THE WEST VALLEY DEMONSTRATION PROJECT:

AHEAD OF SCHEDULE, BELOW BUDGET

AND

APPROACHING RADIOACTIVE OPERATION

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ABSTRACT

There is a general understanding within the nuclear community that the technology exists for processing high level nuclear wastes and that there are several available approaches for disposal of nuclear wastes which provide ample protection of the biological and ecological environment. Nevertheless, there is considerable public concern over the practicability of these technologies. The West Valley Demonstration Project is showing that available technology can be straight-forwardly applied to processing the rather complex West Valley high-level wastes, to cleaning up this former reprocessing plant, and to handling and disposing of resultant low-level wastes.

This paper discusses the project "Actiontrak" philosophy, the status of major systems being installed and the innovative approaches that are being taken in the design and location of these systems.

BACKGROUND

The West Valley Demonstration Project has just completed its fourth year of operation. Created by Public Law[1] in October 1980, the site was taken over by the Department of Energy (DOE) and DOE's prime contractor, the West Valley Nuclear Services Co., Inc. (WVNS), a subsidiary of the Westinghouse Electric Corp., at the end of February 1982.

The objectives of the Project, as specified in the Public Law, are to solidify the High-Level Wastes (HLW) remaining at the site from the fuel reprocessing operations that occurred between 1966 and 1972, to develop suitable containers for the transportation and permanent disposal of the HLW, to decontaminate and decommission (D&D) the facility, dispose of the low-level waste (LLW) produced and transport the HLW and transuranic (TRU) wastes to a federal repository.

The Project has adopted the philosophy that the technology for these tasks exists and that the challenge we face is to show that HLW solidification, transportation and disposal, TRU and LLW management and disposal and D&D of a highly contaminated reprocessing facility can be accomplished safely, expeditiously and at a reasonable cost.

The Project has operated under an approach which we call "Actiontrak". This approach assumes that the basic technology for what we are doing exists, and that our task is simply to apply it. The traditional sequence of Conceptional, Preliminary, Title I and Title II design is not employed. Rather, preliminary designs are developed by WVNS, converted into construction bid packages and equipment ordering data by the Architect-Engineer, Ebasco Services Inc. and bids are solicited and orders placed by WVNS. Provincial redesign by creative engineers to make something "better" are discouraged, rather that creative urge is directed to finding innovative solutions to real constraints and challenges. Some of these innovative solutions will be further reported in later sections of this paper.

Utilizing the "Actiontrak" approach requires an acceptance of the potential that some redesign will occur during construction or testing. The challenge lies in being able to assess, at the outset, what the potential is (in terms of cost and schedule) vice what the potential gains are (in this case in the terms of cost and schedule savings) by aggressively moving forward.

HLW SYSTEMS

The innovative solution to being able to perform an early demonstration of the West Valley HLW Vitrification System (VS) was the concept of creating a Component Test Stand (CTS) which was designed to be capable of being converted into the actual vitrification cell. This concept has been described in detail previously[2] and the results of the initial startup and testing were described in Monday afternoon's Session V[3]. Suffice it to say that essentially all of the VS components are now installed and in operation as an integrated system. Testing is in progress utilizing a fully representative surrogate (non-radioactive) flow sheet. To date, 28 tonnes of glass product have been produced. Valuable training and operating experience is being gained as the operational parameters are being fine-tuned and the process control system and feed sample analyses are being established. Product consistency and product quality will be established by process control within specifically pre- determined parameters. Much of that pre-determination is taking place now.

The major components being tested in the CTS were designed in collaboration with Battelle Pacific Northwest Laboratories (PNL)[4]. The principal components, the melter and turntable, were fabricated with PNL's assistance at the J. A. Jones Co., in Richland, Wa., although the melter was bricked at West Valley. WVNS continues to work closely with PNL on both the final design of the remaining remote components such as the jumpers and process monitoring equipment, as well as final flowsheet definition.

A small scale melter is now also installed at West Valley and will be used to determine the need for, and the composition of, any adjustments to glass former compositions if anomalies should occur in waste feed constituents. In Session XXVII this afternoon, the long term durability testing that has been performed[5] and the method by which West Valley plans to demonstrate compliance with Waste Acceptance Specifications[6], will be described.

