50	61.4	<1.50	<5.00	6.00	NA	NA
910	DOWN - C(3)	<2.50	2.00	16.0	<1.50	<5.00	<5.00	NA	NA
910	DOWN - C(4)	<4.00	<4.00	<20.0	<2.00	6.00	<10.0	NA	NA
Kent Recessional Deposits									
901	UP(3)	<2.50	3.50	585	<1.50	<5.00	<5.00	NA	NA
901	UP(4)	<4.00	<4.00	603	<2.00	<5.00	<10.0	NA	NA
1008B	UP(3)	<2.50	<2.00	432	<1.50	<5.00	<5.00	NA	NA
1008B	UP(4)	<4.00	<4.00	394	<2.00	<5.00	<10.0	NA	NA
903	DOWN - B(3)	<15.0	2.00	53.5	<1.50	<5.00	<5.00	NA	NA
903	DOWN - B(4)	<4.00	<4.00	45.0	<2.00	<5.00	<10.0	NA	NA
8611	DOWN - B(3)	<2.50	<2.00	27.5	<1.50	<5.00	7.50	NA	NA
8611	DOWN - B(4)	<4.00	<4.00	23.0	<2.00	<5.00	15.0	NA	NA
Weathered Till									
908	UP(3)	<15.0	4.50	<75.0	<1.50	<5.00	6.00	NA	NA
908	UP(4)	<4.00	<4.00	<20.0	<2.00	<5.00	<10.0	NA	NA
1005	UP(3)	<2.50	<2.00	86.0	<1.50	<5.00	5.00	NA	NA
1005	UP(4)	<4.00	<4.00	88.0	<2.00	<5.00	<10.0	NA	NA
1008C	UP(3)	<2.50	3.50	314	<1.50	<5.00	<5.00	NA	NA
1008C	UP(4)	<4.00	<4.00	263	<2.00	<5.00	<10.0	NA	NA
906	DOWN - B(3)	<15.0	2.50	54.5	<1.50	<5.00	<5.00	NA	NA
906	DOWN - B(4)	<4.00	<4.00	59.0	<2.00	<5.00	<10.0	NA	NA
1006	DOWN - B(3)	<2.50	3.00	<15.0	<1.50	<5.00	<5.00	NA	NA
1006	DOWN - B(4)	<4.00	<4.00	<20.0	<2.00	<5.00	<10.0	NA	NA
WNNDATR	DOWN - C(3)	<15.0	<2.50	90.0	<1.50	<5.00	<5.00	<5.00	6.00
WNNDATR	DOWN - C(4)	<4.00	<4.00	85.0	<2.00	<5.00	<10.0	<30.0	7.50
909	DOWN - C(3)	<15.0	3.00	129	<1.50	<5.00	<5.00	<15.0	15.0
909	DOWN - C(4)	<4.00	<4.00	84.0	<2.00	<5.00	<10.0	NA	NA

NA - Not available.

Table E - 14 (concluded)
RCRA Hazardous Constituent List and Appendix IX Metals (μg/L) Sampling Results

Location Code	Hydraulic Position	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Tin	Vanadium	Zinc
Unweathered Till										
110	DOWN - B(3)	<1.50	<0.20	<10.0	<2.50	<0.50	<2.50	NA	NA	NA
704	DOWN - B(3)	1.00	<0.20	65.5	<1.50	<0.50	<2.00	NA	NA	NA
707	DOWN - B(3)	35.5	<0.20	21.0	44.5	<0.50	115	NA	NA	NA
707	DOWN - B(4)	17.0	<0.20	273	<4.00	<0.50	<4.00	NA	NA	NA
107	DOWN - C(3)	<1.50	<0.20	<10.0	<2.50	<0.50	2.60	NA	NA	NA
108	DOWN - C(3)	1.80	<0.20	<10.0	<2.50	<0.50	<2.50	NA	NA	NA
910	DOWN - C(3)	<1.50	<0.20	<10.0	2.00	<0.50	<1.50	NA	NA	NA
910	DOWN - C(4)	3.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
Kent Recessional Deposits										
901	UP(3)	<1.50	<0.20	12.0	<1.50	<0.50	<1.50	NA	NA	NA
901	UP(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
1008B	UP(3)	2.00	<0.20	<10.0	<1.50	<0.50	<1.50	NA	NA	NA
1008B	UP(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
903	DOWN - B(3)	1.50	<0.20	<10.0	<1.50	<0.50	<2.00	NA	NA	NA
903	DOWN - B(4)	6.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
8611	DOWN - B(3)	4.50	<0.20	15.0	<1.50	<0.50	<1.50	NA	NA	NA
8611	DOWN - B(4)	16.0	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
Weathered Till										
908	UP(3)	4.50	<0.20	14.0	1.50	<0.50	<2.00	NA	NA	NA
908	UP(4)	8.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
1005	UP(3)	<1.50	<0.20	<10.0	<1.50	<0.50	<1.50	NA	NA	NA
1005	UP(4)	2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
1008C	UP(3)	<1.50	<0.20	21.5	<1.50	<0.50	<1.50	NA	NA	NA
1008C	UP(4)	<2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
906	DOWN - B(3)	1.00	0.22	<10.0	3.50	<0.50	<2.00	NA	NA	NA
906	DOWN - B(4)	4.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
1006	DOWN - B(3)	<1.50	<0.20	10.0	<1.50	<0.50	<1.50	NA	NA	NA
1006	DOWN - B(4)	2.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA
WNNDATR	DOWN - C(3)	<1.50	<0.20	<10.0	<2.50	<0.50	<2.50	<1250	<5.00	<5.00
WNNDATR	DOWN - C(4)	4.00	<0.20	<30.0	<4.00	<0.50	<4.00	<1000	<50.0	12.5
909	DOWN - C(3)	<1.50	<0.20	23.5	<1.50	<0.50	<1.50	<1250	<5.00	18.0
909	DOWN - C(4)	3.00	<0.20	<30.0	<4.00	<0.50	<4.00	NA	NA	NA

NA - Not available.

Table E - 15
Alpha- and Beta-emitting Radioisotopic Results (μCi/mL)

Location Code	Hydraulic Position	C-14	I-129	Ra-226
Sand and Gravel				
401	A (3)	-2.45±5.37E-09	1.01±1.36E-09	2.23±0.90E-10
406	C (3)	-2.83±5.38E-09	4.24±7.43E-10	1.65±1.00E-10
408	C (3)	-1.33±5.43E-09	0.22±1.15E-09	1.95±0.82E-09
905	D (3)	2.12±0.60E-08	0.93±1.53E-09	2.60±1.16E-10
Weathered Till				
WNNDATR	C (3)	4.69±0.66E-08	3.58±9.40E-10	1.15±0.93E-10
909	C (3)	8.17±5.84E-09	3.35±2.21E-09	3.26±1.32E-10

Location Code	Hydraulic Position	Ra-228	Sr-90	Tc-99	U-232
Sand and Gravel					
401	A (3)	-2.11±0.53E-09	3.23±1.74E-09	-1.06±0.08E-08	0.00±7.07E-11
111	C (3)	NA	3.29±0.04E-06	NA	NA
406	C (3)	-2.22±0.40E-09	5.27±2.40E-09	8.49±1.88E-09	0.00±1.06E-10
408	C (3)	1.87±2.57E-08	2.35±0.00E-04	3.25±0.38E-08	0.00±5.61E-11
501	C (3)	NA	6.55±0.04E-05	NA	NA
502	C (3)	NA	5.42±0.03E-05	NA	NA
602	C (3)	NA	1.22±0.29E-08	NA	NA
8605	C (3)	NA	9.54±0.07E-06	NA	NA
8609	C (3)	NA	1.70±0.10E-07	NA	NA
116	D (3)	NA	7.79±0.51E-08	NA	NA
605	D (3)	NA	2.62±0.41E-08	NA	NA
801	D (3)	NA	1.64±0.03E-06	NA	NA
801	D (4)	NA	2.08±0.03E-06	NA	NA
905	D (3)	1.19±0.47E-09	2.62±2.22E-09	-8.38±0.80E-09	0.34±2.14E-10
8603	D (3)	NA	1.95±0.10E-07	NA	NA
Weathered Till					
WNNDATR	C (3)	-2.73±0.46E-09	2.74±0.40E-08	-7.66±0.93E-09	0.00±2.86E-10
909	C (3)	-3.46±5.21E-10	8.84±0.70E-08	-8.52±1.22E-09	1.84±0.22E-10

Location Code	Hydraulic Position	U-233/234	U-235/236	U-238	Total U (μg/mL)
Sand and Gravel					
401	A (3)	1.61±0.80E-10	0.92±1.85E-11	1.52±0.78E-10	-6.75±0.13E-05
406	C (3)	2.13±1.05E-10	1.01±3.23E-11	1.02±0.70E-10	8.59±0.18E-05
408	C (3)	4.45±1.03E-10	4.07±3.10E-11	3.12±0.84E-10	0.00±3.04E-03
905	D (3)	4.56±0.57E-09	1.68±0.80E-10	3.38±0.46E-09	9.48±0.12E-03
Weathered Till					
WNNDATR	C (3)	1.99±0.32E-09	7.73±6.01E-11	1.48±0.26E-09	4.94±0.07E-03
909	C (3)	2.24±0.37E-09	8.12±6.76E-11	1.81±0.32E-09	4.86±0.06E-03

