West Valley Demonstration Project – Past, Present and Future – 11203

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ABSTRACT

The West Valley Demonstration Project (WVDP, the Project) is an environmental management and cleanup project located in West Valley, New York. Former home to the nation's only commercial spent nuclear fuel reprocessing facility, which operated from 1966-1972, the facility represents a significant clean-up and decommissioning challenge. Three Project partners are managing the cleanup at the site: the U.S. Department of Energy, the lead agency for the cleanup; the New York State Energy Research and Development Authority (NYSERDA), the agency that owns the property; and West Valley Environmental Services LLC (WVES), the contractor responsible for implementing cleanup actions.

In June 2007, DOE awarded the Interim End State Contract to WVES to manage the high-level liquid waste and product as a result of processing operations, de-inventory the radioactive and hazardous materials, decontaminate the processing and support facilities, manage a radioactive groundwater plume from a leak in the Main Plant, manage the Nuclear Regulatory Commission (NRC)-licensed Disposal Area (NDA) and deactivate and decontaminate the former reprocessing facility. Due to the highly radioactive nature of the material during processing, the facilities are extensively contaminated and highly radioactive requiring innovative solutions, remote handling technologies and disciplined planning and execution to ensure safe and compliant completion.

INTRODUCTION

Located in the scenic hills of Western New York, just about 56 kilometers (35 miles) south of Buffalo, the 68-hectare (160-acre) WVDP is a unique and challenging environmental cleanup project with a long history and a bright future. But just what is the "demonstration" in the West Valley Demonstration Project? To answer that question, one has to take a look at the history of the site.

Before DOE and NYSERDA took on the challenge of cleaning up the site, West Valley was the location of the only commercial spent nuclear fuel reprocessing facility in the United States. Operated by Nuclear Fuels Services from 1966-1972, the site (located on the 1,335-hectare or 3,330-acre Western New York Nuclear Service Center, WNYNSC, Fig. 1) was owned by the State of New York and licensed by the Atomic Energy

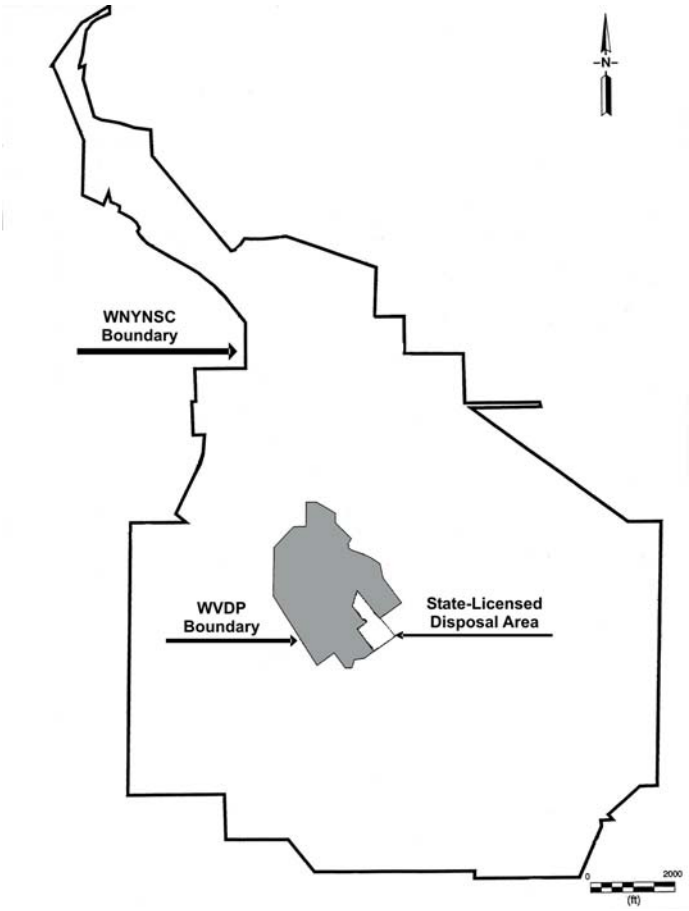

Fig. 1. The 68-hectare (160-acre) WVDP Project Premises are contained within the larger 1,335-hectare (3,300-acre) Western New York Nuclear Service Center (WNYNSC).

Commission (AEC). During operations, the plant reprocessed approximately 640 metric tons of spent nuclear fuel. When commercial operations were discontinued, there were approximately 2,271,247 liters (600,000 gallons) of liquid high-level radioactive waste (HLW) in two of four underground storage tanks and the Main Plant Process Building, the facility that was used to reprocess the spent nuclear fuel. The processing building was highly contaminated and many areas were inaccessible due to contamination levels and radioactive dose fields.