The original schedule had shown that the testing phase of the VS would be shut down for approximately 16 months while the vitrification shield cell was constructed around it. An innovative solution was conceived which obviated the need for that shutdown. A concept was developed that allows the shielded cell to be constructed while VS testing and training continues.

THE VITRIFICATION CELL

Figure 1 illustrates the concept for the construction of the vitrification cell around the VS while nonradioactive operation of the VS continues. In July, 1985 the VS was shutdown for 8 weeks while forms were erected and the 1.2m thick shield wall was poured around the three melter electrode extensions which penetrate the shield wall. That is the only VS shutdown that is foreseen to occur during construction of the shielded cell. In late 1985 and January 1986 the six main columns forming the perimeter of the cell were encapsulated in 1.2m square concrete columns with associated rebar and rebar connectors.

The shield wall modules will be fabricated, delivered and installed within a year. These modules consist of stainless steel sheet, forming the inner wall of the cell, to which are welded the wall jumper connectors (Hanford Type), the "S" shaped jumper wall feedthroughs and structural supports and rebar. These modules will be fabricated as complete subassemblies.

When the wall modules arrive at West Valley they will be lowered into position between the wall columns, leveled and aligned by screw bolts and jacks and fixed in place. Services will be connected to the exterior connections of the jumper wall feedthroughs and the in cell jumpers between the VS components and the wall connections will be fabricated, aligned and attached. Once the jumpers have been attached, fully remote ("Canyon Remote") demonstrations of the removal and replacement of jumpers can be accomplished.

When the remote jumper demonstrations have been successfully completed and it has been determined that all jumper connections satisfy their hydraulic requirements (there are approximately 20% excess jumper locations available to permit relocations and additional services if required) the inner wall stainless plate will be welded to the existing stainless steel pit liner, the module rebar will be connected to the existing rebar in the foundation and the columns, outer wall forms will be erected and the modules will be filled with concrete. The upper portions of the cell walls (above the modules) will be constructed by conventional techniques and the cell roof will be installed using precast cover blocks. VS testing is anticipated to continue uninterrupted during all of this cell construction work.

SUPERNATANT TREATMENT

The neutralized HLW in underground tank 8D2 consists of a precipitated sludge and a supernatant

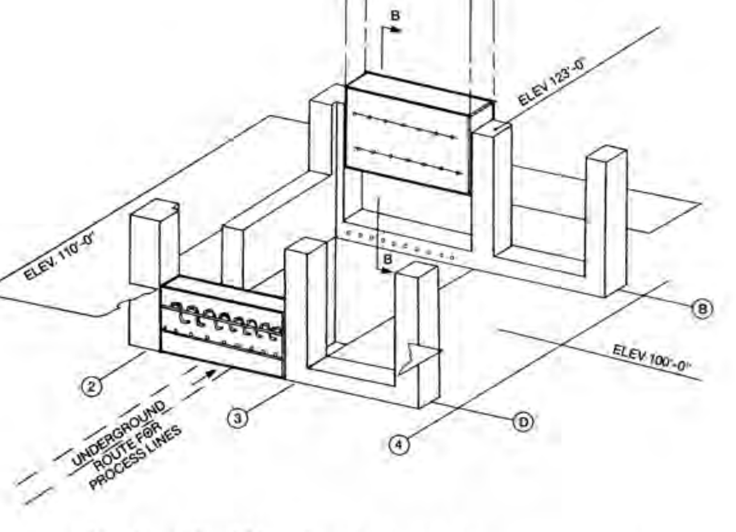

Fig. 1. Vitrification Cell modular wall concept.

phase. The supernatant represents about 90% of that HLW volume and about 50% of the HLW radionuclide inventory (as Cs^{137}). The supernatant will be decontaminated by ion exchange (IX) utilizing three IX columns in series. The IX media will be a Zeolite (Linde Ionsiv(r) IE-96)

To permit an early startup of this system, another innovative concept was required. Schedular conflicts existed in the original plan to install the Supernatant Treatment System (STS) within the existing Process Building. The only shielded cell within the existing plant that provided sufficient space for the STS and which was also not already selected for other Project systems, was the Equipment Decontamination Room (EDR). The EDR is located immediately north of the Chemical Process Cell (CPC) and is the only means of access to the CPC capable of permitting egress of the fuel dissolvers and evaporators. These components have now been removed, but additional equipment and extensive cleanup and decontamination remains to be accomplished. The CPC has also been selected as the cell where the vitrified HLW canisters will be stored until such time as a federal repository is in operation and ready to receive HLW. Storage racks must be installed in the CPC for the long-term storage of the HLW canisters. Again, the EDR is the means of access to the CPC and therefore could not be utilized for the STS until all of the above activities were completed.

