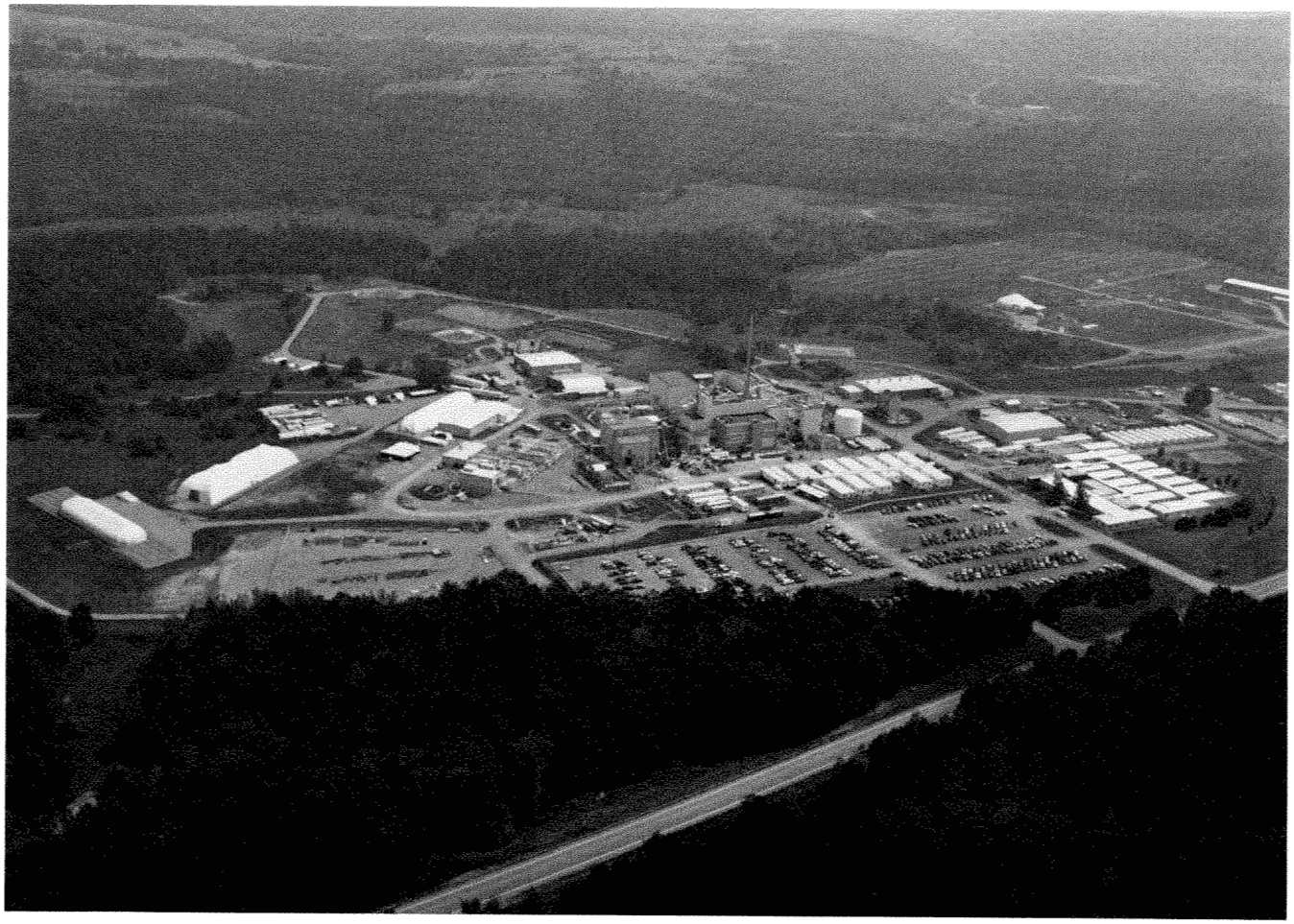

The West Valley Demonstration Project Site

Executive Summary

The West Valley Demonstration Project (WVDP) conducts a comprehensive environmental monitoring program that fulfills U.S. Department of Energy (DOE) Orders and directives and the regulatory requirements of the United States Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC). The results of this program show that public health, safety, and the environment are being protected with respect to activities on the site and the waste materials stored there.