The West Valley Demonstration Project Act (WVDP Act) of 1980 authorized DOE to conduct a clean-up of the site in cooperation with NYSERDA, the state agency responsible for managing the property. In the years before passage of the WVDP Act, the NRC replaced AEC as the regulatory agency for the site. When DOE took control of the facilities at the site in 1981, the Technical Specifications in the NRC license were placed in abeyance and DOE hired West Valley Nuclear Services Company (WVNSCO) – the predecessor company to WVES – to conduct the cleanup.

Since that time, the Project partners have accomplished several key milestones including:

- Solidification of the 2,271,247 liters (600,000 gallons) of high level liquid wastes, which contained approximately 15 million curies, into 275 HLW canisters through a process called vitrification and more than 19,000 drums of solidified LLW;
- Shipment of the remaining 125 spent nuclear fuel assemblies that were in storage on site, the largest single shipment of spent nuclear fuel conducted in the United States;
- Offsite shipment and disposal of more than 304,800 cubic meters of LLW;
- Installation of a permeable treatment wall to mitigate the strontium plume that initiated from a spill from the Main Plant Process Building during commercial fuel processing;
- The installation of a tank and vault drying system to eliminate liquids and moisture from the high-level waste tanks during the interim period before disposition; and
- Issuance of the :
    - Phase 1 Environmental Impact Statement (EIS) Record of Decision (ROD) and the corresponding New York State Statement of Findings;
    - Phase 1 Decommissioning Plan, which details how Phase 1 decommissioning will be conducted; and
    - Consent Decree, which resolves the 2006 lawsuit filed by New York State and delineates cost sharing between DOE and NYSERDA for each of the facilities/areas on site.

Additionally, most of the processing equipment and piping has been removed from the Main Plant Process Building, the resulting waste has been packaged for safe storage and disposal and an interim cap has been placed on the NDA, one of two nonoperational disposal units on site.

Despite the complex environment associated with cleaning up the project with the wide spectrum of challenges presented at West Valley, WVES has continued to further DOE's ability to meet its obligations under the WVDP Act. More recent accomplishments have included deactivation and decontamination of the still very contaminated Main Plant Process Building, management of the four underground waste tanks and their vaults, processing and packaging of both legacy wastes and those generated as a result of clean-up activities, and mitigating the Strontium-90 contaminated groundwater plume.

After years of working together to resolve issues related primarily to the end state vision for the site, DOE and NYSERDA selected the same alternative – Phased Decision-making – and DOE issued a ROD and NYSERDA issued a Findings Statement, in April 2010. Under the Phased Decision-making alternative, the decommissioning will be conducted in two phases. Phase 1 involves near-term decommissioning and removal actions for certain facilities and areas and undertakes characterization work and studies that could facilitate future decision-making for the remaining facilities or areas on the property. DOE and

NYSERDA intend to make the Phase 2 decision within the next 10 years and expects to select either removal or in-place closure, or a combination of the two for those portions of the site for which it has decommissioning responsibility. These areas include the Waste Tank Farm, which contains approximately 500,000 curies (less than 700 curies are long-lived); the NDA, which contains approximately 250,000 curies; and the State-licensed Disposal Area (SDA), which contains approximately 100,000 curies (7,000 long-lived).

This paper will focus on the lessons learned during the environmental clean-up of the WVDP and will discuss the future of the site as it enters Phase 1 decommissioning.

HISTORY

The following historical summary was excerpted from remarks made by Paul J. Bembia, West Valley Site Management Program Director for the New York State Energy Research and Development Authority, to the Blue Ribbon Commission on America's Nuclear Future Subcommittee on Reactor and Fuel Cycle Technology" on August 31, 2010 [1].

The Origins of the West Valley Commercial Nuclear Fuel Reprocessing Facility

Soon after the passage of the Atomic Energy Act in 1954, the AEC had begun a program to encourage the private reprocessing of spent nuclear fuel as part of a program to commercialize the nuclear fuel cycle. As part of the reprocessing program, the AEC announced that it would:

- *Make AEC technology on reprocessing available to private industry;*
- *Invite proposals by private industry to design, construct, and operate reprocessing plants; and*
- *Provide a base-load of fuel from AEC production reactors until the construction of additional commercial power reactors created an adequate demand for spent fuel reprocessing services.*

New York State became interested in the AEC privatization program as a way to promote industrial development within the State. New York established an Office of Atomic Development in 1956, and by 1961, the OAD had acquired 3,300 acres in the Town of Ashford in Cattaraugus County with the intent of establishing a spent fuel reprocessing facility. The Town of Ashford was, and remains, a rural, economically depressed area.

