THE WEST VALLEY DEMONSTRATION PROJECT

THREE YEARS OF PROGRESS

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ABSTRACT

The West Valley Demonstration Project (WVDP) has just completed its third year. A Component Test Stand (CTS) has been built and the Slurry-Fed Ceramic Melter (SFCM) has been operated nonradioactively. Installation of the integrated, remotized components of the CTS are in progress with startup scheduled for this summer. The feasibility of converting the CTS to become the radioactive vitrification facility has been demonstrated. An innovative way to advance the schedule for decontamination of the high-level waste supernatant has been developed and processing will begin next year. The cement solidification portion of the new Radioactive Waste Treatment System (RTS) will be in operation this year. An effective but inexpensive Transuranic (TRU) Assay System has been put in place. Decontamination of existing processing cells has advanced to the point that firm schedules for the reuse of cells has been established. Installation of new waste processing equipment in former reprocessing cells will begin later this year. The major vessels in the Chemical Process Cell will be removed this summer. A recently completed review of the total Project cost is $30M less than that of a year ago.

PROJECT PHILOSOPHY

The WVDP is now starting its fourth year of operation. Established by Public Law in October of 1980 [1], with site takeover in February 1982, the objectives of the Project are to solidify the high-level waste, develop containers suitable for permanent disposal of the high-level radioactive waste, decontaminate and decommission the facility, dispose of low-level radioactive waste produced and transport the solidified high-level and transuranic wastes to a federal repository. The basic premise of the Project is that the technology for high-level waste processing and for D&D for reuse of nuclear facilities is available and can be adapted to practical situations. To demonstrate this requires that this job be done professionally, without serious problems, but also expeditiously. Thus, the working philosophy of the Project is to do all parts of the Project carefully and safely and also to finish the job ahead of schedule, within or below cost. This has led to an aggressive management philosophy called the "Actiontrak" approach. Being a Demonstration Project, there is also an active open public access and information program in place.

Because of the "Actiontrak" approach to the Project, there has been no traditional Conceptual, Preliminary, Title I or Title II design, per se, done at West Valley. Instead, preliminary designs are developed by West Valley Nuclear Services Co., Inc. (WVNS) engineers and these designs are developed into construction bid packages and equipment ordering data by the Architect-Engineer (A-E) on the Project, Ebasco Services Inc. The "Actiontrak" approach reinforces the practical demonstration that the basic technology is available. There is no time for provincial redesign effort. The use of existing technology is encouraged whenever possible. It is realized that this aggressive attitude may, in some cases, lead to design verification being conducted during construction or testing. The potential for rework being required during construction, testing, or cold operations is deliberately weighed against available cost and schedule opportunities. In addition to formal, disciplined design reviews, this Project utilizes a far greater degree of peer reviews, and technology exchange on a national and international basis than normal, so as to minimize such potential. Project engineers have had to develop innovative solutions to the unique challenges presented at West Valley, and such creative thinking has not only been permitted but positively encouraged. In this paper, we will describe some examples of these novel approaches.

WEST VALLEY WASTE

There are two pairs of underground storage tanks at West Valley (Fig. 1) that store two different types of high-level waste: 1) neutralized PUREX wastes, consisting of a layer of sludge below a layer of supernatant and 2) acidic THOREX wastes. The neutralized PUREX wastes are similar to the defense high-level wastes at Savannah River and Hanford in that these latter wastes also consist of a neutralized supernatant and an associated sludge. The two 2.8 million litre tanks 8D-1 and 8D-2 are located adjacent to each other in separate vaults. Tank 8D-2 contains the 2 million litres of high level waste from the 1966-1972 period of reprocessing plant operations. Tank 8D-1 contains liquid with a low radioactivity content, as only the condensate from 8D-2 has been put in this tank; the tank is essentially in an unused condition.