NA - Not analyzed.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

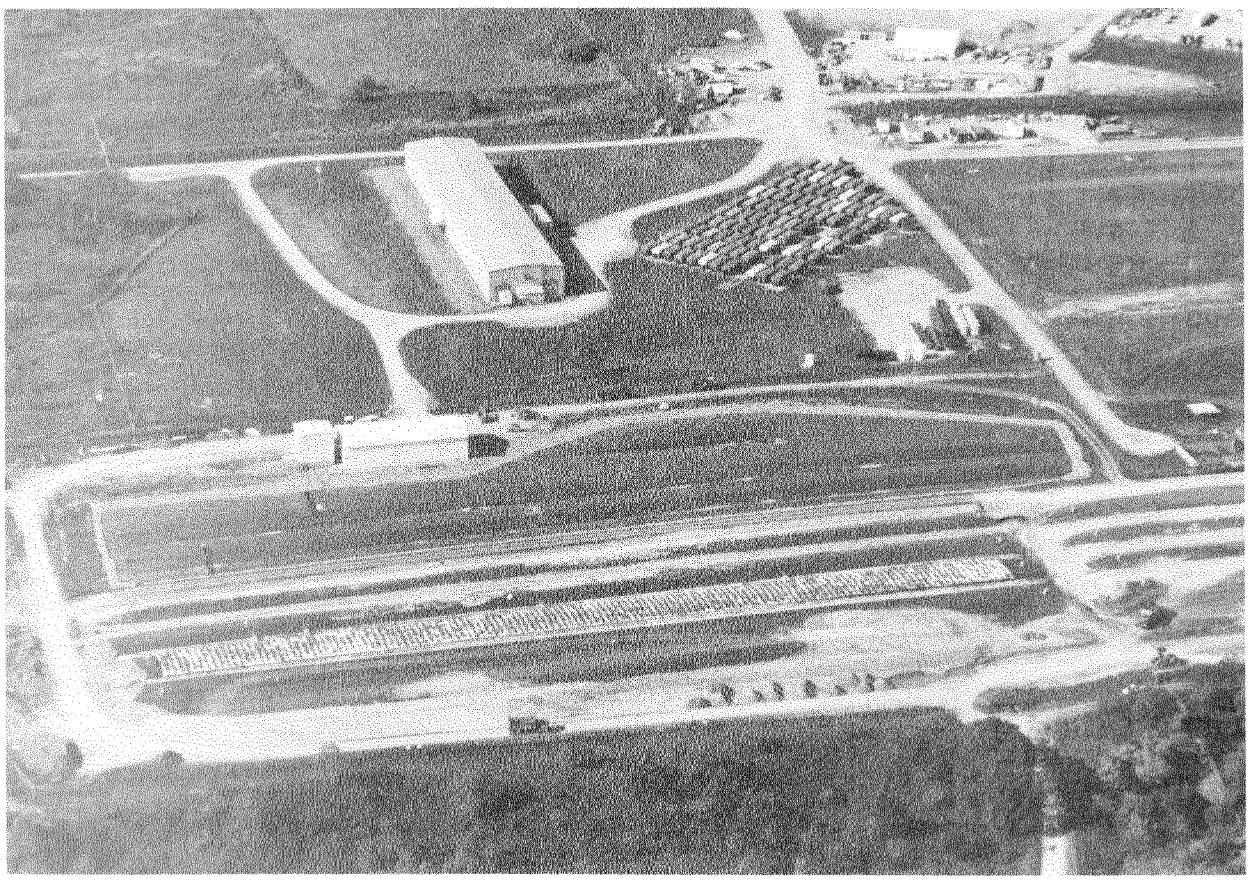
Table E - 16

1995 Radiological Concentrations (µCi/mL) at Well Points

Location	Alpha	Beta	H-3	Cs-137	Co-60	K-40
WP-A	2.49±4.88E-10	3.85±0.52E-08	1.59±0.05E-05	0.00±1.33E-08	0.00±2.07E-08	0.00±1.90E-07
WP-C	2.47±4.84E-10	4.71±0.56E-08	8.65±0.26E-05	0.00±1.72E-08	0.00±1.80E-08	0.00±2.17E-07
WP-D	-1.02±1.48E-09	1.15±0.02E-06	2.00±0.84E-07	0.00±1.54E-08	0.00±1.84E-08	0.87±1.03E-07
WP-E	-2.13±2.56E-09	2.56±0.01E-05	3.91±0.87E-07	0.00±1.72E-08	0.00±1.70E-08	0.00±1.98E-07
WP-F	1.38±1.94E-08	4.09±0.01E-04	3.15±0.86E-07	0.00±3.04E-08	0.00±2.29E-08	0.00±2.08E-07
WP-G	-1.42±2.08E-09	4.80±0.57E-08	3.12±0.15E-06	0.00±9.35E-09	0.00±1.24E-08	0.00±1.56E-07
WP-H	-1.14±5.89E-09	8.92±0.28E-07	1.28±0.04E-05	0.00±1.51E-08	0.00±1.80E-08	0.00±2.31E-07

Appendix F

Summary of NYSERDA Groundwater Monitoring Data



An Aerial View of the New York State-licensed Disposal Area

Table F - 1

1995 SDA Contamination Indicator Results for the Unweathered Lavery Till Unit

Location Code	Hydraulic Position	pH	Conductivity *μmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *μCi/mL*	Gross Beta *μCi/mL*	Tritium *μCi/mL*	Cs-137 *μCi/mL*	Co-60 *μCi/mL*
1101B	DOWN - B(1)	7.13	481	<1.0	<0.005	5.10±2.80E-09	5.30±2.50E-09	0.00±6.97E-08	0.00±1.60E-08	0.00±1.70E-08
1101B	DOWN - B(2)	7.28	734	<1.0	<0.005	3.50±2.60E-09	2.90±2.80E-09	0.00±9.00E-08	0.00±2.00E-08	0.00±2.00E-08
1101B	DOWN - B(3)	7.45	776	<1.0	<0.005	3.00±2.60E-09	0.00±5.00E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1101B	DOWN - B(4)	7.15	729	<1.0	<0.005	1.00±0.70E-08	7.70±3.90E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1106B	DOWN - B(1)	7.10	1089	<1.0	<0.005	4.70±2.90E-09	4.20±2.50E-09	0.00±6.97E-08	0.00±1.10E-08	0.00±1.30E-08
1106B	DOWN - B(2)	7.28	551	1.9	<0.005	2.50±2.30E-09	2.90±2.60E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1106B	DOWN - B(3)	7.54	718	1.6	<0.005	1.40±1.10E-09	1.10±1.00E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1106B	DOWN - B(4)	7.15	804	2.2	<0.005	1.40±0.50E-08	8.40±3.90E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1109B	DOWN - B(1)	7.43	794	<1.0	<0.005	2.70±2.10E-09	2.80±2.40E-09	5.24±0.98E-07	0.00±9.70E-09	0.00±1.20E-08
1109B	DOWN - B(2)	7.58	619	<1.0	<0.005	2.05±1.40E-09	2.20±3.30E-09	4.30±1.60E-07	0.00±2.00E-08	0.00±2.00E-08
1109B	DOWN - B(3)	7.37	506	<1.0	<0.005	2.60±2.20E-09	0.00±5.00E-09	6.30±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1109B	DOWN - B(4)	7.25	491	1.1	0.006	6.55±4.36E-09	6.05±3.80E-09	4.85±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1102B	DOWN - C(1)	7.28	289	<1.0	0.028	0.00±2.00E-09	2.10±1.20E-09	0.00±6.97E-08	0.00±1.60E-08	0.00±1.90E-08
1102B	DOWN - C(2)	7.33	384	<1.0	<0.005	0.00±2.00E-09	1.30±0.40E-08	0.00±9.00E-08	0.00±2.00E-08	0.00±2.00E-08
1102B	DOWN - C(3)	7.60	594	1.2	<0.005	2.00±0.90E-09	0.00±3.00E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1102B	DOWN - C(4)	7.10	617	<1.0	<0.005	3.30±3.00E-09	5.80±3.60E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1103B	DOWN - C(1)	7.12	707	<1.0	<0.005	4.60±2.10E-09	0.00±4.00E-09	0.00±6.97E-08	0.00±1.70E-08	0.00±1.60E-08
1103B	DOWN - C(2)	7.37	734	<1.0	0.006	2.50±2.30E-09	4.60±2.50E-09	0.00±9.00E-08	0.00±1.00E-08	0.00±2.00E-08
1103B	DOWN - C(3)	7.62	662	<1.0	<0.005	3.40±1.60E-09	0.00±5.00E-09	0.00±1.00E-07	0.00±1.00E-08	0.00±2.00E-08
1103B	DOWN - C(4)	7.16	698	<1.0	<0.005	4.90±3.70E-09	4.10±3.60E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1104B	DOWN - C(1)	6.90	1001	<1.0	<0.005	6.70±3.50E-09	3.70±2.50E-09	0.00±6.97E-08	0.00±1.70E-08	0.00±1.80E-08
1104B	DOWN - C(2)	7.38	567	<1.0	<0.005	7.20±3.30E-09	8.10±2.70E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1104B	DOWN - C(3)	7.21	628	<1.0	<0.005	4.10±2.33E-09	1.95±2.79E-09	0.00±1.00E-07	0.00±1.58E-08	0.00±2.00E-08
1104B	DOWN - C(4)	7.28	599	1.3	<0.005	6.90±3.90E-09	4.20±3.60E-09	0.00±1.00E-07	0.00±1.00E-08	0.00±2.00E-08
1105A	DOWN - C(1)	7.13	829	<1.0	<0.005	5.40±3.10E-09	3.20±2.40E-09	6.00±5.10E-08	0.00±1.60E-08	0.00±1.60E-08
1105A	DOWN - C(2)	7.41	746	<1.0	<0.005	4.20±2.80E-09	0.00±5.00E-09	0.00±9.00E-08	0.00±2.00E-08	0.00±2.00E-08
1105A	DOWN - C(3)	7.33	847	1.7	0.005	2.80±1.50E-09	0.00±3.00E-09	1.60±0.60E-07	0.00±9.00E-09	0.00±2.00E-08
1105A	DOWN - C(4)	7.16	798	6.9	<0.005	1.10±0.50E-08	6.90±3.80E-09	9.70±5.50E-08	0.00±2.00E-08	0.00±2.00E-08
1105B	DOWN - C(1)	7.18	1376	<1.0	<0.005	1.10±0.40E-08	3.00±2.40E-09	0.00±6.97E-08	0.00±1.10E-08	0.00±1.30E-08
1105B	DOWN - C(2)	7.52	954	5.6	<0.005	4.60±2.10E-09	0.00±4.00E-09	0.00±9.00E-08	0.00±1.00E-08	0.00±2.00E-08
1105B	DOWN - C(3)	7.27	917	1.7	<0.005	6.40±1.80E-09	0.00±3.00E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1105B	DOWN - C(4)	7.13	883	<1.0	<0.005	1.00±0.50E-08	1.00±0.40E-08	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08

Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 2

1995 SDA Contamination Indicator Results for the Kent Recessional Sequence

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	Tritium *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
1101C	DOWN - B(1)	7.11	857	2.6	0.014	4.70±2.80E-09	3.40±2.40E-09	0.00±6.97E-08	0.00±1.80E-08	0.00±1.80E-08
1101C	DOWN - B(2)	7.55	413	2.6	<0.005	1.70±1.50E-09	0.00±5.00E-09	0.00±9.00E-08	0.00±2.00E-08	0.00±2.00E-08
1101C	DOWN - B(3)	7.78	412	1.6	<0.005	3.80±1.50E-09	2.90±2.60E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1101C	DOWN - B(4)	7.35	410	4.9	<0.005	4.20±3.00E-09	4.30±3.50E-09	9.20±5.20E-08	0.00±2.00E-08	0.00±2.00E-08
1103C	DOWN - C(1)	7.60	462	NA	NA	3.90±2.90E-09	1.40±0.30E-08	0.00±6.97E-08	NA	NA
1103C	DOWN - C(2)	NA	NA	NA	NA	0.00±2.00E-09	9.50±5.00E-09	0.00±1.00E-07	NA	NA
1103C	DOWN - C(3)					*Not sampled (dry)*				
1103C	DOWN - C(4)	NA	NA	NA	NA	4.70±4.40E-09	1.50±0.60E-08	0.00±1.00E-07	NA	NA
1104C	DOWN - C(1)	6.98	NA	2.2	<0.005	9.50±6.60E-09	8.20±4.80E-09	0.00±6.97E-08	NA	NA
1104C	DOWN - C(2)	NA	NA	7.2	NA	8.10±4.00E-09	1.50±0.20E-08	0.00±1.00E-07	NA	NA
1104C	DOWN - C(3)	7.17	1547	5.9	NA	8.00±2.60E-09	9.90±3.60E-09	0.00±1.00E-07	NA	NA
1104C	DOWN - C(4)	6.83	NA	NA	0.012	0.00±2.00E-09	3.70±3.00E-09	0.00±1.00E-07	NA	NA

NA - Not available.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 3

1995 SDA Contamination Indicator Results for the Weathered Lavery Till Unit

Location Code	Hydraulic Position	pH	Conductivity *µmhos/cm@25°C*	TOC *mg/L*	TOX *mg/L*	Gross Alpha *µCi/mL*	Gross Beta *µCi/mL*	Tritium *µCi/mL*	Cs-137 *µCi/mL*	Co-60 *µCi/mL*
1101A	DOWN - B(1)	7.24	335	<1.0	0.007	4.80±3.50E-09	4.00±3.70E-09	0.00±6.97E-08	0.00±1.00E-08	0.00±1.10E-08
1101A	DOWN - B(2)	7.27	637	<1.0	<0.005	3.30±2.40E-09	0.00±4.00E-09	0.00±9.00E-08	0.00±1.00E-08	0.00±2.00E-08
1101A	DOWN - B(3)	7.20	615	<1.0	<0.005	4.00±2.00E-09	0.00±5.00E-09	1.40±0.60E-07	0.00±2.00E-08	0.00±2.00E-08
1101A	DOWN - B(4)	7.16	603	<1.0	<0.005	6.50±3.80E-09	3.70±3.50E-09	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1106A	DOWN - B(1)	7.27	938	<1.0	<0.005	6.00±2.80E-09	3.10±2.40E-09	9.30±1.10E-07	0.00±1.60E-08	0.00±1.80E-08
1106A	DOWN - B(2)	7.29	380	<1.0	<0.005	7.30±1.90E-09	6.20±2.40E-09	1.00±0.10E-06	0.00±2.00E-08	0.00±2.00E-08
1106A	DOWN - B(3)	7.68	704	<1.0	0.005	7.20±5.60E-09	0.00±6.00E-09	9.30±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1106A	DOWN - B(4)	7.15	761	<1.0	<0.005	1.10±0.50E-08	6.10±3.70E-09	7.50±2.00E-07	0.00±2.00E-08	0.00±2.00E-08
1108A	DOWN - B(1)	7.05	992	1.8	<0.005	9.70±5.70E-09	0.00±6.00E-09	0.00±6.97E-08	0.00±1.50E-08	0.00±1.90E-08
1108A	DOWN - B(2)	7.23	1206	1.6	<0.005	7.60±4.00E-09	4.00±2.70E-09	1.30±0.60E-07	0.00±2.00E-08	0.00±2.00E-08
1108A	DOWN - B(3)	6.19	1133	1.4	0.016	1.00±0.20E-08	4.40±1.00E-09	1.50±0.60E-07	0.00±1.00E-08	0.00±2.00E-08
1108A	DOWN - B(4)	6.85	1086	<1.0	<0.005	1.40±0.60E-08	5.70±3.80E-09	1.80±0.60E-07	0.00±2.00E-08	0.00±2.00E-08
1109A	DOWN - B(1)	7.13	842	<1.0	<0.005	8.50±4.50E-09	1.00±0.40E-08	3.60±0.96E-07	0.00±1.10E-08	0.00±1.30E-08
1109A	DOWN - B(2)	7.25	644	<1.0	0.011	5.70±3.20E-09	6.50±2.60E-09	2.80±0.90E-07	0.00±2.00E-08	0.00±2.00E-08
1109A	DOWN - B(3)	7.21	798	<1.0	<0.005	4.40±2.80E-09	0.00±5.00E-09	4.70±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1109A	DOWN - B(4)	7.06	743	<1.0	<0.005	1.40±0.50E-08	1.10±0.40E-08	4.20±1.30E-07	0.00±2.00E-08	0.00±2.00E-08
1102A	DOWN - C(1)	7.13	730	<1.0	0.007	1.10±0.50E-08	0.00±7.00E-09	1.78±0.14E-07	0.00±1.10E-08	0.00±1.40E-08
1102A	DOWN - C(2)	7.33	341	<1.0	0.007	4.00±2.40E-09	0.00±3.00E-09	3.50±1.60E-07	0.00±2.00E-08	0.00±2.00E-08
1102A	DOWN - C(3)	7.17	782	<1.0	<0.005	2.30±1.60E-09	3.40±1.30E-09	2.80±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1102A	DOWN - C(4)	7.14	771	<1.0	<0.005	7.90±4.20E-09	3.90±3.60E-09	2.70±1.30E-07	0.00±2.00E-08	0.00±2.00E-08
1103A	DOWN - C(1)	7.03	1162	<1.0	<0.005	1.50±0.60E-08	0.00±7.00E-09	4.56±0.98E-07	0.00±1.70E-08	0.00±1.70E-08
1103A	DOWN - C(2)	7.29	911	<1.0	0.007	9.30±2.80E-09	3.20±2.70E-09	3.70±1.60E-07	0.00±2.00E-08	0.00±2.00E-08
1103A	DOWN - C(3)	7.17	911	1.1	0.012	4.90±1.40E-09	4.50±1.30E-09	4.50±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1103A	DOWN - C(4)	7.14	878	1.1	0.007	9.60±4.80E-09	5.90±3.70E-09	4.10±0.70E-07	0.00±2.00E-08	0.00±2.00E-08
1104A	DOWN - C(1)	7.01	1094	<1.0	0.015	1.20±0.50E-08	1.60±0.40E-08	1.70±0.14E-07	0.00±1.60E-08	0.00±1.70E-08
1104A	DOWN - C(2)	7.82	674	<1.0	<0.005	6.70±1.60E-09	3.90±2.60E-09	1.40±0.60E-07	0.00±2.00E-08	0.00±2.00E-08
1104A	DOWN - C(3)	7.15	723	1.1	<0.005	2.30±0.70E-09	1.20±1.00E-09	2.60±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1104A	DOWN - C(4)	7.26	595	5.6	0.008	1.00±0.40E-08	1.80±0.40E-08	0.00±1.00E-07	0.00±2.00E-08	0.00±2.00E-08
1107A	DOWN - C(1)	6.47	895	29.0	0.088	9.05±5.71E-09	1.25±0.35E-08	2.06±0.14E-05	0.00±1.40E-08	0.00±1.76E-08
1107A	DOWN - C(2)	6.95	1703	22.0	0.130	1.10±0.40E-08	1.60±0.30E-08	1.70±0.20E-05	0.00±2.00E-08	0.00±2.00E-08
1107A	DOWN - C(3)	6.72	1488	23.0	0.160	4.60±1.80E-09	1.50±0.20E-08	2.00±0.20E-05	0.00±2.00E-08	0.00±2.00E-08
1107A	DOWN - C(4)	6.74	1359	24.0	0.085	9.40±6.40E-09	1.30±0.40E-08	1.70±0.20E-05	0.00±2.00E-08	0.00±2.00E-08
1110A	DOWN - C(1)	6.93	1325	2.4	<0.005	1.70±0.70E-08	3.80±3.60E-09	6.00±5.10E-08	0.00±9.50E-09	0.00±1.10E-08
1110A	DOWN - C(2)	7.10	1326	1.3	<0.005	1.20±0.30E-08	3.30±2.50E-09	1.20±0.60E-07	0.00±2.00E-08	0.00±2.00E-08
1110A	DOWN - C(3)	6.80	1391	1.4	0.007	1.20±0.50E-08	3.90±3.90E-09	1.40±0.60E-07	0.00±8.00E-09	0.00±2.00E-08
1110A	DOWN - C(4)	6.79	1410	<1.0	<0.005	1.90±0.70E-08	1.00±0.40E-08	1.40±0.50E-07	0.00±2.00E-08	0.00±2.00E-08
1111A	DOWN - C(1)	6.92	994	<1.0	<0.005	8.70±5.10E-09	3.50±2.40E-09	8.50±5.10E-08	0.00±9.30E-09	0.00±1.20E-08
1111A	DOWN - C(2)	7.08	508	<1.0	0.026	6.10±2.70E-09	4.40±2.40E-09	2.60±1.50E-07	0.00±2.00E-08	0.00±2.00E-08
1111A	DOWN - C(3)	7.16	992	2.8	0.006	6.40±1.50E-09	3.00±1.30E-09	3.40±1.40E-07	0.00±2.00E-08	0.00±2.00E-08
1111A	DOWN - C(4)	6.88	959	1.2	0.006	1.10±0.50E-08	7.80±3.80E-09	1.10±0.60E-07	0.00±2.00E-08	0.00±2.00E-08

Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 4

1995 SDA Groundwater Quality Results (mg/L) for the Unweathered Lavery Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phenols	Phosphate	Silica	Sulfide
1101B	DOWN - B(2)	<1.0	140	0.50	<0.05	250	<1.0	<0.005	0.040	4.6	<1.0
1101B	DOWN - B(4)	<1.0	110	0.45	<0.05	260	<1.0	NA	0.033	4.7	<1.0
1106B	DOWN - B(2)	1.1	170	0.04	<0.05	300	<1.0	<0.005	0.25	5.0	1.4
1106B	DOWN - B(4)	<1.0	160	n/a	<0.05	310	<1.0	NA	0.12	5.4	<1.0
1109B	DOWN - B(2)	1.4	62.0	0.04	<0.05	190	<1.0	<0.005	0.034	5.1	1.0
1109B	DOWN - B(4)	1.0	67.0	0.12	<0.05	195	<1.0	NA	0.079	5.4	<1.0
1102B	DOWN - C(2)	<1.0	46.0	0.12	<0.05	280	<1.0	<0.005	0.029	5.6	1.2
1102B	DOWN - C(4)	1.2	98.0	0.10	<0.05	290	<1.0	NA	0.030	5.9	<1.0
1103B	DOWN - C(2)	<1.0	68.0	0.18	<0.05	290	<1.0	<0.005	<0.010	5.4	<1.0
1103B	DOWN - C(4)	<1.0	78.0	0.16	<0.05	300	<1.0	NA	0.036	5.3	<1.0
1104B	DOWN - C(2)	<1.0	100	0.51	<0.05	240	<1.0	<0.005	0.020	4.2	1.0
1104B	DOWN - C(4)	<1.0	98.0	0.19	<0.05	240	<1.0	NA	0.030	3.9	<1.0
1105A	DOWN - C(2)	1.7	220	0.49	<0.05	220	<1.0	NA	0.090	3.4	1.2
1105A	DOWN - C(4)	2.3	390	0.32	<0.05	210	<1.0	NA	0.89	3.7	1.4
1105B	DOWN - C(2)	1.7	280	0.74	<0.05	250	<1.0	NA	0.79	3.6	<1.0
1105B	DOWN - C(4)	1.2	450	0.89	<0.05	240	<1.0	NA	0.16	3.6	1.2

** as mg$CaCO_3$/L*
NA - Not available.
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 4 (concluded)

1995 SDA Groundwater Quality Results (mg/L) for the Unweathered Lavery Unit

Location	Hydraulic	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
Code	Position	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
1101B	DOWN - B(2)	100	100	30.0	30.0	23.0	24.0	2.30	2.30	0.540	0.160	0.021	<0.010	0.240	0.110
1101B	DOWN - B(4)	91.0	78.0	28.0	23.0	30.0	12.0	2.80	1.60	0.240	0.036	0.012	<0.010	0.210	<0.100
1106B	DOWN - B(2)	97.0	100	37.0	38.0	23.0	24.0	2.50	2.00	4.20	<0.030	0.059	0.010	2.20	<0.100
1106B	DOWN - B(4)	86.0	89.0	34.0	36.0	27.0	29.0	3.70	2.30	4.00	0.096	0.054	<0.010	3.80	<0.100
1109B	DOWN - B(2)	68.0	65.5	19.5	18.0	8.95	8.60	1.70	1.45	1.20	0.057	0.042	0.017	0.620	<0.100
1109B	DOWN - B(4)	57.5	59.0	16.5	17.0	10.0	10.0	1.45	1.25	0.870	0.058	0.022	<0.010	0.645	<0.100
1102B	DOWN - C(2)	71.0	74.0	28.0	30.0	13.0	13.0	2.00	1.80	1.10	<0.030	0.028	<0.010	0.510	<0.100
1102B	DOWN - C(4)	60.0	62.0	26.0	27.0	18.0	18.0	1.90	1.70	0.780	0.060	0.017	<0.010	0.540	<0.100
1103B	DOWN - C(2)	75.0	75.0	31.0	31.0	23.0	22.0	2.00	1.90	0.170	<0.030	0.018	0.011	<0.100	<0.100
1103B	DOWN - C(4)	67.0	67.0	30.0	30.0	29.0	29.0	2.10	2.00	0.450	0.140	0.022	<0.010	0.420	<0.100
1104B	DOWN - C(2)	77.0	78.0	24.0	24.0	23.0	22.0	1.50	1.70	0.045	<0.030	<0.010	<0.010	<0.100	<0.100
1104B	DOWN - C(4)	67.0	70.0	22.0	23.0	26.0	27.0	1.60	1.70	0.085	<0.030	<0.010	<0.010	<0.100	<0.100
1105A	DOWN - C(2)	140	120	38.0	24.0	20.0	20.0	6.20	1.80	54.0	<0.030	1.40	0.012	26.0	<0.100
1105A	DOWN - C(4)	150	110	43.0	23.0	26.0	25.0	13.0	1.70	61.0	<0.030	1.40	0.070	37.0	<0.100
1105B	DOWN - C(2)	200	120	55.0	28.0	29.0	28.0	7.50	2.10	77.0	<0.030	1.90	0.033	35.0	<0.100
1105B	DOWN - C(4)	170	120	45.0	28.0	40.0	38.0	13.0	2.10	48.0	<0.030	0.840	0.028	32.0	<0.100

** as* $mgCaC0_3/L$
NA - Not available.
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 5

1995 SDA Groundwater Quality Results (mg/L) for the Kent Recessional Sequence

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phenols	Phosphate	Silica	Sulfide
1101C	DOWN - B(2)	5.6	33.0	0.08	<0.05	180	<1.0	<0.005	2.4	5.1	3.1
1101C	DOWN - B(4)	1.2	61.0	0.09	<0.05	180	<1.0	NA	0.68	3.6	<1.0

Location Code	Hydraulic Position	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
		Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
1101C	DOWN - B(2)	400	100	120	34.0	25.0	6.80	9.00	2.10	150	0.400	4.20	0.024	50.0	0.250
1101C	DOWN - B(4)	220	47.0	78.0	8.40	33.0	28.0	16.0	2.30	200	0.031	2.80	0.076	70.0	<0.100