The AEC announcements on reprocessing also created interest within the business community, and the Davison Chemical Company (which would be bought out by W.R Grace and Company) set up Nuclear Fuel Services Inc. (NFS) to pursue the reprocessing venture.

Negotiations among NFS, AEC, and New York State resulted in several agreements, and in 1962, NFS filed an application with Atomic Energy Commission for a construction permit and license for the spent fuel reprocessing facility at West Valley.

Construction of the reprocessing plant began in 1963 and was completed in 1966. That same year, the Atomic Energy Commission granted a provisional operating license for the facility. NFS was licensed as the operator of the reprocessing facility, and the New York State Atomic Research and Development Authority, a predecessor agency of NYSERDA, was licensed as the owner.

The construction cost for the reprocessing facility was about $33 million. AEC set the fee structure for NFS reprocessing services, stipulating that NFS could not charge more than 15 percent above the AEC-published charges for reprocessing based on a conceptual AEC reprocessing plant.

Operational History of the West Valley Reprocessing Facility

640 metric tons of fuel from both AEC defense reactors and commercial power reactors were reprocessed at West Valley between 1966 and 1971. Of the 640 metric tons of spent fuel, 380 metric tons were from the N-reactor at Hanford – supplied by AEC under the baseload contract with NFS.

In addition to spent fuel reprocessing, NFS established two radioactive waste disposal areas at the Center– a commercial radioactive waste disposal facility, and a separate facility that was used for the disposal of high-activity reprocessing waste with radiation levels that were too high to be buried in the commercial disposal facility.

During the time it operated, the facility experienced operational difficulties, higher than expected worker doses, and unplanned releases of radioactive material to the environment.

Shut-down and Uncertainty

After operating the facility for six years, NFS halted reprocessing operations in 1972 in order to make modifications to the plant to increase reprocessing capacity, reduce worker doses, and reduce radioactive effluents. NFS expected that these modifications would cost $15 million.

During this shut-down period, new regulatory requirements were issued by the Atomic Energy Commission related to earthquake and tornado protection, and waste management requirements. NFS estimated that meeting these new regulatory requirements could cost $600 million, and NFS concluded that it would not be economically viable to continue the reprocessing operation at West Valley.

In 1976, NFS informed New York State that it was withdrawing from the reprocessing business and intended to turn the West Valley facility and its waste over to New York State. At that time, the facility contained 750 spent fuel assemblies that had not been reprocessed, 600,000 gallons of liquid high-level radioactive waste stored in two steel tanks, the highly contaminated Main Plant Process Building, and the two radioactive waste disposal areas that contained almost 3 million cubic feet of radioactive waste.

The NFS announcement that it planned to turn the West Valley facility over to New York created considerable uncertainty and anxiety within the State. New York objected, saying that the perpetual care fund that had been accumulated by NFS (less than $4 million) was inadequate to safely care for the facilities. In addition, the agreements between the State and NFS required the waste to be in "good condition."

In order to better understand the responsibility, cost, and technical issues surrounding West Valley, the United States Congress held hearings, directed the GAO to investigate the issues, and directed DOE to study options for the future of the Center. These activities eventually led to Congress passing the West Valley Demonstration Project Act in 1980.

It is clear that the reprocessing facility at West Valley failed to live up to its high expectations, and in retrospect, it was a combination of economic factors, technological difficulties, and an evolving regulatory framework that led to the failure of the facility.

West Valley Demonstration Project

The WVDP Act directs the U.S. Department of Energy to conduct a demonstration project at the Center. Specifically, the WVDP Act directs DOE to: develop containers to transport the high-level waste to a federal repository; solidify the high-level waste; transport the solidified high-level waste to a federal repository; dispose of the low-level waste and transuranic waste generated, and decontaminate and decommission the tanks, facilities, material and hardware used in connection with the Project in accordance with decommissioning criteria prescribed by the Nuclear Regulatory Commission.

The Clean-up – A Federal-State Partnership

In 1982, under terms of a Cooperative Agreement between DOE and NYSERDA, and in accordance with a 1981 amendment to the NRC's License for the Center, DOE assumed control of about 160 acres of the Center to conduct the West Valley Demonstration Project.

NYSERDA is responsible for the balance of the Center property, which consists of 3,100 acres of undeveloped property, and the commercial disposal facility. As directed by the WVDP Act, the Federal Government pay 90 percent of the costs associated with the West Valley Demonstration Project, and New York State pays 10 percent.

