The West Valley Demonstration Project Site

Executive Summary

The West Valley Demonstration Project (WVDP) conducts a comprehensive environmental monitoring program that fulfills 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 United States Department of Energy (DOE) Orders 5400.1 and 5400.5, summarizes the environmental monitoring data collected during 1990.

On-site and off-site radiological and nonradiological monitoring in 1990 confirm that site activities, with few exceptions, were conducted well within state and federal regulatory limits. The exceptions noted have resulted in no significant impacts upon public health or the environment and are described below.

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 2.2 million liters (580,000 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 (DOE) to be operations 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.

Through the mid-1980s West Valley Nuclear Services, as prime contractor to DOE, secured environmental approval and constructed various subsystems that made possible the successful start-up of the integrated radwaste treatment system (IRTS) in May 1988. In the first two years of operation 1,454,000 liters (384,000 gals.) of liquid from the high-level waste tanks were processed through the IRTS. During 1990, 1,030,000 liters (272,000 gals.) of liquid supernatant were processed, solidifed in a special cement mixture, and stored on-site in an engineered above-ground vault.

Compliance

The West Valley Demonstration Project operates within the radiological guidelines of Department of Energy Orders for protection of 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 1990, 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 air effluent monitoring is not currently required because of the very limited discharges. Surface effluent water quality is tested for pH, biochemical oxygen demand and other chemical factors and is regulated by the New York State Department of Environmental Conservation. The State Pollutant Discharge Elimination System (SPDES) permit identifies discharge water quality limits. In 1990 there were nine instances when individual water quality parameters exceeded permitted levels. Six of these deviations resulted from the sewage treatment plant operating beyond its rated capacity. One excursion was attributed to a minor upset that released solids slightly above the permitted limits. Another unrelated excursion of high iron content in the low-level waste treatment system effluent resulted from what is believed to be a natural iron buildup. This condition is being evaluated to determine how the potential for its recurrence can be reduced.

In each case, appropriate actions were taken to stabilize the condition and to notify NYSDEC in accordance with permit requirements. These deviations resulted in no significant effect on the environment. However, the sewage treatment plant operation is being modified to prevent recurrences.

Effects of Project activities upon site groundwaters are regulated by NYSDEC and the EPA. Groundwater sampling and analyses confirm that groundwater quality has been and continues to be affected both radiologically and nonradiologically by past facility operations. Increased well drilling and sampling activities in 1990 intensified the investigation of these effects. Although definite radiological and nonradiological effects upon on-site groundwaters can be seen, these do not affect public health or the off-site environment.

Effluent And Environmental Monitoring

The 1990 environmental monitoring program provided radiological and nonradiological measurements of site effluent discharges and of related on-site and off-site samples. The two major pathways by which radioactive material could migrate off-site were monitored by collecting air and surface water samples. Analysis of animal, soil, and vegetation samples from the facility environs 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. In 1990 the site recorded one instance of radioactivity being transported by a biological vector (flying insects), which was the subject of a special investigation completed in 1990 and is reported in section 2.1.6. A second study, also completed in 1990, evaluated several waste facilities as potential diffuse sources of airborne radioactivity. (See section 2.1.6.)

Airborne particulate radioactivity was sampled continuously at five site perimeter and four remote locations during 1990. 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 and was 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. Nonradiological discharges from the site are regulated by NYSDEC; however, no special monitoring and reporting of nonradiological airborne effluents are required.

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 of carbon-14, iodine-129, and americium-241 were added to the program requirements at several collection points. As a result of past site activities and continuing releases of treated liquids, gross radioactivity concentrations remained 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 1990 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, strontium-90, and tritium were below DOE guidelines at all locations, including Frank's Creek at the inner site security fence more than three miles from Cattaraugus Creek.

The low-level liquid waste treatment facility (LLWTF) contributes most of the activity released from the site in liquid discharges. The 1990 annual average liquid effluent concentrations of radionuclides were below DOE release guidelines at the point of discharge.