In searching for an alternate location for the STS, other than constructing a new shielded facility, the innovative concept of using the spare underground HLW tank 8D1 was conceived. Figures 2 and 3 illustrate this concept. The four IX columns (three in use, the fourth being discharged of Cs-loaded Zeolite and recharged with fresh Zeolite), a supernatant feed tank, a sluice water lift tank, pre-and post-filters, a cooler and 8 mobilization/sluicing pumps will be mounted in (and shielded by) tank 8D1, Fig. 3.

The design of the STS has been described in detail previously[7]. Utilizing this concept for the STS location has permitted the Project to start construction of this system 9 months earlier than previously scheduled. The foundations for the STS valve aisle and the concrete shielding for the piping runs between the valve aisle and the top of 8D1 are complete. Holes are being cut now in the 8D1 concrete vault for the subsequent installation of the components described above. The holes will be cut using an ADMAC high pressure water jet abrasive cutter using 35,000 psi water and No. 36 garnet grit. The 30.5 cm thick steel valve aisle is being fabricated, installation will start on site in May of this year. Nonradioactive operation of the STS is scheduled to commence late this year. Radioactive operation should occur before Waste Management '87.

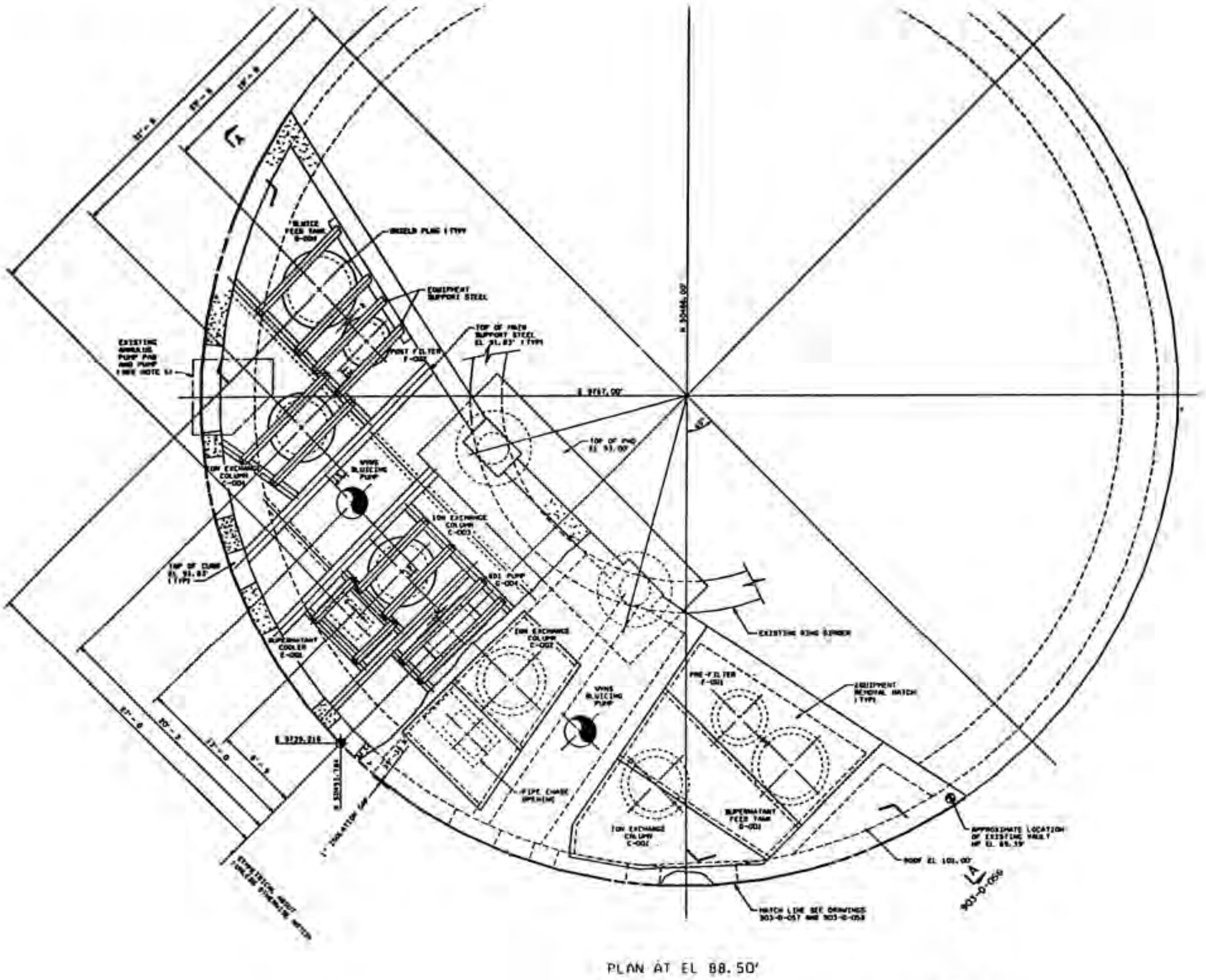

Fig. 2. Plan View of Supernatant Treatment System Installation in Underground Tank 8D-1.

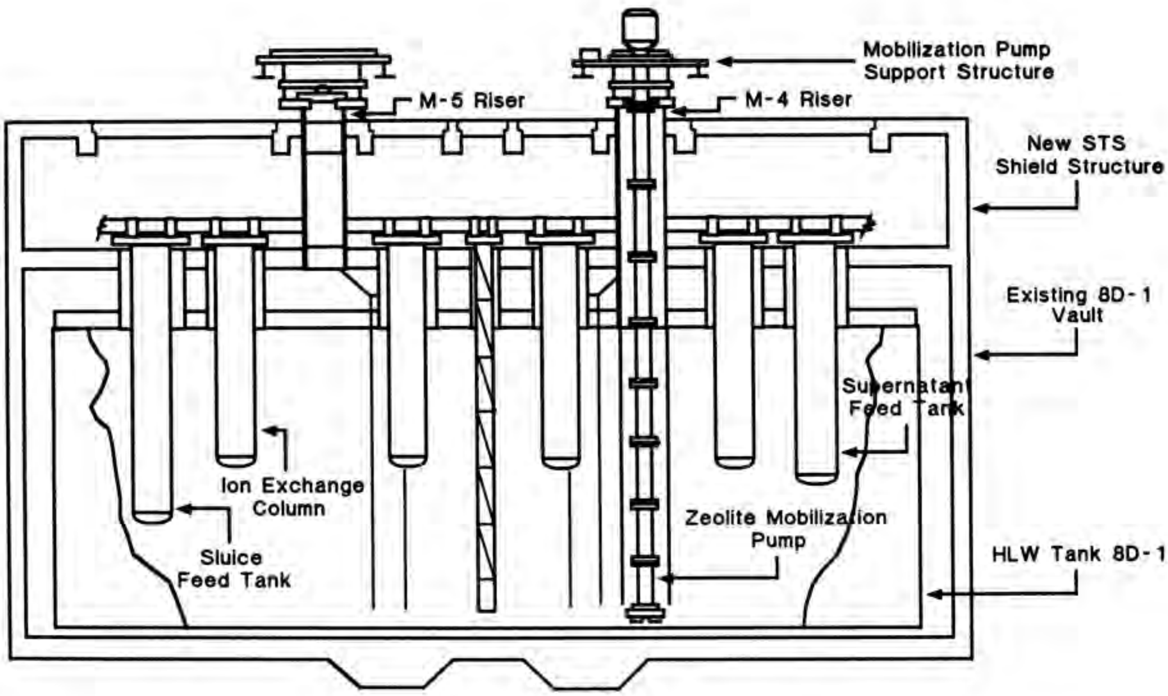

Fig.3. Elevation View of Supernatant Treatment System Installation in Underground Tank 8D-1

SLUDGE MOBILIZATION

The design and status of the Sludge Mobilization System (SMS) will be described in detail in this afternoon's Session XXVII[8]. Testing has continued in the 1/6th scale model of tank 8D2 to optimize the parameters and location of the SMS pumps and for sluicing the Zeolite from 8D1. Design and fabrication of equipment for remote installation of pump risers in 8D2 has been accomplished by Rockwell Hanford Operations under WVNS' direction. Demonstration of that technique will occur on spare tank 8D1 this spring, prior to the remote operations on HLW tank 8D2.