Progress on Vitrification

A key requirement of the West Valley Demonstration Project Act was the solidification of HLW. During commercial fuel processing conducted between 1966 and 1972, approximately 2,271,247 liters (600,000 gallons) of liquid HLW was generated. Inside the underground tank, the waste had separated into high activity and low activity portions. In the late 1980s and early 1990s, the low-activity portion was mixed with cement into nearly 20,000 313-liter (71-gallon) drums. This waste was originally stored in the Radioactive Waste Treatment System (RTS) Drum Cell and was shipped and disposed of as LLW at the Nevada Test Site in 2006 and 2007. The remaining higher-activity sludge was solidified into borosilicate glass using a process called vitrification and created 275 stainless steel canisters from 1996-2002. The canisters contain approximately 15million curies and are currently stored in a shielded cell inside the Main Plant Process Building awaiting offsite shipment and disposal at a federal HLW repository.

After the last canister was made in June 2002, the system was flushed and powered down in September 2002, and the cleanup focus began to shift from vitrification to decontamination and deactivation – dismantlement – of the Vitrification Cell. Three major vitrification components – the melter, the Concentrator Feed Makeup Tank (CFMT) and the Melter Feed Hold Tank (MFHT) were removed from the Vitrification Cell and placed in safe storage on the southern plateau of the site.

A slurry-fed ceramic melter was used for the vitrification process. The melter was a 48-metric ton (53-ton) Inconel component lined with refractory brick. It was nominally 3 meters long, 3 meters wide and 3 meters high (10 feet long, 10 feet wide and 10 feet high). Based on samples and dose to curie calculations, it has been estimated that approximately 4,660 total curies remain in the melter, with approximately 4,370 attributed to Cs-137. The vitrification system, which included eight major components and 579 meters (1,900 linear feet) of piping, was located in a cell that was 21 meters long, 13 meters wide and 14 meters tall (70 feet long, 43 feet wide and 46 feet tall). The components and piping were dismantled remotely from 2003-2005. The dose rates in the cell ranged from 5-50 R/hr and the contamination rates were greater than 100 million dpm/cm^2 beta gamma.

Crane-supported shears and Brokk® equipment were used to cut jumpers and piping. The components were disconnected and removed and placed in specially-designed containers. The dose rates on the packages ranged from 25-150 R/hr on contact. Some packages were filled with grout to fix contamination, eliminate void space, reduce dose rates external to the containers, and stabilize the components inside the containers. The final weights on the three main component containers ranged from 138-174 metric tons (305,000-384,000 pounds).

Progress on NRC-Licensed Disposal Area (NDA)

Between 1966 and 1986, approximately 10,194 cubic meters (360,000 cubic feet) of radioactive waste were disposed in the NDA. This area is a 3.2-hectare (8-acre) facility that utilized shallow land burial techniques. While NFS operated the site, the NDA was used to dispose of nuclear fuel reprocessing-related equipment and by-products that exceeded 200 millirad per hour and other materials not permitted in the adjacent SDA.

Examples of the materials buried during that era include contaminated nuclear fuel solvent treated with absorbent, contaminated fuel reprocessing equipment, and empty fuel hulls following fuel dissolution. NFS continued to dispose of waste in the NDA until 1981. Between 1982 and 1986, the WVDP disposed of approximately 5,400 cubic meters (190,000 cubic feet) of waste in the NDA. The LLW disposed by the WVDP (approximately 0.4percent of the total radioactivity in the NDA) originated from the clean-up activities at the site. No waste has been buried at the NDA since 1986.

An interceptor trench and associated Liquid Pretreatment System was installed at the NDA in the 1980s after chemical and radioactive contamination were found in the groundwater, down-gradient of the NDA. The purpose was to intercept potentially contaminated groundwater. The trench subsurface is radiologically contaminated and several organic constituents have been detected. Water collected through the system is transported to the WVDP's liquid waste treatment system for treatment and release under the site's State Pollutant Discharge Elimination System (SPDES) permit.

The configuration of the NDA (direct-buried waste with an earthen cap) contributed to the burial area's susceptibility to water infiltration. Without additional controls, rainwater infiltration was occurring through natural fissures in the cap. Lateral movement of the groundwater in the NDA also occurred during large rain events or snow melts when the water table was high. The natural processes of rain, snow, and freeze/thaw conditions subjected the NDA earthen cap to degradation.