** as mgCaCO$_3$/L*
NA - Not available.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 6

1995 SDA Groundwater Quality Results (mg/L) for the Weathered Lavery Till Unit

Location Code	Hydraulic Position	Chloride	Sulfate	Nitrate + Nitrite-N	Ammonia	Bicarbonate Alkalinity*	Carbonate Alkalinity*	Phenols	Phosphate	Silica	Sulfide
1101A	DOWN - B(2)	1.6	80.0	0.14	<0.05	240	<1.0	<0.005	0.010	4.5	<1.0
1101A	DOWN - B(4)	1.8	80.0	0.14	<0.05	250	<1.0	NA	0.020	3.9	<1.0
1106A	DOWN - B(2)	3.0	120	0.02	<0.05	280	<1.0	<0.005	0.010	5.2	1.0
1106A	DOWN - B(4)	2.9	120	n/a	<0.05	300	<1.0	NA	0.029	5.2	<1.0
1108A	DOWN - B(2)	1.4	340	0.17	0.22	310	<1.0	<0.005	0.26	3.4	<1.0
1108A	DOWN - B(4)	1.3	380	0.05	<0.05	300	<1.0	NA	0.77	4.2	1.3
1109A	DOWN - B(2)	1.6	140	0.19	0.07	220	<1.0	<0.005	0.012	3.3	1.6
1109A	DOWN - B(4)	1.7	160	0.12	<0.05	240	<1.0	NA	0.020	3.7	<1.0
1102A	DOWN - C(2)	1.3	150	0.12	<0.05	260	<1.0	<0.005	0.023	4.4	<1.0
1102A	DOWN - C(4)	1.4	110	0.12	<0.05	260	<1.0	NA	0.030	5.0	<1.0
1103A	DOWN - C(2)	1.3	150	0.04	<0.05	340	<1.0	NA	0.038	5.9	<1.0
1103A	DOWN - C(4)	1.5	250	<0.01	<0.05	340	<1.0	NA	0.44	6.0	<1.0
1104A	DOWN - C(2)	2.2	150	0.10	<0.05	260	<1.0	<0.005	0.010	7.0	<1.0
1104A	DOWN - C(4)	2.2	120	0.08	<0.05	230	<1.0	NA	0.024	6.8	<1.0
1107A	DOWN - C(2)	6.9	580	0.03	<0.05	540	<1.0	<0.005	0.020	5.6	<1.0
1107A	DOWN - C(4)	7.4	220	<0.01	<0.05	640	<1.0	NA	0.019	7.2	<1.0
1110A	DOWN - C(2)	3.9	320	0.20	<0.05	460	<1.0	<0.005	0.26	5.1	2.6
1110A	DOWN - C(4)	2.9	400	0.22	<0.05	450	<1.0	NA	0.090	5.4	<1.0
1111A	DOWN - C(2)	<1.0	130	0.02	<0.05	410	<1.0	<0.005	0.014	6.1	1.6
1111A	DOWN - C(4)	1.2	100	0.02	<0.05	420	<1.0	NA	0.020	6.2	<1.0

** as mg$CaCO_3$/L*
NA - Not available.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 6 (concluded)

1995 SDA Groundwater Quality Results (mg/L) for the Weathered Lavery Till Unit

Location	Hydraulic	Calcium		Magnesium		Sodium		Potassium		Iron		Manganese		Aluminum	
Code	Position	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
1101A	DOWN - B(2)	89.0	90.0	24.0	24.0	9.60	10.0	1.60	1.60	0.110	<0.030	0.014	0.011	<0.100	<0.100
1101A	DOWN - B(4)	80.0	86.0	23.0	27.0	12.0	29.0	1.60	2.60	0.058	<0.030	<0.010	<0.010	<0.100	<0.100
1106A	DOWN - B(2)	94.0	96.0	36.0	36.0	10.0	9.50	2.00	2.10	0.630	0.070	0.019	0.013	0.110	<0.100
1106A	DOWN - B(4)	95.0	93.0	36.0	35.0	12.0	12.0	2.40	2.40	0.037	<0.030	0.055	0.016	<0.100	<0.100
1108A	DOWN - B(2)	150	160	52.0	53.0	17.0	18.0	3.80	3.40	7.00	<0.030	0.290	<0.010	3.30	<0.100
1108A	DOWN - B(4)	160	150	54.0	52.0	20.0	20.0	4.50	3.60	3.90	0.076	0.160	<0.010	2.40	<0.100
1109A	DOWN - B(2)	100	100	24.0	24.0	8.50	8.20	2.00	1.90	<0.030	<0.030	0.011	0.013	<0.100	<0.100
1109A	DOWN - B(4)	110	110	25.0	25.0	10.0	11.0	2.10	2.10	0.087	<0.030	<0.010	<0.010	<0.100	<0.100
1102A	DOWN - C(2)	52.0	100	8.60	34.0	23.0	6.00	3.10	2.20	<0.030	<0.030	0.066	<0.010	<0.100	<0.100
1102A	DOWN - C(4)	93.0	89.0	33.0	32.0	9.30	9.50	2.40	2.20	0.150	<0.030	<0.010	<0.010	0.140	<0.100
1103A	DOWN - C(2)	130	130	48.0	48.0	10.0	9.80	2.20	2.10	0.400	<0.030	0.038	0.014	0.260	<0.100
1103A	DOWN - C(4)	130	110	48.0	42.0	14.0	13.0	5.80	2.40	15.0	0.180	0.490	0.012	10.0	0.240
1104A	DOWN - C(2)	110	110	31.0	31.0	8.30	8.30	1.70	1.80	<0.030	<0.030	<0.010	<0.010	<0.100	<0.100
1104A	DOWN - C(4)	82.0	82.0	24.0	24.0	9.50	9.50	1.70	1.70	<0.030	<0.030	<0.010	<0.010	<0.100	<0.100
1107A	DOWN - C(2)	260	270	90.0	89.0	15.0	16.0	2.40	2.60	0.650	<0.030	9.70	6.80	0.240	0.140
1107A	DOWN - C(4)	210	220	74.0	74.0	13.0	13.0	2.40	2.50	0.130	<0.030	20.0	13.0	<0.100	<0.100
1110A	DOWN - C(2)	140	140	84.0	87.0	25.0	26.0	3.60	3.40	5.00	<0.030	0.400	0.014	2.30	<0.100
1110A	DOWN - C(4)	140	140	85.0	89.0	31.0	33.0	5.00	4.10	3.20	<0.030	0.180	<0.010	2.60	<0.100
1111A	DOWN - C(2)	120	130	53.0	54.0	13.0	13.0	2.40	2.50	0.220	<0.030	0.017	<0.010	0.150	<0.100
1111A	DOWN - C(4)	120	120	53.0	53.0	19.0	18.0	3.10	2.90	0.380	<0.030	0.015	0.024	0.360	<0.100

NA - Not available.
NR - Not reported. These results have not been reported because the data validation process indicated the data were not reliable.
Sample collection period (rep) noted in parenthesis next to hydraulic position.

Note: All data in Tables F-1 through F-7 have been provided by NYSERDA.

Table F - 7

1995 SDA Expanded Characterization Radioisotopic Results (μCi/mL)

Location Code	Hydraulic Position	Pb-212	Pb-214	Bi-214	Th-227
Kent Recessional Deposits					
1101C	B	9.00±5.00E-09	2.70±1.40E-08		
1101C	B	9.00±4.30E-09			
Unweathered Till					
1106B	B	7.50±3.90E-09			
1102B	C	1.40±0.60E-08	4.30±1.70E-08		
1103B	C	6.20±3.80E-09			
1105A	C	1.30±0.80E-08	3.90±2.20E-08		
Weathered Till					
1107A	C		6.50±1.02E-08	6.95±1.36E-08	
1107A	C		1.90±0.90E-08		
1111A	C	1.20±0.60E-08			3.50±1.70E-08

Location Code	Hydraulic Position	Th-234	U-235	Ra-224	Ra-226
Kent Recessional Deposits					
1101C	B	2.00±0.40E-07			
1101C	B	3.20±0.31E-07	1.70±0.41E-08	1.10±0.52E-07	2.70±0.68E-07
Unweathered Till					
1101B	B	3.10±0.33E-07	1.20±0.39E-08		1.90±0.64E-07
1106B	B	3.50±0.36E-07	2.00±0.39E-08	9.10±7.20E-08	
1109B	B	2.10±0.36E-07	9.10±5.98E-09		1.55±1.00E-07
1102B	C	2.90±0.31E-07	1.90±0.35E-08		3.20±0.57E-07
1103B	C	3.00±0.32E-07	2.10±0.36E-08	7.50±4.60E-08	
1104B	C	3.00±0.32E-07	1.60±0.37E-08		2.70±0.62E-07
1105A	C	2.90±0.45E-07	1.70±0.58E-08		2.70±0.95E-07
1105B	C	2.70±0.34E-07	1.60±0.36E-08		2.70±0.59E-07
Weathered Till					
1101A	B	2.50±0.47E-07	2.00±0.54E-08	3.30±0.89E-07	
1106A	B	3.00±0.33E-07	1.30±0.43E-08	2.10±0.70E-07	
1109A	B	2.50±0.44E-07	1.00±0.66E-08	1.70±1.10E-07	
1102A	C	2.30±0.44E-07	1.50±0.51E-08	2.50±0.84E-07	
1103A	C	2.60±0.47E-07	1.80±0.54E-08	3.00±0.89E-07	
1104A	C	2.30±0.48E-07	1.40±0.63E-08	2.20±1.00E-07	
1107A	C	2.10±0.50E-07	1.10±0.55E-08	1.80±0.91E-07	
1111A	C	2.50±0.47E-07	1.40±0.54E-08	2.40±0.88E-07	

Note: The concentrations reported above are near the detection limits for analyzing these radionuclides by gamma spectroscopy. Upon reanalyzing 25% of the December 1995 samples for gamma emitters, the radionuclides reported above were not detected. Thus, the presence of these nuclides during the initial December 1995 analysis could not be confirmed.

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Glossary

ACTION PLAN. An action plan addresses assessment findings and root causes identified in an audit or assessment report. It is intended to set forth specific actions that the site will undertake to remedy deficiencies. The plan includes a timetable and funding requirements for implementation of the planned activities.

ALLUVIUM. Sedimentary material deposited by flowing water such as a river.

ALLUVIAL FAN. A cone-shaped deposit of alluvium made by a stream where it runs out onto a level plain.

AQUIFER. A water-bearing unit of permeable rock or soil that will yield water in usable quantities to wells. *Confined aquifers* are bounded above and below by less permeable layers. Groundwater in a confined aquifer is under a pressure greater than the atmospheric pressure. *Unconfined aquifers* are bounded below by less permeable material but are not bounded above. The pressure on the groundwater in an unconfined aquifer at the top of the aquifer is equal to that of the atmosphere.