Two smaller tanks, 8D-3 and 8D-4, 57,000 litres each, are located in a single vault. Tank 8D-4

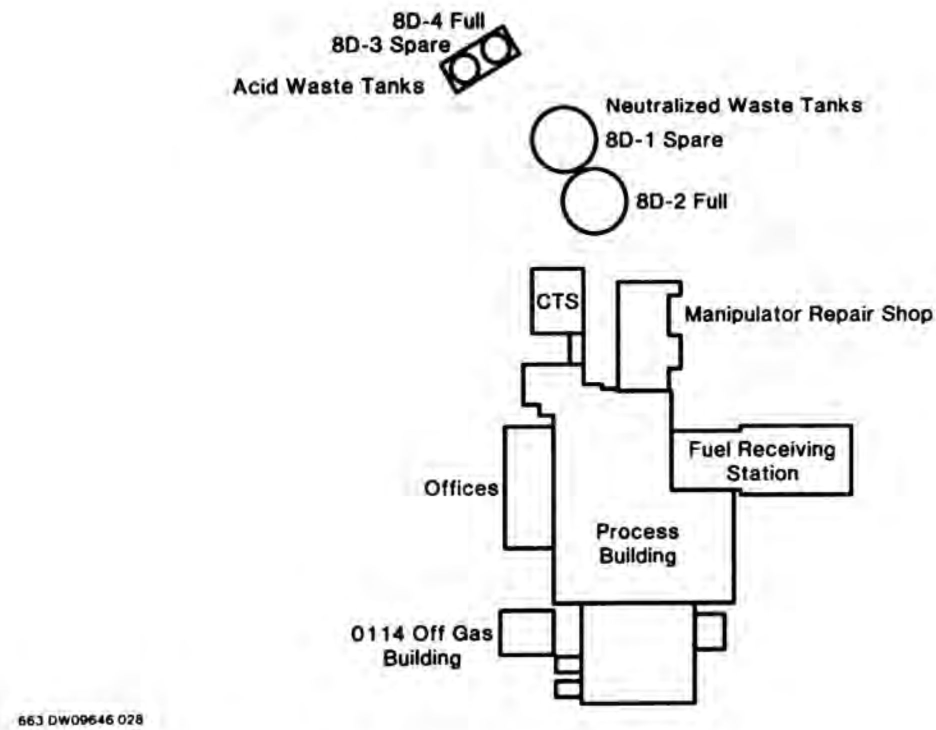

Fig. 1. Process Building and Waste Tanks (Plan View).

contains all 30,000 litres of the acidic THOREX process high-level waste generated at West Valley from reprocessing the first Indian Point core; the waste Tank 8D-3 has not been used for high-level wastes. A complete description of the high-level wastes at West Valley is contained in Ref. 2 and an update on the analyses completed to date will be presented[3].

THE VITRIFICATION FACILITY

The main objective of the Project is to solidify the high-level wastes stored in the underground storage tanks. Early in the Project, it was determined that the best way to accomplish this task was to immobilize the waste in borosilicate glass. The Vitrification System chosen for the Project was originally to be located in the old fuel reprocessing facility Chemical Processing Cell (CPC).

Locating the process in the CPC would require extensive decontamination of this large cell. The CPC is the largest cell in the building, 6.7 metres by 28.3 metres by 13.1 metres high and constructed of reinforced concrete. Its original use was for fuel dissolution and waste disposal operations. There are thirteen vessels located in the CPC and 1,400 of metres of pipe. Radiation surveys done with a remote device designed by WVNS specifically for this job indicated that general activity levels exceed 50 R/hr and there are several hot spots over 100 R/hr. Due to these levels and the large number of unknowns associated with the cell (e.g., vessels contain unknown solutions and a complete survey of the cell has not been completed) it was concluded that virtually all of the D&D work would have to be done remotely. This work would clearly be on the Project critical path. Preliminary consideration was given to construction of supplemental facilities for the vitrification process, leaving the refurbished reprocessing plant for low-level waste processing, interim high-level waste storage, and supporting functions.

Regardless of the final location of the Vitrification System, a need was determined for a full size, fully integrated and remotely operated test facility. During conceptual design it became apparent that very modest costs would be involved in constructing the full size test facility in such a manner that it could be convertible to a radioactive facility, without committing the Project as to the final location of the Vitrification System. It has now been concluded that conversion of the test facility is a particularly attractive concept, in that it decouples the vitrification of the high-level waste from the decontamination of the CPC and the Equipment Decontamination Room (EDR). A careful assessment of alternatives shows that the implementation of this idea will lead to a two year schedule improvement and a cost reduction of approximately 50 million dollars relative to the next best alternative for reuse of existing cells, and an even greater cost saving relative to construction of a new self contained system.