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 corroborated the low doses calculated from the measured concentrations in site effluents.

Nonradiological liquid discharges are monitored as a requirement of the State Pollutant Discharge Elimination System (SPDES). Liquid is discharged at permitted outfalls or points of final release 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. Monitoring indicated that nonradiological liquid discharges had no effect on the off-site environment.

Direct environmental radiation was measured continuously during each quarter in 1990, as in previous years, using thermoluminescent dosimeters (TLDs). Monitoring is carried out 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.

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 underlying 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 1990 groundwater monitoring network included on-site wells for surveillance of solid waste management units and off-site wells for drinking water monitoring. The on-site system of seventeen monitoring points was expanded in 1990 to 106 points. The additional wells installed were sampled on a limited program, but they will be in full use in 1991. 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, and other solid waste management units. Wells comprising the existing on-site groundwater monitoring network were each sampled eight times during 1990. All new wells were developed to produce water suitable for analysis and wells associated with several solid waste management units were sampled for a complete set of parameters. After initial physical measurements at each well, samples were collected and analyzed for a variety of radiological and water quality parameters. The range of analyses performed was determined by regulatory requirements and site-specific concerns or needs. Statistical tests were performed to define real differences between up- and downgradient wells.

Data from groundwater monitoring 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. Levels of gross beta activity appear to be rising slightly in some locations, as measured at the french drain outfall and at wells monitoring groundwater in the vicinity of the LLWTF lagoons (WNW86-03, WNW86-04, and WNW86-05). Other measured parameters such as pH and conductivity have shown significant differences between upgradient and downgradient locations. Most notable are the sodium and chloride concentrations at well WNW86-06, which is upgradient of the lagoons. It is believed that these elevated salt concentrations are due to migration from the sludge ponds which, in turn, are located just upgradient of well WNW86-06.

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 activity and greater-than-detectable concentrations of 1,1-dichloroethane at wells WNW86-09 and WNW86-12.

Groundwater monitoring around the NRC-licensed disposal area (NDA) indicates no discernible effects on the deeper deposits in the area, as indicated primarily by measurements for tritium. However, one shallow well in the vicinity of the NDA (WNW82-4A1) has consistently shown elevated tritium levels. In addition, continued organic solvent migration was detected in other shallow wells within the NDA. Migration of contaminated solvent is currently the focus of a control and remediation effort within the NDA (see section 2.1.6).

The potential effect of Project activities on near-site groundwater is monitored by annual sampling of designated private drinking water wells in addition to the on-site measurements. 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 1990 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 programs AIRDOS-PC, version 3.0, and CAP-88 were used to calculate hypothetical radiation doses from airborne effluents. The highest effective dose equivalent (EDE) to a nearby resident was estimated to be 0.0007 mrem, which is 0.007% of the EPA limit. The collective dose to all persons within a 50-mile radius was estimated to be 0.008 person-rem EDE.

Computer modeling was also used to estimate a hypothetical maximum radiation dose from liquid effluents. The highest EDE to an individual was estimated to be 0.23 mrem, which is 0.23% of the DOE limit. Overall, the average EDE from air and liquid discharges to individuals within an 80-kilometer (50-mi) radius of the site was calculated to be 2.8×10^{-5} mrem.

Radiation doses estimated from maximum consumption rates of locally produced foods are similar in magnitude to the values reported in previous years.

The above conservatively high, hypothetical calculated doses can be compared 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 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 1990, ensuring that selected samples and locations are 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 1990. General program adequacy and specific issues of quality assurance were audited by the WVNS quality assurance department in 1990. Isolated problems of quality control and/or program design that were identified by the 1989 Tiger Team and the 1990 audit have been or are currently being remedied. Quarterly self-appraisals, conducted by an independent team of environmental monitoring staff, identify areas needing improvement and track the actions taken to achieve the high quality standards that the environmental monitoring program represents. Overall, the program was found to be satisfactory.