This annual report, published to meet the requirements of DOE Orders 5400.1 and 5400.5, summarizes the environmental monitoring data collected during 1991. On-site and off-site radiological and nonradiological monitoring in 1991 confirm that site activities, with few exceptions, were conducted well within state and federal regulatory limits. (A description of regulatory issues is found in the *Environmental Compliance Summary:Calendar Year 1991.)* The exceptions noted have resulted in no significant effects upon public health or the environment.

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 under which the Atomic Energy Commission encouraged 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 3,345 acres near West Valley, New York and established the Western New York Nuclear Service Center (WNYNSC). The Davison Chemical Co., co-licensed with the New York State Atomic Research and Development Authority, which later became the New York State Energy Research and Development Authority (NYSERDA), formed Nuclear Fuel Services, Inc. (NFS) to construct and operate a nuclear fuel reprocessing plant. NFS leased the Western New York Nuclear Service Center and began operations in 1966 to recycle fuel from both commercial and federally owned reactors.

In 1972, while the plant was closed for modifications and expansion, more rigorous federal and state safety regulations were imposed. Most of the changes were aimed at the disposal of high-level radioactive liquid waste and at preventing earthquake damage to the facilities. Compliance with the new regulations was deemed 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 to the passage of Public Law 96-368, which authorized the Department of Energy to demonstrate a method for solidifying the 2.5 million liters (660,000 gals.) of liquid high-level waste that remained at the West Valley site. The technologies developed at West Valley would be used at other facilities throughout the United States. West Valley Nuclear Services Co. (WVNS), a subsidiary of Westinghouse Electric, was chosen by the Department of Energy to be the management and opera-

tions contractor for the West Valley Demonstration Project.

The purpose of the West Valley Demonstration Project 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 transport 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 an underground storage tank and had settled into two layers — a liquid supernatant and a precipitate sludge. West Valley Nuclear Services, as prime contractor to DOE, secured environmental approval and constructed various subsystems that made possible the successful start-up in May 1988 of the integrated radwaste treatment system (IRTS). The system stripped radioactivity from the liquid supernatant. Treatment of the supernatant liquid from the high-level waste tanks through the IRTS was completed in 1990. The resulting 10,393 drums of low-level treated liquid were solidified in a special cement mixture and stored on-site in an engineered above-ground vault.

The next step in the process, washing the remaining sludge with water to remove soluble constituents, began in late 1991. (See Chapter 1, *Environmental Monitoring Program Information* for a more detailed description.)

Compliance

The West Valley Demonstration Project operates within the radiological guidelines of Department of Energy Orders for protection of human health, safety, and the environment. Limits on radioactivity concentrations and individual doses are specified in the DOE Orders. The Project did not exceed or approach any of the limits on radioactivity or radiation doses in 1991, including the emission standards promulgated by the EPA and incorporated in DOE Orders.

Nonradiological plant effluents are regulated by the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (EPA). New York State inspects nonradiological air emission points periodically although nonradiological air effluent monitoring is not currently required because discharges resulting from site activities are very limited. Surface effluent water quality, regulated by NYSDEC, is tested for pH, biochemical oxygen demand, and other chemical factors.

The State Pollutant Discharge Elimination System (SPDES) permit identifies discharge water quality limits. On three occasions in 1991 the concentration of total iron in water exceeded permitted levels. These deviations resulted from flow-weighting formulas in the site's SPDES permit that did not adequately compensate for variations in the high natural iron present in the Project's raw intake water. In each case, appropriate actions were taken to notify NYSDEC in accordance with permit requirements. These deviations resulted in no significant effect on the environment. Evaluations of alternative methods continued in order to determine the best way to prevent recurrence. There were no excursions attributable to the sewage treatment plant in 1991. (See the *Environmental Compliance Summary: Calendar Year 1991* for a more detailed description.)

Effects of Project activities upon site groundwaters are 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. Increased well sampling in 1991 added to the understanding of these effects. Although definite radiological and nonradiological effects upon localized on-site groundwaters can be seen, these do not affect public health or the off-site environment.

Effluent and Environmental Monitoring Program

The 1991 environmental monitoring program provided radiological and nonradiological measurements of site effluent discharges and of related on-site and off-site samples. Air and surface water samples were collected to monitor the two major pathways by which radioactive material could migrate off-site.

Analysis of animal, soil, and vegetation samples from the facility environs also provided data from which the risk of exposure to radioactivity through ingestion pathways could be determined. Control, or background, samples were taken to compare with on- or near-site samples.