Building on lessons learned from NYSERDA's installation of a cover on the SDA, a system was designed to reduce water infiltration into the NDA and reduce the subsequent volume of contaminated groundwater requiring collection and treatment in 2008. The key feature of the designed system was a geo-membrane cover that was ultraviolet ray-resistant, puncture resistant, and very low permeability. In 2008, WVES installed barriers between the buried waste and both ground and surface water sources. A 2.8-hectare (7-acre) geo-membrane cover was installed over the burial area and surrounding areas and a 250-meter (850-foot) long groundwater barrier wall was constructed along two sides of the NDA. The 0.9-meter (3-foot) wide subsurface barrier wall involved excavation of a trench to the depth of 1.5 meter (5 feet) into undisturbed soil (actual depth ranged from 3-6 meters or 10-20 feet). The trench was backfilled with a combination of native soils combined into slurry with bentonite clay which thickened to form a low-permeability water barrier.

In the first two years after the installation of the water barrier, the amount of water collected from the NDA's water collection system has been reduced by 80 percent.

PRESENT

The West Valley site includes the following major processes and facilities:

- Waste processing facilities, including various storage facilities, the Remote Handled Waste Facility (RHWF), and the Vitrification Facility
- Two disposal units: the NDA and SDA
- Waste Tank Farm
- Main Plant Processing Building
- Wastewater treatment and storage basins/lagoons
- HLW Canister storage (within the Main Plant)
- Sr-90 contaminated groundwater plume
- Support infrastructure and buildings

The current four-year contract focuses work activities on deactivation and decontamination of site facilities, radioactive waste processing, drying the underground waste tanks, and mitigating the contaminated groundwater plume. The addition of American Recovery and Reinvestment Act (ARRA) funds allowed for acceleration of Main Plant decontamination in preparation for future demolition, the installation of the system to dry the underground tanks and their associated vaults, PTW installation, and accelerated waste processing and packaging.

On April 20, 2010, DOE and NYSERDA issued a Record of Decision (ROD) and Statement of Findings, respectively, that selects a two-phase decision-making approach to decommissioning the site. Phase 1 involves near-term decommissioning and removal actions for certain facilities and areas, such as the Main Plant Process Building, the waste water treatment lagoons, and the majority of the balance of site facilities. Phase 1 also includes characterization work and studies (Phase 1 Studies) to support future decision-making for the remaining facilities or areas on the property. DOE's plan is to complete any remaining WVDP decommissioning decision-making with its Phase 2 decision to be made within 10 years of the ROD.

In August 2010, DOE and NYSERDA reached an agreement on the allocation of clean-up costs. This agreement settled nearly 30 years of dispute between the agencies on cost allocations. The agreement is formalized in the Consent Decree, approved by the U.S. District Court, Western District of New York. The cost split was effective on August 17, the day the Decree was signed. The agreed cost allocation is as follows:

Facilities used in the WVDP (Main Plant, Tank Farm, etc.)	90% DOE, 10% NYSERDA
Wastewater Treatment Lagoons	90% DOE, 10% NYSERDA
NDA	50% DOE, 50% NYSERDA
North Plateau Groundwater Plume	50% DOE, 50% NYSERDA
SDA	30% DOE, 70% NYSERDA

Progress on Main Plant Processing Building Decontamination

The Main Plant Process Building at West Valley is comprised of approximately 55 individual cells and operating aisles. Depending upon the type of equipment, levels of radioactive and hazardous constituents, and the structural and infrastructure present in a specific area, the methods of dismantlement and decontamination in cells and aisles can vary dramatically. Another complicating factor is that the Main Plant primary support systems (power, ventilation, fire protection, etc.) must remain operational to not only support clean-up efforts, but to support HLW canister storage and to ensure appropriate radiological controls are maintained. In support of future decommissioning objectives, current work activities include

decontamination of the most radioactively-contaminated cells in the Main Plant Process Building. Some of the more significant activities are summarized below.

The Extraction Cells in the Main Plant were used to extract re-useable uranium and plutonium from reprocessed nuclear fuel. The equipment and piping has been removed from all three of these cells. The last cell was heavily contaminated and required all of the cutting and removal operations to be conducted remotely. This cell included more than 1.6 kilometers (1 mile) of piping, three large tanks and several other vessels and tanks. Several industry experts partnered with WVES to design and test remote applications for use in the completion of this task. The lessons learned and technology advancements as a result of the WVDP clean-up will benefit contact and remote decommissioning efforts commercially, internationally and within the DOE complex.