DECONTAMINATION

Decontamination and decommissioning (D&D) of highly contaminated former reprocessing cells has continued. The cells decontaminated to date have been those which are first needed by the Project, principal of which are those cells designated to receive the Liquid Waste Treatment System (LWTS) portion of the Radwaste Treatment System (RTS).

The major components of the LWTS will be installed in the Product Purification Cell (PPC) and Extraction Cell 3 (XC3). D&D of PPC & XC3 was completed in 1985.

Present D&D activity is centered in the CPC. The eight major vessels (dissolvers and evaporators) and all of the jumpers have been removed to temporary storage. Two weeks ago the first remote entry by a robot was made into the CPC. Provided by Viking Energy Corp., under a Small Business Innovative Research contract, a six-wheeled, skid-steered robot carrying an industrial manipulator arm and towing a HI-VAC vacuum cleaning system is presently removing debris from the floor of the CPC.

The jumpers and vessels removed from the CPC were packaged in large metal boxes, sealed, and have been temporarily stored behind a wall of hollow concrete hexagons which contain, as additional shielding, up to twenty-one uncompacted 208 litre drums of LLW. Additional concrete shielding is placed over the metal boxes as necessary to eliminate sky shine. The entire storage area is weather protected by a fabric-covered sprung structure mounted on wheels and tracks to permit loading of the boxes within the concrete wall, Fig. 4.

SPENT FUEL SHIPMENTS

Six hundred and sixteen of the 750 spent fuel assemblies present in the fuel pool at the time of site takeovover have been returned to their utility owners without incident. The successful program of concern for the public issues raised by these shipments was described in yesterday morning's Session IX[9]. A rod consolidation demonstration was performed by Nuclear Assurance Corp. on 13 Rochester Gas & Electric Co. (RG&E) fuel assemblies in the last two months. These consolidated assemblies are now ready for shipment to RG&E. The remaining 125 assemblies, belonging to Nuclear Fuel Services, are ready for shipment as soon as the rail casks to be used complete the certification process. All of the utility owned spent fuel was returned by truck shipments.

When the last of the spent fuel has been shipped (expected by late Spring), the Fuel Receiving and Storage (FRS) area (the fuel pool) will be converted to a size reduction and vessel decontamination area. The large vessels removed from the CPC, which are now in temporary storage, will be moved to the FRS for decontamination, size reduction and packaging.

RADIOACTIVE WASTE TREATMENT

The design of the LWTS is complete, orders have been placed for the components and the contract for the first phase of installation work in PPC & XC3 has been placed and work is underway.

The Cement Solidification System (CSS) portion of the RTS is complete and went into radioactive operation in December 1985 processing 16 m^3 of Uranyl Nitrate Hexahydrate which remained in storage in the plant from the former reprocessing operations. The retrofitting of the CSS into an existing building at West Valley and the initial operations of that system was described in yesterday's Session XVIII[10] as was the design, installation and testing of the material (drum) handling portion of the system[11].

The CSS will process all liquid LLW into a disposable solid waste form, receiving waste streams from all plant systems, D&D activities and the HLW processes, notably the approximately 5700 m^3 of decontaminated supernatant. Cement recipe development has been performed on all expected waste streams to ensure that a product acceptable for disposal can be made. Some of that product testing was described in yesterday's Session XVIII[12] also.

PROJECT LLW DISPOSAL

The Project Environmental Impact Statement (EIS)[13] did not address the disposal of Project LLW but provided that it would be the subject of future environmental review. An Environmental Assessment is nearing completion on this subject. It is premature to judge what the final approved method for disposal of Project LLW will be, until the environmental review process is completed, however, as presently envisioned, this also will be innovative. As presently conceived, Class A LLW will be disposed in engineered shallow land trenches, with suitable drainage and monitoring capabilities. Class B and C LLW will be disposed in an engineered above-grade tummulus constructed of clay caps, reinforced with geotechnical fabric and a rip-rap precast concrete element intruder barrier. The precept for the tummulus is that, in the period beyond instituitional control, if any surface water should reach the waste because of breaching of the waste cover, the contact time of the water with the waste will be minimal as gravity drainage would cause the water to quickly pass the waste (which is above the natural grade) and run off through the engineered drainage system. "Bathtubbing" would not occur, therefore extended contact of the water with the waste would be avoided and waste leaching would be minimized.