AS LOW AS REASONABLY ACHIEVABLE. Describes an approach to radiation protection to control or manage exposures (both individual and collective) to the work force and the general public and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. As used in DOE Order 5400.5, ALARA is not a dose limit but rather a process that has as its objective the attainment of dose levels as far below the applicable limits of the Order as practicable.

BACKGROUND RADIATION. Includes both natural and manmade radiation such as cosmic radiation and radiation from naturally radioactive elements and from commercial sources and medical procedures.

BECQUEREL (Bq). A unit of radioactivity equal to one nuclear transformation per second.

CLASS A, B, AND C LOW-LEVEL WASTE. Waste classifications from the Nuclear Regulatory Commission's 10 CFR Part 61 rule. Maximum concentration limits are set for specific isotopes. Class A waste disposal is minimally restricted with respect to the form of the waste. Class B waste must meet more rigorous requirements to ensure physical stability after disposal. Greater concentration limits are set for the same isotopes in Class C waste, which also must meet physical stability requirements. Moreover, special measures must be taken at the disposal facility to protect against inadvertent intrusion.

CLASS GA GROUNDWATERS. Class GA waters are fresh groundwaters that can be used as a source of potable water supply. The New York Code of Rules and Regulations, Title 6, Part 703.5, "Water quality standards for taste-, color-, and odor-producing toxic and other deleterious substances," specifies the standards for specific substances or groups of substances in Table 1 of subdivision (f).

COMPLIANCE FINDINGS. Conditions that may not satisfy applicable environmental or safety and health regulations, DOE Orders and memoranda, enforcement actions, agreements with regulatory agencies, or permit conditions.

CONFIDENCE COEFFICIENT OR FACTOR. The chance or probability, usually expressed as a percentage, that a confidence interval includes some defined parameter of a population. The confidence coefficients usually associated with confidence intervals are 90%, 95%, and 99%.

COSMIC RADIATION. High-energy subatomic particles from outer space that bombard the earth's atmosphere. Cosmic radiation is part of natural background radiation.

Glossary

COUNTING ERROR. The variability caused by the inherent random nature of radioactive disintegration and the detection process.

CURIE (Ci). A unit of radioactivity equal to 37 billion (3.7×10^{10}) nuclear transformations per second.

DETECTION LIMIT OR LEVEL. The smallest amount of a substance that can be distinguished in a sample by a given measurement procedure at a given confidence level.

DERIVED CONCENTRATION GUIDE (DCG). Concentrations of radionuclides in air and water by which a person continuously exposed and inhaling 8,400 cubic meters of air or ingesting 730 liters of water per year would receive an annual effective dose equivalent of 100 mrem per year from either mode of exposure. The committed dose equivalent is included in the DCGs for radionuclides with long half-lives. (See *Appendix B*.)

DISPERSION (Groundwater). The process whereby solutes are spread or mixed as they are transported by groundwater as it moves through sediments.

DOSIMETER. A portable device for measuring the total accumulated exposure to ionizing radiation.

DOWNGRADIENT. The direction of water flow from a reference point to a selected point of interest. (See GRADIENT.)

EFFECTIVE DOSE. See EFFECTIVE DOSE EQUIVALENT under RADIATION DOSE.

EFFLUENT. Flowing out or forth; an outflow of waste. In this report, effluent refers to the liquid or gaseous waste streams released into the environment from the facility.

EFFLUENT MONITORING. Sampling or measuring specific liquid or gaseous effluent streams for the presence of pollutants.

ENVIRONMENTAL MONITORING. The collection and analysis of samples or the direct measurements of environmental media. Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance.

ENVIRONMENTAL SURVEILLANCE. The collection and analysis of samples or the direct measurement of air, water, soil, foodstuff, and biota in order to determine compliance with applicable standards and permit requirements.

ERG. One-billionth (1E-09) of the energy released by a 100 watt bulb in 1 second.

EXPOSURE. The subjection of a target (usually living tissue) to radiation.

FALLOUT. Radioactive materials mixed into the earth's atmosphere. Fallout constantly precipitates onto the earth.

Glossary

GAMMA ISOTOPIC (also GAMMA SCAN). An analytical method by which the quantity of several gamma ray-emitting radioactive isotopes may be determined simultaneously. Typical nuclear fuel cycle isotopes determined by this method include but are not limited to Co-60, Zr-95, Ru-106, Ag-110m, Sb-125, Cs-134, Cs-137, and Eu-154. Naturally occurring isotopes that are often requested include Be-7, K-40, Ra-224, and Ra-226.

FINDING. A Department of Energy compliance term. A finding is a statement of fact concerning a condition in the Environmental, Safety, and Health program that was investigated during an appraisal. Findings include best management practice findings, compliance findings, and noteworthy practices. A finding may be a simple statement of proficiency or a description of deficiency (i.e., a variance from procedures or criteria). See also SELF-ASSESSMENT.

GRADIENT. Change in value of one variable with respect to another variable, especially vertical or horizontal distance.

GRAY. A unit of absorbed dose.

GROUNDWATER. Subsurface water in the pore spaces of soil and geologic units.

HALF-LIFE. The time in which half the atoms of a radionuclide disintegrate into another nuclear form. The half-life may vary from a fraction of a second to thousands of years.

HIGH-LEVEL WASTE (HLW). The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations sufficient to require permanent isolation. (See also TRANSURANIC WASTE.)

HYDRAULIC CONDUCTIVITY. The ratio of flow velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium; the ratio describing the rate at which water can move through a permeable medium.

INTERIM STATUS. Any facility in existence on the effective date of statutory or regulatory amendments under RCRA that render the facility subject to the requirement to have a RCRA permit shall have interim status and shall be treated as having been issued a permit (Title 6 New York Code of Rules and Regulations [NYCRR] Part 373.

INTERSTITIAL LEAK DETECTION SYSTEM. The (annular) space between the inner and outer tank walls in a double-walled storage tank.

ION. An atom or group of atoms with an electric charge.

ION EXCHANGE. The reversible exchange of ions contained in solution with other ions that are part of the ion-exchange material.

Glossary

ISOTOPE. Different forms of the same chemical element that are distinguished by having the same number of protons but different number of neutrons in the nucleus. An element can have many isotopes. For example, the three isotopes of hydrogen are protium, deuterium, and tritium, with one, two, and three neutrons in the nucleus, respectively.

KAME DELTA. A conical hill or short irregular ridge of gravel or sand deposited in contact with glacier ice.

LACUSTRINE SEDIMENTS. A sedimentary deposit consisting of material pertaining to, produced by, or formed in a lake or lakes.

LAND DISPOSAL RESTRICTIONS (LDR). Regulations promulgated by the U.S. EPA (and by NYSDEC in New York State) governing the land disposal of hazardous wastes. The wastes must be treated using the best demonstrated available technology or must meet certain treatment standards before being disposed.

LEACHED HULLS. Stainless steel cladding that remains after acid dissolution of spent fuel.

LINE MANAGEMENT SELF-ASSESSMENT (LMSA). The qualitative evaluation of a particular program operation and/or organization by those immediately responsible for overseeing the work. (See also SELF-ASSESSMENT.)

LOWER LIMIT OF DETECTION (LLD). The lowest limit an instrument is capable of detecting. A measurement of analytical sensitivity.

LOW-LEVEL WASTE. Radioactive waste not classified as high-level waste, transuranic waste, spent fuel, or uranium mill tailings. (See CLASS A, B, and C LOW-LEVEL WASTE.)

MAXIMALLY EXPOSED INDIVIDUAL. A hypothetical person who remains in an uncontrolled area who would, when all potential routes of exposure from a facility's operations are considered, receive the greatest possible dose equivalent.

MEAN. The average value of a series of measurements.

MILLIREM (MREM). A unit of radiation dose equivalent that is equal to one one-thousandth of a rem. An individual member of the public can receive up to 500 millirems per year according to DOE standards. This limit does not include radiation received for medical treatment or the 100 to 360 mrem that people receive annually from background radiation.

MINIMUM DETECTABLE CONCENTRATION. Depending on the sample medium, the smallest amount or concentration of a radioactive or nonradioactive analyte that can be reliably detected using a specific analytical method. Calculations of the minimum detectable concentrations are based on the lower limit of detection.

MIXED WASTE. A waste that is both radioactive and hazardous. Also referred to as RADIOACTIVE MIXED WASTE (RMW).

N-DODECANE/TRIBUTYL PHOSPHATE. An organic solution composed of 30% tributyl phosphate (TBP) dissolved in n-dodecane used to separate the uranium and plutonium from the fission products in the dissolved fuel and to separate the uranium from the plutonium.

Glossary

NOTICE OF VIOLATION. A letter of notice from a regional water engineer in response to an instance of significant noncompliance with a SPDES permit. Generally, an official notification from a regulatory agency of noncompliance with requirements put forth in a permit.

OUTFALL. The end of a drain or pipe that carries wastewater or other effluents into a ditch, pond, or river.

PARAMETER. Any of a set of physical properties whose values determine the characteristics or behavior of something (e.g., temperature, pressure, density of air). In relation to environmental monitoring, a monitoring parameter is a constituent of interest. Statistically, the term "parameter" is a calculated quantity, such as a mean or variance, that describes a statistical population.

PARTICULATES. Solid particles and liquid droplets small enough to become airborne.

PERSON-REM. The sum of the individual radiation dose equivalents received by members of a certain group or population. It may be calculated by multiplying the average dose per person by the number of persons exposed. For example, a thousand people each exposed to one millirem would have a collective dose of one person-rem.