The Head End Cells area of the Main Plant was used to prepare used nuclear fuel for reprocessing. Equipment in the two largest cells, the Process Mechanical Cell and the General Purpose Cell, was removed from 2004-2006. However, the cells were heavily contaminated and had residual material on the floor from cutting operations. Additionally, the floor and walls had been coated with fixative to hold loose contamination. An innovative technology called Nitrocision® has been utilized to remove the coating and to decontaminate the surfaces of the cell. This is the first remote application of this innovative technology. Nitrocision® technology uses super-cooled high-pressure liquid nitrogen to freeze dry materials inside the cells, enabling them to be vacuumed and packaged. A number of smaller cells and ancillary areas that belong to the Head End Cells are also being decontaminated in preparation for demolition. Due to past activities in these areas of the facility, contamination and radioactive dose levels in these cells are among the highest in the building.

The equipment in the Hot Acid Cells was removed and decontaminated in 2009. Due to the tight configuration of the cell and the lack of internal infrastructure in the cell, intact removal of the vessels through the exterior wall of the Main Plant was deemed the most practical method of removal. The project's successes included removal of the vessels in less than two weeks, reduced radiological exposure to involved workers and cost avoidance by removing the vessels intact.

As work proceeds to prepare the facility for demolition, asbestos containing material (ACM) is being removed from piping and ventilation ducts throughout the Main Plant Process Building, including externally. More than 1.6 kilometers (1 mile) of ACM is scheduled to be removed by June 2011. The removal of this material must be carefully coordinated with other clean-up activities to ensure that facility access, emergency exits and fire protection requirements continue to be met. Work on ACM removal and clean-up activities, continues in multiple areas of the facility simultaneously.

Progress on Waste Tank Management

The Tank Farm was constructed in the early 1960s to store liquid HLW by-product created during commercial nuclear fuel reprocessing activities. Liquid wastes were transferred from the Main Plant to the Waste Tank Farm by underground piping. The major components in the Tank Farm are two large 2,839,058-liter (750,000-gallon) carbon steel tanks encased in separate concrete vaults and two smaller 52,996-liter (14,000-gallon) stainless steel tanks that share a third common vault.

One of the tasks directed by the West Valley Demonstration Project Act was to solidify the liquid HLW from the Tank Farm. Although that mission was completed in 2002, water management continued to be a concern for the four underground waste tanks. In addition to residual liquids, rainfall and humidity levels in Western New York result in wet soil conditions that have contributed to groundwater infiltration into the vaults. At the end of 2010, approximately 25,000 gallons of liquid remained in the tanks and vaults.

As part of its base contract, WVES designed a system to eliminate the residual liquid and maintain a relatively low humidity level in the vaults.

In 2010, Recovery Act funds were used to install the Tank and Vault Drying System and the system became operational in December 2010. The system, which consists of a rotary desiccant dehumidifier, minimizes tank corrosion and maintains the tanks in safe configuration while decisions on the disposition of the Waste Tank Farm are evaluated. The system can maintain the tanks for up to 30 years. The Tank and Vault Drying System discharge is tied to an existing HEPA filtered ventilation system to prevent release. The installation included removal of pump risers, severing and capping above grade connections and installation of new piping, and the excavation and removal of 97.5 kilometers (320 feet) of existing internally-contaminated ventilation piping and replacement with new stainless steel piping. All of this work was conducted in very close proximity to the tanks and associated piping, using configuration drawings developed over 50 years ago, and required disciplined planning and strict work control to mitigate interferences and prevent damage to existing infrastructure.

Calculations indicate the Tank and Vault Drying System will successfully evaporate the existing liquids in the two carbon steel tanks in approximately three to six years and then maintain a low relative humidity of approximately 30 percent in the underground structures.

Progress on Groundwater Mitigation

In late 1993, radioactively-contaminated groundwater surfaced at the WVDP and an investigation was conducted in 1994 to determine the nature and extent of the contamination. The contaminant was determined to be Strontium-90 (Sr-90) and was attributed to a leak in a process line that occurred during commercial nuclear fuel reprocessing operations. The leak was a one-time event and does not continue. Over the years, different methods have been used to slow the spread of the contamination, including a “pump and treat” system that has processed more than 54.7 million gallons of radioactive water since 1995.

To define the challenge, extensive characterization of the plume and the soil has been completed. In 2007, WVES was tasked with designing a passive in-situ permeable treatment wall to remove the Sr-90 from the groundwater. The infusion of funds under the Recovery Act made it possible to move forward with installation in 2010.