The flying insects that had been the subject of a special investigation in 1990 were not present in 1991. The control measures used to prevent recurring insect hatches appeared to be effective, and radioactivity was not detected in the very limited insect samples available.

Air Pathway Monitoring

Airborne particulate radioactivity was sampled continuously at five WNYNSC perimeter locations (see Fig. 2-2 in Chapter 2, *Environmental Monitoring*) and four remote locations during 1991. Sample filters were collected weekly and analyzed for gross alpha and beta radioactivity. Airborne gross activity around the site boundary was, in all cases, indistinguishable from background concentrations measured at the remote locations. The specific alpha and beta-gamma isotopes measured in the ventilation exhausts were well below the Department of Energy limits. (See *Appendix B.*)

Direct monitoring of airborne effluents at the main plant stack and other permitted release points showed all discharges to be well below DOE or EPA effluent limitations. Special testing for naturally occurring radon and thoron of the main stack exhaust air showed that radon and thoron are detectable below DOE effluent dose limits.

Surface Water Pathway Monitoring

Six automatic samplers collected surface water at 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 isotopes, 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 below the West Valley Project site than at the upstream background sample point. Yearly average concentrations in water below the Project site in Cattaraugus Creek during 1991 were indistinguishable from background concentrations measured in Buttermilk Creek upstream of the Project facilities. All Cattaraugus Creek concentrations observed are well below regulatory limits. Concentrations of cesium-137 and other gamma emitters, strontium-90 and other beta emitters, uranium and plutonium isotopes, and tritium were below DOE guidelines at all locations, including Frank's Creek at the inner site security fence more than three miles upstream of Cattaraugus Creek.

The low-level liquid waste treatment facility (LLWTF) contributes most of the activity released from the site in liquid discharges. The 1991 annual average liquid effluent concentrations of radionuclides were below DOE release guidelines at the point of discharge.

Food Pathway Monitoring

Radioactivity that could pass through the food chain was measured by sampling milk, beef, hay, corn, apples, beans, fish, and venison. Available results were not very different from 1989 and 1990 samples and corroborated the low doses calculated from the measured concentrations in site effluents.

Direct Environmental Monitoring

Direct environmental radiation was measured continuously during each quarter in 1991 using thermoluminescent dosimeters (TLDs) at forty-one points distributed around the site perimeter and access road, at the waste management units, at the inner facility fence, and at various background locations. No significant differences were noted among exposure rates measured at background stations and the WNYNSC perimeter locations. Some TLD data were also collected within the restricted area boundary to monitor the exposure 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 are required.

Nonradiological liquid discharges are monitored as a requirement of the State Pollutant Discharge Elimination System (SPDES). Liquid is discharged at permitted outfalls to surface waters. Project effluents are monitored for biochemical oxygen demand (BOD), suspended solids, ammonia, iron, pH, oil and grease, and other water quality indicators. Although there were three iron excursions, monitoring indicated that nonradiological liquid discharges had no effect on the offsite environment.

Groundwater Monitoring

The WVDP is underlain directly by layers of glacial sand, clay and rock, and/or by layers of deposited lake and stream materials. The under-

lying bedrock is primarily Devonian shales and sandstones. As the material deposited across the site is not uniformly distributed, groundwater flow and seepage rates are uneven.

The 1991 monitoring network included both on-site wells for surveillance of solid waste management units and off-site wells to monitor drinking water. In 1991 ninety-six on-site groundwater monitoring wells were added to the thirteen existing monitoring points. The additional on-site wells were sampled at an increased frequency and for more parameters.

These wells provided upgradient and downgradient monitoring of the low-level liquid waste treatment facility (LLWTF) lagoons, the high-level waste tank complex, the NRC-licensed disposal area (NDA), and other solid waste management units. Wells in the groundwater monitoring network were each sampled during 1991. The range of analyses performed was determined by regulatory requirements and site-specific characterization needs.

Wells are grouped by geologic unit in the description of groundwater monitoring results in Chapter 3, *Groundwater Monitoring*. 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. Compared to background, both tritium and gross beta concentrations are elevated in groundwater surrounding the lagoon system. However, the level of tritium contamination has declined steadily since 1982, as indicated by measurements at the french drain outfall. Gross beta activity that previously had increased leveled off or declined in 1991 at LLWTF monitoring points WNSP008, WNW8605, and WNW8603. Gross beta increased in well WNW8604 in 1991.