Construction of the test facility, known as the Component Test Stand (CTS), was completed in 1984 and the Slurry Fed Ceramic Melter and Canister Turntable were fabricated and installed. The CTS was constructed directly north of, and adjacent to, the existing Process Building (Fig. 1). It has been designed to demonstrate the integrated and remote operation of the Slurry Fed Ceramic Melter, its

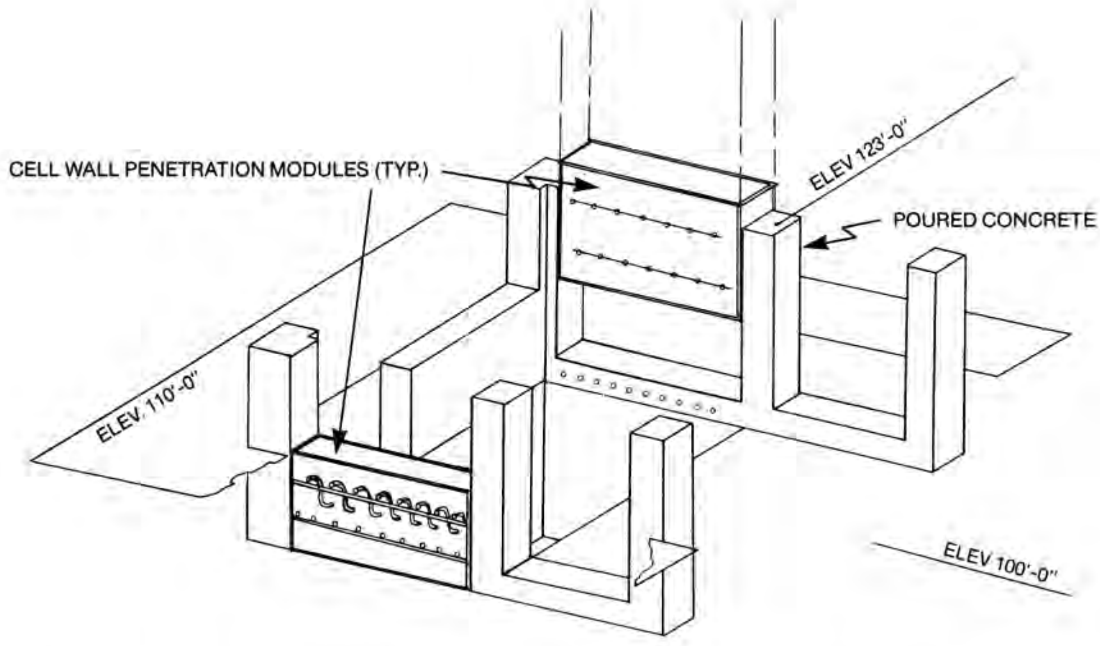

Fig. 2. Concept for Modular Construction of Vitrification Cell.

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Canister Turntable, and the immediate upstream and downstream components of the Vitrification System, ie., the Concentrator/Feed Makeup Tank, Melter Feed Tank, Feed Delivery System, and the Off-Gas System Submerged Bed Scrubber. This facility was described at Waste Management '84.[4]

In December of 1984, the first nonradioactive glass log was poured at West Valley. All components performed exactly as planned. Detailed conceptual design of the conversion of the CTS to a remote shielded vitrification facility is now being done. Extensive nonradioactive testing is scheduled to commence this summer in preparation for the 1988 start of radioactive operations.

In the ongoing effort to improve the schedule further, a concept for starting construction of the shield walls of the containment cell in 1985 has been developed (Fig. 2). If this can be accomplished as proposed, a 14-16 month system downtime now allocated for conversion construction can largely be eliminated, thereby allowing additional time for cold testing, and the potential for improving the vitrification start date. The system proposed for installation of the shield walls while component testing is ongoing is another example of the "Actiontrak" approach and will certainly be the subject of a future paper.

SUPERNATANT TREATMENT SYSTEM

The Supernatant Treatment System (STS) is an innovative and schedularly attractive approach to the decontamination of the high-level waste supernatant. After analysis, it was decided that the supernatant that contained nonradioactive salts and Cs-137 could be separately treated from the sludge, thereby reducing the number of borosilicate glass logs by a factor of six. To accomplish this separation, the STS will remove the supernatant from Tank 8D-2 and decontaminate it by processing it through a series of three ion exchange columns loaded with cesium specific zeolite. In total, there will be four columns installed to allow for continuous operation of the STS. As the first in the series becomes fully loaded, the stream will be diverted to the next three to allow for zeolite flushing and reloading of the first column. This also provides a margin of safety in the event that one of the columns becomes plugged or otherwise inoperative; there would continue to be three processing columns. The entire STS will be installed in waste Tank 8D-1 adjacent to Tank 8D-2, (Fig. 3). This innovative approach to using Tank 8D-1 to house this system accomplishes several things:

1. It eliminates the need for construction of a new shielded facility to house the ion exchange columns and associated tanks.