The PTW is a passive system that uses zeolite to strip Sr-90 from the groundwater as it moves through the below-ground wall. A new surface water drainage system diverts storm water away from the PTW to maximize efficiency. Extensive engineering and planning have been performed to ensure effective removal of Sr-90 by the PTW. The zeolite used in the PTW is a group of naturally-occurring minerals that can exchange positively charged ions in its mineral structure with Sr-90 ions from the groundwater. In this manner, zeolite removes Sr-90 from the groundwater through cation exchange.

A specially designed 90-metric ton (100 ton) one-pass trencher was used to construct the wall. The “one-pass trencher” excavates the trench and places the zeolite in one evolution. The excavated soil was placed in a container constructed alongside the trench. The PTW is 250 meters long, 0.9 meters wide and ranges in depth from 5.8-9.1 meters deep (850 feet long, 3 feet wide, and ranges from 19-30 feet deep). More than 2,407 cubic meters (85,000 cubic feet) of soil were excavated to construct the PTW and over 2000 bags of zeolite (one metric ton each) were used in constructing the PTW.

Groundwater wells will monitor the effectiveness of the PTW, which has been designed to last for at least 20 years.

Progress on Radioactive Waste Management

Waste at the WVDP consists of legacy (previously stored) and newly generated waste streams. Both waste streams are the result of dismantlement, clean-up and decontamination activities. Past practices removed equipment and materials with little consideration for the end-state. As a result there were approximately 2,280 cubic feet (80,500 cubic) feet of Transuranic (TRU) waste and 2,449 cubic meters (86,500 cubic feet) of LLW in storage as of July 2007 that required characterization, processing and repackaging. Due to the processing history at West Valley, many of the waste streams require remote processing due to high contamination, high radiation, or both.

Waste is stored in storage buildings (including the Chemical Process Cell – Waste Storage Area), in special above-ground shielded concrete storage areas for oversized or highly-contaminated equipment, and outside hardstands. As the inventory has been processed and repackaged and transported off site, the resultant reduced volumes have allowed consolidation of storage capability. This consolidation is especially important to reduce the number of RCRA units required under the pending Part B permit.

LLW at West Valley includes contact handled (CH) LLW and mixed LLW (MLLW) streams, remote handled (RH) LLW, and includes both solid and liquid streams. The dose rates on LLW range from background to several Rem on contact. LLW is no longer disposed of on site so all of its LLW must be packaged for transport and offsite disposal at either federal or commercial facilities.

As discussed earlier, as a result of solidification of the liquid HLW, there are 275 canisters of vitrified HLW in stainless steel canisters. These canisters are presently stored in a shielded cell inside the Main Plant, pending offsite shipment to a federal repository.

There are also a number of components that potentially require an evaluation under DOE Order 435.1, Radioactive Waste Management, to determine its status relative to Waste Incidental to Reprocessing (WIR). The documentation for the melter component has been submitted to DOE for review. Additional documentation is required for other components. The purpose of the evaluation is to determine if the waste is high level or is the remnant of creating and or managing HLW. If the waste is determined to be incidental to managing HLW, it will be managed as LLW or TRU waste per DOE requirements based on the waste's specific radioisotopic inventory. This evaluation will be used to determine the final disposition of these waste streams, including any additional processing, repackaging, transportation and disposal.

TRU waste is defined by DOE as waste that is contaminated with alpha-emitting radionuclides (greater than Uranium on the periodic table) with half-lives greater than 20 years and concentrations greater than 100nCi/g. Depending on dose rates, DOE categorizes TRU waste as either contact handled (less than or equal to 200 mR/hour on contact) or remote handled (greater than 200 mR/hr on contact). DOE uses the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico, as a national repository for these wastes. However, a defense determination must be made regarding the origin of the wastes before they can be disposed at WIPP. At this time, a defense determination has not been made for West Valley TRU wastes. Therefore, these waste volumes are also included in the Greater than Class C (GTCC) Programmatic Environmental Impact Statement. West Valley currently accounts for over 90 percent of the GTCC waste in storage and represents approximately 10 percent of the forecasted volume requiring disposal in a GTCC facility.

DOE has directed that the TRU waste at West Valley will be repackaged in accordance with the WIPP Waste Acceptance Criteria (WAC) for CH and RH-TU as a best management practice. This approach ensures that the waste is compliant if a defense determination is made and also increases the probability

that the waste will be compliant with a yet-to-be-determined waste acceptance criteria for a future Greater than Class C disposal facility.

Repackaging TRU waste provides the added benefit of additional characterization, removal of prohibited items, packaging into compliant containers that are better suited for long-term storage, and allows significant volume reduction in the TRU waste in storage.