Data from monitoring wells 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 and tritium in well WNW0408, WNW0501, and WNW0502, downgradient of the main process plant facilities.

Other measured parameters such as pH and conductivity have shown significant differences between upgradient and downgradient locations. Well WNW0103 demonstrated a high sodium and hydroxide ion level in 1991 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. The till-sand well WNW0202 also shows an elevated pH. This higher pH is of unknown origin.

Greater-than-detectable concentrations of 1,1-dichloroethane at wells WNW8609 and WNW8612 continued to be found in 1991. At the WNGSEEP location 1,1,1-trichloroethane remained detectable but at lower levels than in 1990.

Groundwater monitoring around the NRC-licensed disposal area (NDA) indicates no discernible effects on the deeper unweathered Lavery till deposits in the area, as indicated primarily by measurements for tritium. However, one shallow well (in the weathered Lavery till) in the vicinity of the SDA (WNW1107A) has shown elevated tritium levels slightly above the New York State groundwater quality standard. Although other SDA wells in the shallow geologic units have shown detectable tritium, elevated tritium has not been observed in the monitoring wells in the deeper lacustrine unit.

Ongoing environmental characterization and facility investigations are assessing the groundwater in greater detail.

Migration of contaminants from the NDA was not detected in 1991 by the interceptor trench. This control and remediation effort within the NDA includes monitoring the water collected in a gravel back-filled trench downgradient of the known kerosene-contaminated soils. No solvent was found in the water collected from the trench in 1991.

In addition to the on-site measurements the potential effect of Project activities on near-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.

Radiological Dose Assessment

Potential radiation doses to the public from airborne and liquid effluent releases of radioactivity from the site during 1991 were estimated via computer models. Potential radiation doses from ingestion of locally produced foods were also calculated and compared to results derived from the computer models.

The EPA-approved computer program CAP88-PC was used to calculate hypothetical radiation doses from airborne effluents. The highest annual effective dose equivalent (EDE) to a nearby resident was estimated to be 4.9×10^{-4} mrem, which is 0.005% of the 10 mrem EPA standard. The collective dose to all persons within a 50-mile radius was estimated to be 4.7×10^{-3} person-rem effective dose equivalent (EDE).

Computer modeling was also used to estimate a hypothetical maximum annual radiation dose from liquid effluents. The highest EDE to an individual was estimated to be 5.5×10^{-2} mrem, which is 0.055% of the DOE limit. Overall, the annual EDE from air and liquid discharges to the people within an 80-kilometer (50-mi) radius of the site was calculated to be 1.6×10^{-2} person-rem.

Radiation doses estimated from maximum consumption rates of locally produced foods are lower than the values reported in previous years.

The hypothetical calculated doses presented above should be considered in relation to an average dose of 300 mrem per year to a U.S. resident from natural background radiation. The dose assessment described in Chapter 4, *Radiological Dose Assessment*, predicts an insignificant effect on the public's health as a result of radiological releases from the WVDP.

Quality Assurance

The quality assurance (QA) program overseeing environmental monitoring activities includes the evaluation and control of data from both on-site and off-site sources. Commercial contract laboratories and their internal quality assurance programs are routinely reviewed by site personnel. In addition, commercial laboratories must 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 DOE), and outside auditing by organizations that include the U.S. Nuclear Regulatory Commission (NRC), the Department of Energy, and Westinghouse Electric Corporation.

Environmental sample sharing and co-location of measurement points with the New York State Department of Health (NYSDOH) and the Nuclear Regulatory Commission continued in 1991, ensuring that selected samples and locations were routinely measured by two or more independent organizations.

Crosscheck program participation coupled with other internal quality control procedures and external laboratory checks verified the overall high quality of data gathered in 1991. General program adequacy and specific issues of quality assurance were audited by the WVNS quality assurance department in 1991. Quarterly self-assessments, conducted by an independent team of environmental monitoring staff, identified areas needing improvement and tracked the actions taken to achieve the high quality standards that the environmental monitoring program represents.

The major auditing activity in 1991 was a visit by the DOE Office of Environmental Audit in July and August. Overall, the environmental monitoring program was found to be satisfactory. (See the *Environmental Compliance Summary: Calendar Year 1991* for a more complete discussion.)