PLUME. The distribution of a pollutant in air or water after being released from a source.

PROGLACIAL LAKE. A lake occupying a basin in front of a glacier; generally in direct contact with the ice.

QUALITY FACTOR. The extent of tissue damage caused by different types of radiation of the same energy. The greater the damage, the higher the quality factor. More specifically, the factor by which absorbed doses are multiplied to obtain a quantity that indicates the degree of biological damage produced by ionizing radiation. (See RADIATION DOSE.) The factor is dependent upon radiation type (alpha, beta, gamma, or x-ray) and exposure (internal or external).

RAD. Radiation absorbed dose. One hundred ergs of energy absorbed per gram.

RADIATION. The process of emitting energy in the form of rays or particles that are thrown off by disintegrating atoms. The rays or particles emitted may consist of alpha, beta, or gamma radiation.

> ***ALPHA RADIATION.*** The least penetrating type of radiation. Alpha radiation can be stopped by a sheet of paper or outer dead layer of skin.
>
> ***BETA RADIATION.*** Electrons emitted from a nucleus during fission and nuclear decay. Beta radiation can be stopped by an inch of wood or a thin sheet of aluminum.
>
> ***GAMMA RADIATION.*** A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shielding such as lead, concrete, or steel to be stopped.
>
> ***INTERNAL RADIATION.*** Radiation originating from a source within the body as a result of the inhalation, ingestion, or implantation of natural or manmade radionuclides in body tissues.

Glossary

RADIATION DOSE:

ABSORBED DOSE. The amount of energy absorbed per unit mass in any kind of matter from any kind of ionizing radiation. Absorbed dose is measured in rads or grays.

DOSE EQUIVALENT. Also known simply as "dose." A measure of external radiation, dose is the product of the absorbed dose, the quality factor, and any other modifying factors. Dose equivalent is used to compare the biological effects of different kinds of radiation on a common scale. The unit of dose equivalent is the rem or sievert.

COLLECTIVE DOSE EQUIVALENT. The sum of the dose equivalents for all the individuals comprising a defined population. The per capita dose equivalent is the quotient of the collective dose equivalent divided by the population. The unit of collective dose equivalent is person-rem or person-sievert.

EFFECTIVE DOSE EQUIVALENT (EDE). An expression of the health risk of doses of radiation to an individual. Since some organs are more sensitive than others, each organ is given a weighting factor. This tissue-specific weighting factor is multiplied by the organ dose for each organ and the numbers are added together to obtain the effective dose equivalent. The effective dose equivalent includes the COMMITTED EFFECTIVE DOSE EQUIVALENT (from internal deposition of radionuclides) and the dose equivalent (from penetrating radiation from external sources). Units of measurement are rems or sieverts.

COLLECTIVE EFFECTIVE DOSE EQUIVALENT. The sum of the effective dose equivalents for the individuals comprising a defined population. Units of measurement are person-rems or person-sieverts. The per capita effective dose equivalent is obtained by dividing the collective dose equivalent by the population. Units of measurement are rems or sieverts.

COMMITTED DOSE EQUIVALENT. A measure of internal radiation. The predicted total dose equivalent to a tissue or organ over a fifty-year period after a known intake of a radionuclide into the body. It does not include contributions from sources of external penetrating radiation. Committed dose equivalent is measured in rems or sieverts.

COMMITTED EFFECTIVE DOSE EQUIVALENT. The sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor. Committed effective dose equivalent is measured in rems or sieverts.

RADIOACTIVITY. A property possessed by some elements such as uranium whereby alpha, beta, or gamma rays are spontaneously emitted.

RADIOISOTOPE. A radioactive isotope of a specified element. Carbon-14 is a radioisotope of carbon. Tritium is a radioisotope of hydrogen. (See ISOTOPE.)

RADIONUCLIDE. A radioactive nuclide. Radionuclides are variations (isotopes) of elements. They have the same number of protons and electrons but different numbers of neutrons, resulting in different atomic masses. There are several hundred known nuclides, both manmade and naturally occurring.

Glossary

REM. An acronym for Roentgen Equivalent Man. A unit of radiation exposure that indicates the potential effect of radiation on human cells.

SELF-ASSESSMENT. Self-assessments are appraisals conducted by the WVDP to identify and correct any existing deficiencies in the environmental monitoring program. See also LINE MANAGEMENT SELF-ASSESSMENT. Under the WVDP environmental monitoring procedure *Self-Assessments for Environmental Programs*, information obtained from an appraisal is categorized as follows:

> ***KEY FINDING***. A direct and significant violation of a DOE regulatory, or other applicable guidance or procedural requirement, or a recurring pattern of observed deficiencies that could result in such a violation. A finding is a deficiency that requires corrective action.
>
> ***OBSERVATION***. A weakness that, if not corrected, could result in a deficiency. An observation may result if an explicit procedural nonconformance is noted but the nonconformance is an isolated incident or of minor significance. An observation requires corrective action.
>
> ***COMMENT OR CONCERN***. A comment is a subjective opinion of the assessment team that may be used to improve any of the specific environmental monitoring program activities noted in *Self-Assessments for Environmental Programs* such as sample collection, preparation, logging, storage, and shipping; instrument and equipment calibration; data receipt and data entry; training requirements and records; and compliance with discharge permit requirements. Corrective action in response to a comment or concern is at the discretion of the cognizant staff.
>
> ***COMMENDABLE PRACTICE***. A significant strength noted during the course of a self-assessment.
>
> ***DEFICIENCY***. A condition that does not meet or cannot be documented to meet applicable requirements.

SIEVERT. A unit of dose equivalent from the International System of Units. Equal to one joule per kilogram.

SOLID WASTE MANAGEMENT UNIT. Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released.

SPENT FUEL. Nuclear fuel that has been used in a nuclear reactor; this fuel contains uranium, activation products, fission products, and plutonium.

STANDARD DEVIATION. An indication of the dispersion of a set of results around their average.

SUPER SOLID WASTE MANAGEMENT UNIT. Individual SWMUs that have been grouped and ranked into eleven larger units — super-solid waste management units (SSWMUs) because some SWMUs are contiguous or so close together as to make monitoring of separate units impractical.

SURFACE WATER. Water that is exposed to the atmospheric conditions of temperature, pressure, and chemical composition at the surface of the Earth.

SURVEILLANCE. The act of monitoring or observing a process or activity to verify conformance with specified requirements.

Glossary

THERMOLUMINESCENT DOSIMETER (TLD). A device that luminesces upon heating after being exposed to radiation. The amount of light emitted is proportional to the amount of radiation to which the luminescent material has been exposed.

TRANSURANIC WASTE. Transuranic means elements which have an atomic number greater than 92, including neptunium, plutonium, americium, and curium.

UPGRADIENT. Referring to the flow of water or air, it is analogous to upstream. A point that is "before" an area of study that is used as a baseline for comparison with downstream data. See GRADIENT and DOWNGRADIENT.

WATERSHED. The area contained within a drainage divide above a specified point on a stream.

WATER TABLE. The upper surface in a body of groundwater. The surface in an unconfined aquifer or confining bed at which the pore water pressure is equal to atmospheric pressure.

X-RAY. Penetrating electromagnetic radiations having wave lengths shorter than those of visible light. They are usually produced by bombarding a metallic target with fast electrons in a high vacuum. In nuclear reactions it is customary to refer to photons originating in the nucleus as gamma rays and those originating in the extranuclear part of the atom as x-rays. These rays are sometimes called roentgen rays after their discoverer, W.C. Roentgen.

Acronyms

AEA. Atomic Energy Act

ALARA. As Low As Reasonably Achievable

ANOVA. Analysis of Variance

BEIR. Committee on Biological Effects of Ionizing Radiation

BOD. Biochemical Oxygen Demand (5-day)

CAA. Clean Air Act

CDDL. Construction and Demolition Debris Landfill

CEDE. Committed Effective Dose Equivalent

CEQ. (President's) Council on Environmental Quality

CERCLA. Comprehensive Environmental Response, Compensation, and Liability Act

CFR. Code of Federal Regulations

CO. Certificate-to-Operate

CPC. Chemical Process Cell

CSRF. Contact Size-reduction Facility

CSS. Cement Solidification System

CWA. Clean Water Act

CX. Categorical Exclusion

CY. Calendar Year

DCG. Derived Concentration Guide

DE. Dose Equivalent

DMR. Discharge Monitoring Report

DOE. (U.S.) Department of Energy

DOE-EM. (U.S.) Department of Energy, Office of Environmental Restoration and Waste Management

DOE-HQ. Department of Energy, Headquarters Office

DOE-OH. Department of Energy, Ohio Field Office

Acronyms

DOE-WV. Department of Energy, West Valley Area Office

EA. Environmental Assessment

EDE. Effective Dose Equivalent

EE. Environmental Evaluation

EHS. Extremely Hazardous Substance

EID. Environmental Information Document

EIS. Environmental Impact Statement

ELAP. Environmental Laboratory Approval Program

EML. Environmental Measurements Laboratory

EMSL. Environmental Monitoring Systems Laboratory (Las Vegas)

EPA. (U.S.) Environmental Protection Agency

EPI. Environmental Physics, Inc.