2. It decouples the STS from decontamination operations in the existing Process Building thereby allowing earlier construction, installation, and operation of the STS.

3. It serves as a full scale nonradioactive mock-up for later penetrations that will be made remotely in Tank 8D-2 for sludge mobilization and transfer pumps. (The Sludge Mobilization System is described in Ref. 5 and an update[6] of the status of that system has been presented.)

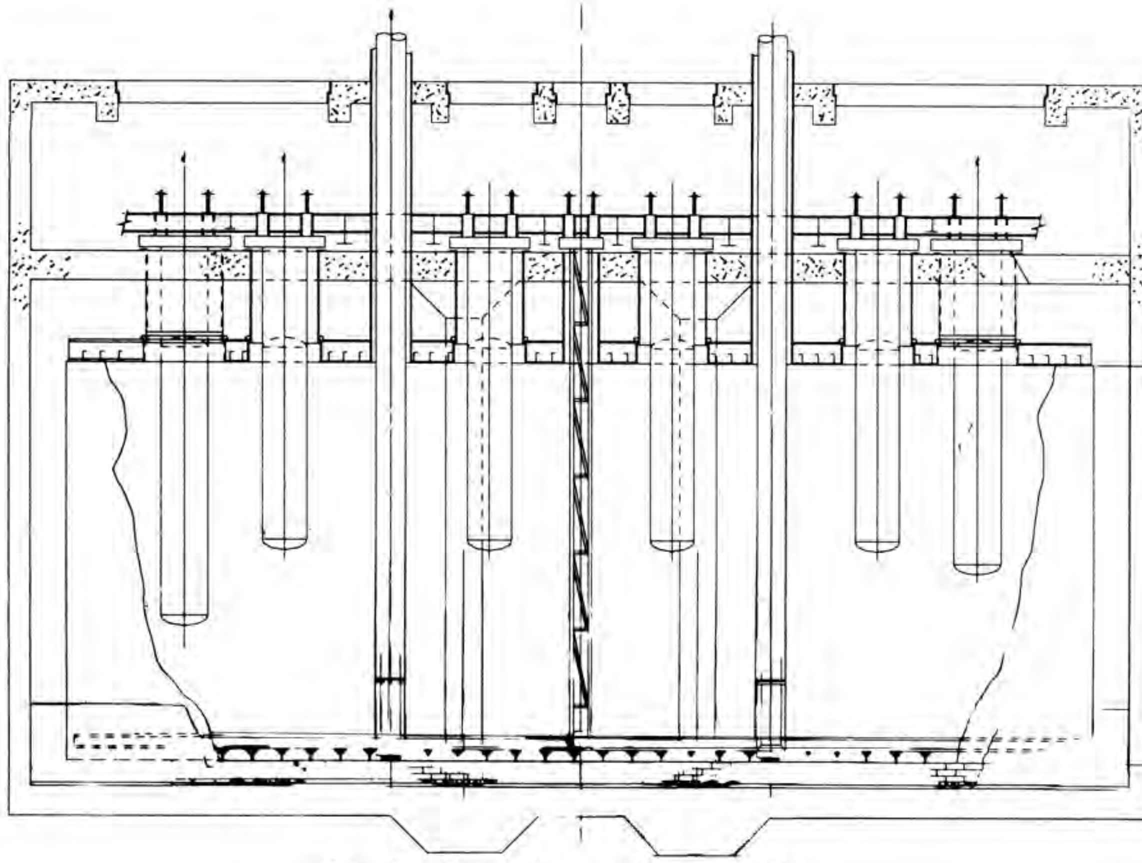

Fig. 3. Supernatant treatment system.

4. By removing the supernatant, sludge washing can begin earlier, thereby also decoupling this radioactive operation from the Vitrification Process.

The current plan is that the cesium loaded zeolite will be discharged directly into the bottom of Tank 8D-1 and will later be pumped to the Vitrification Facility. The STS was described in Ref. 7. The decontaminated Supernatant salt solution will be sent to the Cement Solidification System for solidification in concrete and disposal.