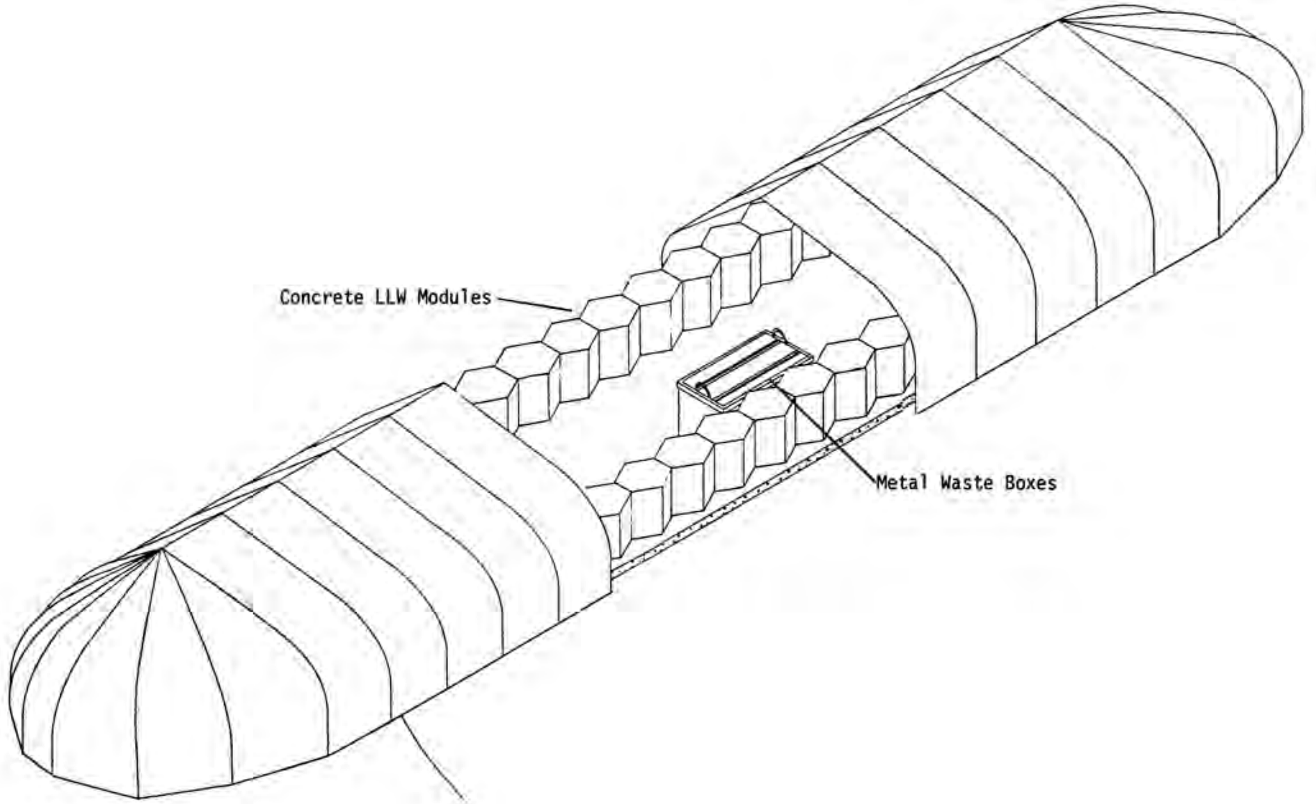

Fig. 4. Spring Structure Waste Storage Area.

SUMMARY

Actiontrak has produced cost and schedule savings for the WVDP. The start of vitrification of the HLW has been moved up to 1988 from 1991. The start of radioactive operation of the STS has been advanced by one year. Innovative thinking has minimized the need for construction of new facilities. The Total Plant Cost Estimate has been reduced by $36M. The West Valley Demonstration Project is ahead of schedule, below budget and will commence radioactive operation of HLW processes within a year!

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