

Mr. Andre-Claude LaCoste, Directeur  
Direction de la Surete des Installations Nucleaires  
99 Rue de Grenelle  
75353 Paris 07 SP  
France

SUBJECT: WEST VALLEY DEMONSTRATION PROJECT LEGACY WASTE

Dear Mr. LaCoste:

On March 7, 2001, the U.S. Nuclear Regulatory Commission (NRC) briefed the Directorate for the Safety of Nuclear Installations (DSIN) on legacy waste at the West Valley Demonstration Project. During this briefing, the DSIN asked about the design specifications for the high-level waste (HLW) canisters used at West Valley. DSIN also asked about the relationship between the original volume of HLW to be vitrified and the total number of HLW canisters produced. The enclosed responses to these questions were coordinated with the U.S. Department of Energy's West Valley Demonstration Project Office.

If you have any questions, please contact Ms. Amy M. Snyder of my staff at (301) 415-7644.

Sincerely,

John T. Greeves, Director  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

Enclosures: Responses to Questions

cc: A. Williams, U.S. DOE (WVDP)  
J. Hamil, U.S. DOE (WVDP)

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**/RA/**  
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Enclosures: Questions and Responses  
WVDP-185  
WVDP-186

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## **RESPONSE TO QUESTIONS CONCERNING HIGH-LEVEL RADIOACTIVE WASTE AT WEST VALLEY**

### **HIGH-LEVEL RADIOACTIVE WASTE CANISTER DESIGN**

The high-level radioactive waste (HLW) canisters were designed by West Valley Nuclear Services, Inc., a Westinghouse Company. The specifications and reference drawings are found in Section 2 of the Waste Form Compliance Plan (WCP) for the West Valley Demonstration Project High-Level Waste Form, WVDP-185 (Attachment A). The WCP also contains a brief history of the site and the Project's overall strategy for meeting the repository requirements that are specified in the Waste Acceptance Product Specifications (WAPS).

### **RELATIONSHIP BETWEEN THE ORIGINAL VOLUME OF HLW TO BE VITRIFIED AND THE TOTAL NUMBER OF HLW CANISTERS**

According to the Department of Energy's - West Valley Demonstration Project Office (DOE/OH/WVDP), the HLW volume and the resulting number of canisters are related to the chemical composition of the waste. The waste, from spent fuel reprocessed between 1966 and 1972, was a combination of sludge and supernatant liquid. At West Valley, the spent fuel came from various reactors; however most of it came from a research reactor. When vitrification began in 1996, the HLW had existed since the sixties and the highest activity resulted from Cs-137. Furthermore, the chemical composition of the waste was modified in pretreatment before vitrification. The waste was treated to remove non-radiological constituents such as sodium sulfate. At West Valley, vitrification is a batch process. The glass recipe for vitrification must meet certain chemical specifications to ensure waste acceptance.

The volume of the HLW present at West Valley when the Project began in 1981 was about 600,000 gallons. Two separate layers had formed in the waste tank: (1) a liquid layer on top containing all the soluble components, in particular sodium and cesium salts; and (2) a layer of insoluble sludge, approximately 18-inches thick, on the bottom of the tank containing the long-lived isotopes of uranium, plutonium, etc. The presence of two very different and separable layers in the tank led to the decision to make two different waste forms.

The liquid layer was processed through a zeolite ion exchange medium which removed more than 99.9% of the cesium. (Cs-137 being the main source of radioactivity in the liquid.) The resulting nearly-non-radioactive liquid was then boiled in a concentrator and then mixed with cement and poured into 71-gallon square drums. After processing most of the liquid, mixing pumps were installed in the tank to "mobilize" the sludge layer. Water was also added to "wash" some of the sodium from the sludge. The water added to the tank was processed through the zeolite and solidified with cement. Nearly 20,000 drums of cement were produced. These drums are classified as low-level radioactive waste and are stored on site.

The zeolite ion exchange medium, now contaminated with the Cs-137, was mixed with the sludge. The resulting sludge/zeolite mixture, containing virtually all of the HLW radioactive isotopes, provided the feed for the vitrification process. As of March 29, 2001, 255 canisters of

Enclosure

glass have been produced. (Each canister contains slightly less than one cubic meter of glass weighing about 2000 kg.)

Because of the complexities of the overall processing scheme, it is not possible to provide a direct correlation between the starting amount of liquid HLW and the resulting immobilized HLW. Additionally, the waste tank is now being rinsed to remove the remaining radioactive sludge left on the walls, adding additional gallons of material to be processed, but not additional curies. In the end, the total volume of liquid processed through both the cement and vitrification facilities will be several times the original volume of the waste present in 1981.

In summary, the number of canisters produced or filled with solidified waste, is determined by chemical composition of HLW to be vitrified and the overall processing scheme. For detailed information on the spent fuel sources and the chemical form of the waste, refer to Section 1.2 of the WVDP Waste Form Qualification Report - Canistered Waste Form Specifications, WVDP- 186 (Attachment B).

Attachments:

- A. Waste Form Compliance Plan
- B. Waste Form Qualification Report