SLUDGE MOBILIZATION

Following extraction of the supernatant, a heavy clay like layer will remain on the bottom of Tank 8D-2. This sludge contains all of the high-level waste constituents except for the Cs which is soluble in the supernatant. In addition, the sludge is wet with interstitial supernatant. To simplify the vitrification process, the sludge will be washed to remove the bulk of the residual supernatant salts, and then slurried and transferred in batches to the melter system. In this instance, since this function closely parallels work already done at Savannah River, the plan is to directly adapt Savannah River technology. A One-Sixth Scale Model has been fabricated and tested to confirm the slurrying capabilities of pumps for West Valley wastes. Details of this adaptation are described in Ref. 6. Nature as well as parallel programs appear to be assisting us here in that preliminary indications from actual sludge samples are that the bottom layers of the sludge are high in soluble sulfates, which should make slurrying quite feasible.

SUPPORT SYSTEMS

Just as a nuclear power program is unusable without waste management, waste processing is meaningless without a means of processing and disposing of effluent streams. For West Valley the most interesting of these is the Radioactive Waste Treatment System (RTS) for handling all the low-level liquid waste streams from the Vitrification System, from the STS and from plant decontamination and decommissioning activities. Cement has been selected as the Project low-level waste form and recipes have been developed for the various Project effluent streams.

A high shear mixer system has been obtained and modification of existing structures is underway for this system. The system is described in some detail in Ref. 8 and it will be in operation this year. This system will be supported by a complex of evaporation, ion exchange, and filtration to be located in former extraction cells of the reprocessing facility. Detailed design of this system is underway.

DECONTAMINATION AND DECOMMISSIONING

Decontamination and Decommissioning (D&D) operations are continuing with extensive work being accomplished in several plant areas. The decoupling of the Vitrification and Supernatant Treatment Systems from the old facility has allowed D&D to proceed on a logical basis which enables the D&D schedule to also be accelerated. Major accomplishments have occurred in Extraction Cell 3 where 12 large vessels and 2,000 metres of piping have been removed. Engineers on-site developed procedures which enabled site personnel to refurbish all the plant analytical cell shield windows. Regaining use of these cells has enabled sludge and supernatant testing to be done on site. Several new and innovative methods are being employed in D&D to accelerate the schedule and reduce exposure of personnel. Robotics have played a part with the development of the Viking robot to enter the large cells and remotely accomplish what used to require manned entry and the use of a hydraulic arm for removal of pipe from the Extraction Cells. A hydroblast has also been procured that uses a high pressure water jet to cut through pipe, cement, etc.

PUBLIC INFORMATION

Public information and awareness is a vital aspect of this Project. In addition to the peer review emphasis noted above, we have an active communications program in place to meet the special information needs of environmental groups. This includes quarterly project meetings with such groups as the Sierra Club, the Coalition on West Valley Nuclear Wastes, and the Springville Field and Stream Club. These meetings involve addressing specific questions on topics agreed upon by the Project spokesperson and the principal contact with these groups. Project managers and experts present areas of interest and answer questions. Meetings take place on-site to allow use of visual aids and site tours.

We have extended an open invitation to the media to visit our Project. The attitude here is to cultivate press interest and encourage media coverage. We do this by giving journalists and reporters tours of the facility, press releases, fact sheets, videotapes, and slides. This open media policy has helped the media accurately describe the positive events taking place at the West Valley site.

Our credibility has been enhanced with the media by honestly reporting problems as well as accomplishments. Each year we invite the public to view our accomplishments first hand. This is done at our annual open house. Last year over 1,200 people attended.

SUMMARY

The WVDP is now starting its fourth year of operation. The Project "Actiontrak" approach has encouraged several innovative and schedularly active means of dealing with Project challenges. The major components of the Vitrification System have been installed in the CTS and nonradioactive glass has been produced. The decision to convert the CTS to a radioactive facility has been made and efforts are now underway to construct the containment cell. The Supernatant Treatment System has been designed and the first tank penetrations are scheduled to be made in August 1985.

Plant decontamination is continuing with extensive work accomplished in several plant areas. Fuel shipout is over 50% complete and other site maintenance and upgrade activities are continuing. Environmental and Safety programs are ongoing. The Safety Analysis and other Safety documentation is on schedule. The WVDP is ahead of schedule and below cost. By using existing methods and technology as well as new and innovative ideas, the Project has been able to maintain an "Actiontrak" mode of operation.

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