EPCRA. Emergency Planning and Community Right-to-Know Act

ES&H. Environmental Safety and Health

FFC Act. Federal Facility Compliance Act

FONSI. Finding of No Significant Impact

FSFCA. Federal and State Facility Compliance Agreement

FY. Fiscal Year

GC/MS. Gas Chromatograph/Mass Spectrometer

HEPA. High-efficiency Particulate Air (Filter)

HLW. High-level (Radioactive) Waste

HPIC. High-pressure Ion Chamber

HVAC. Heating, Ventilation, and Air Conditioning

ICRP. International Commission on Radiological Protection

INEL. Idaho National Engineering Laboratory

Acronyms

IRTS. Integrated Radwaste Treatment System

LAS. Linear Alkylate Sulfonate

LDR. Land Disposal Restriction

LIMS. Laboratory Information Management System

LLD. Lower Limit of Detection

LLW. Low-level (Radioactive) Waste

LLWTF. Low-level Liquid Waste Treatment Facility

LPS. Liquid Pretreatment System

LWTS. Liquid Waste Treatment System

MDC. Minimum Detectable Concentration

MDL. Method Detection Limit

MSDS. Material Safety Data Sheet

MTAR. Monthly Trend Analysis Report

NCRP. National Council on Radiation Protection and Measurements

NDA. Nuclear Regulatory Commission-licensed Disposal Area

NEPA. National Environmental Policy Act

NERL CRD. National Exposure Research Laboratory Characterization Research Division (formerly EMSL).

NESHAP. National Emissions Standards for Hazardous Air Pollutants

NFS. Nuclear Fuel Services, Inc.

NIST. National Institute of Standards and Technology

NOI. Notice of Intent

NPOC. Nonpurgeable Organic Carbon

NPDES. National Pollutant Discharge Elimination System

NRC. (U.S.) Nuclear Regulatory Commission

NYCRR. New York Code of Rules and Regulations

Acronyms

NYSDEC. New York State Department of Environmental Conservation

NYSDOH. New York State Department of Health

NYSERDA. New York State Energy Research and Development Authority

NYSGS. New York State Geological Survey

ODIS. On-site Discharge Report

ORR. Operational Readiness Review

OSHA. Occupational Safety and Health Act

OSR. Operational Safety Requirement

OVE. Outdoor Ventilated Enclosure

PC. Permit-to-Construct

PCB. Polychlorinated Biphenyl

PCDD. Polychlorinated dibenzo-p-dioxin

PCDF. Polychlorinated dibenzofurans

PQL. Practical Quantitation Limit

PVU. Portable Ventilation Unit

QA. Quality Assurance

QAP. Quality Assessment Program

QC. Quality Control

QEMDR. Quarterly Environmental Monitoring Data Report

RCRA. Resource Conservation and Recovery Act

RESL. Radiological and Environmental Science Laboratory

RFI. RCRA Facility Investigation

RMW. Radioactive Mixed Waste

RTS. Radwaste Treatment System

SAR. Safety Analysis Report

Acronyms

SARA. Superfund Amendments and Reauthorization Act

SD. Standard Deviation

SDA. (New York) State-licensed Disposal Area

SDWA. Safe Drinking Water Act

SER. (annual) Site Environmental Report

SI. International System of Units (Systeme Internationale)

SPDES. State Pollutant Discharge Elimination System

STS. Supernatant Treatment System

SWMU. Solid Waste Management Unit

SSWMU. Super Solid Waste Management Unit

TCL. Target Compound List

TIC. Tentatively Identified Compound

TLD. Thermoluminescent Dosimetry

TOC. Total Organic Carbon

TOX. Total Organic Halogens

TPQ. Threshold Planning Quantity

TRI. Toxic Release Inventory

TSCA. Toxic Substances and Control Act

TSDF. Treatment, Storage, and Disposal Facility

USGS. U.S. Geological Survey

VOC. Volatile Organic Compound

WESR. WVDP Effluent Summary Report

WNYNSC. Western New York Nuclear Service Center

WVDP. West Valley Demonstration Project

WVNS. West Valley Nuclear Services Company, Inc.

Units of Measure

Radioactivity

Symbol	*Name*
Ci	curie
mCi	millicurie (1E-03 Ci)
μCi	microcurie (1E-06 Ci)
nCi	nanocurie (1E-09 Ci)
pCi	picocurie (1E-12 Ci)
Bq	becquerel (27 pCi)

Volume

Symbol	*Name*
cm^3	cubic centimeter
L	liter
mL	milliliter
m^3	cubic meter
gal	gallons
ft^3	cubic feet
ppm	parts per million
ppb	parts per billion

Dose

Symbol	*Name*
Sv	sievert (100 rems)
mSv	millisievert (1E-03 Sv)
Gy	gray (100 rads)

Area

Symbol	*Name*
ha	hectare (10,000 m^2)

Length

Symbol	*Name*
m	meter
km	kilometer (1E+03 m)
cm	centimeter (1E-02 m)
mm	millimeter (1E-03 m)
μm	micrometer (1E-06 m)

Concentration

Symbol	*Name*
μCi/mL	microcuries per milliliter
mL/L	milliliter per liter
μCi/g	microcuries per gram
mg/L	milligrams per liter
μg/mL	microgram per milliliter

Mass

Symbol	*Name*
g	gram
kg	kilogram (1E+03 g)
mg	milligram (1E-03 g)
μg	microgram (1E-06 g)
ng	nanogram (1E-09 g)
t	metric ton (1E+06 g)

Flow Rate

Symbol	*Name*
MGD	million gallons per day
CFM	cubic feet per minute
LPM	liters per minute

Unit Prefixes

centi	$1/100 = 1 \times 10^{-2} = 0.01$
milli	$1/1{,}000 = 1 \times 10^{-3} = 0.001$
micro	$1/1{,}000{,}000 = 1 \times 10^{-6} = 0.000001$
nano	$1/1{,}000{,}000{,}000 = 1 \times 10^{-9} = 0.000000001$
pico	$1/1{,}000{,}000{,}000{,}000 = 1 \times 10^{-12} = 0.000000000001$

Scientific Notation

Scientific notation is used to express very large or very small numbers. A very small number is expressed with a negative exponent: 1.3×10^{-6}. To convert this number to decimal form, the decimal point is moved left by the number of places equal to the exponent. Thus, 1.3×10^{-6} becomes 0.0000013.

A very large number is expressed with a positive exponent: 1.3×10^{6}. To convert this number to decimal form, the decimal point is moved right by the number of places equal to the exponent. Thus, 1.3×10^{6} becomes 1,300,000.

The power of 10 is also expressed as E. For example, 1.3×10^{-6} can also be written as 1.3E-06. The chart below show the values of exponents.

1E+01	=	10	
1E+00	=	1	
1E-01	=	0.1	
1E-02	=	0.01	
1E-03	=	0.001	
1E-04	=	0.0001	
1E-05	=	0.00001	
1E-06	=	0.000001	One Millionth
1E-07	=	0.0000001	
1E-08	=	0.00000001	

Conversion Chart

Both traditional radiological units (curie, roentgen, rad, rem) and the Systeme Internationale (S.I.) units (becquerel, gray, sievert) are used in this report. Nonradiological measurements are presented in metric units with the English equivalent often in parentheses.

1 centimeter (cm)	=	0.3937 inches (in)
1 meter (m)	=	39.37 inches (in) = 3.28 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 milliliter (mL)	=	0.0338 ounce (oz)
	=	0.061 cubic inch (in^3)
	=	1 cubic centimeter (cm^3)
1 liter (L)	=	1.057 quart (qt)
	=	61.02 cubic inches (in^3)
1 gram (g)	=	0.0353 ounce (oz)
	=	0.0022 pound (lb)
1 kilogram (kg)	=	2.2 pounds (lb)
1 curie (Ci)	=	3.7×10^{10} disintegrations per second (d/s)
1 becquerel (Bq)	=	1 disintegration per second (d/s)
	=	27 picocuries (pCi)
1 roentgen (R)	=	2.58×10^{-4} coulombs per kilogram of air (C/kg)
1 rad	=	0.01 gray (Gy)
1 rem	=	0.01 sievert (Sv)
1 millirem (mrem)	=	0.001 rem

Distribution

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T. McIntosh	DOE-HQ
N. Brown	DOE-OH
J.P. Hamric	DOE-OH
E. Osheim	DOE-OH
S. Smiley	DOE-OH
R. Tormey	DOE-OH
G. Comfort	NRC-HQ
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D. Wiggins	SNIEPD
L. Maybee	SNICPD
E. Wohlers	CCHD
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J. Quinn	U.S. Congressman, 30th Dist.
A. Houghton	U.S. Congressman, 31st Dist.
D. Moynihan	U.S. Senator, New York
A. D'Amato	U.S. Senator, New York
J. Present	New York Senator, 56th Dist.
W. Stachowski	New York Senator, 58th Dist.
T. Reynolds	New York Assemblyman, 147th Dist.

Olean Public Library, Olean, New York

West Valley Central School Library, West Valley, New York

Town of Concord Hulbert Library, Springville, New York

Central Buffalo Public Library, Buffalo, New York

Community Relations, WVNS (Technical File)

Buffalo News, Buffalo, New York *

Salamanca Republican Press, Salamanca, New York *

Springville Journal, Springville, New York *

* Notice of public availability

Acknowledgments

This report was compiled and edited by Ed Picazo and Valerie Marvin of the Dames & Moore West Valley Demonstration Project staff. The Environmental Compliance Summary was written by Scott Thompson of the West Valley Nuclear Services Environmental Affairs (Sue Schneider, Manager). Other portions of this report were written by Dames & Moore staff (Larry M. Coco, Project Manager), including the Environmental Laboratory (David Scalise, Manager). Desktop publishing and manuscript control were provided by Dawn Frazier. Technical preparers and reviewers are listed below:

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