CH-TRU waste reprocessing is conducted in several areas at the West Valley Demonstration Project. The Waste Processing Area is a self-contained structure with ventilation that allows video and audio taping of the waste as it is repackaged. The facility allows repackaging, waste inspection and waste segregation. The Equipment Decontamination Room and Fuel Receiving and Storage Areas are also used for waste processing of large CH- wastes. Typical activities in these areas include opening and inspecting containers for prohibited items and foaming containers to fill voids. The Contact Size Reduction Facility contains plasma cutting equipment for rapid size reduction and processing of large or heavy CH- items. The facility conducts predecessor activities for the Waste Processing Area. In the Contact Size Reduction Facility, larger items are processed into smaller pieces and transported to the Waste Processing Area for final characterization and packaging. The Contact Size Reduction Facility can cut and size-reduce not only the wastes but the waste containers.

RH- TRU waste is processed in either the RHWF or the retrofitted Vitrification Cell. Both facilities allow waste processing and repackaging of wastes with very high dose rates and both facilities are capable of safely managing waste streams with several hundred Rem/hour dose fields. The RHWF allows operators to remotely size-reduce using Brokk® demolition equipment, size-reduce waste using a modified drum crusher, and repackage wastes into WIPP-compliant TRU waste containers. The facility also allows the segregation of LLW components from TRU to reduce the volume of TRU waste in storage after processing.

The Vitrification Cell inside the Vitrification Facility was dismantled and the equipment removed after completion of HLW solidification. The large facility is now being used as a remote waste processing area for large scale and highly radioactive components. Processing equipment in the cell consists of Brokk® equipment with demolition end effectors, power manipulators, a plasma system, and a portable Nitrocision® decontamination system.

In all of its waste management challenges, WVES has implemented innovative technical solutions (Fig. 2), often adapting waste management practices, equipment and techniques to the unique waste situations at West Valley.

Fig. 2. Innovative technical solutions to address waste and environmental challenges.

Innovative Solutions

- Innovative use of waste characterization equipment (In-situ Object Counting System, ISOCS) to pre-screen waste containers to identify the areas of highest activity and facilitate its surgical removal has resulted in large volumes of waste being classified as LLW.

- Characterization and waste segregation techniques have resulted in an 83 percent reduction in TRU waste after processing.

- Implementation of waste characterization techniques including surface-contaminated objects, waste averaging, bulk waste characterization, and careful application of DOE Order 435.1 requirements have contributed to reductions in TRU waste inventories.

- Technology applications including remote plasma cutting and remote handling, cutting and size reduction have resulted in lessons learned that benefit the entire industry.

FUTURE

The EIS identified the Phased Decision-making Alternative as the preferred alternative. Phased Decision-making involves near-term decommissioning and removal actions where there is agency consensus and undertakes characterization work and studies that could facilitate future decision-making for the remaining facilities or areas (Fig. 3). Phase 1 activities are expected to take 8 to 10 years to complete. The Phase 2 decision would be made no later than 10 years after issuance of the initial DOE ROD and NYSERDA Statement of Findings.

Fig. 3. Proposed West Valley Demonstration Project condition after completion of Phase 1 activities.

Phase 1 of the Phased Decision-making alternative requires removal of the major facilities (including the Main Plant Process Building, the Vitrification Facility, the 01-14 Building and the lagoons) thereby reducing or eliminating potential human health impacts associated with these facilities while introducing minimal potential for generation of new orphan waste. Phase 1 would also remove the source area for the

Sr-90 plume, thereby further reducing the amount of radionuclides on site. Phase 1 includes the relocation of HLW canisters to a new Interim Storage Facility on site pending shipment and disposal at an offsite federal repository.

Other major areas of the site including the disposal areas and the Waste Tank Farms will be actively managed and maintained in their current configuration during Phase 1. Phase 1 allows up to 10 years for collection and analysis of data and information on these areas, with the goal of facilitating agency consensus on the Phase 2 decisions.

SUMMARY

Without a doubt, partnership has been the cornerstone of the success that is being realized at the West Valley Demonstration Project.

The partnership between the three organizations – DOE, NYSERDA, and WVES – has led to tremendous strides in the cleanup of the West Valley Demonstration Project. By agreeing on the fundamental concept that safety is our number one value, the priority of cleanup activities, and the methods to be used, the West Valley team has ensured the safest, most efficient and cost-effective cleanup of the site as possible.

REFERENCES

1. P.J. BEMBIA, “Blue Ribbon Commission on America’s Nuclear Future Subcommittee on Reactor and Fuel Cycle Technology,” New York State Energy Research and Development Authority (2010).