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# SLUDGE WASHING AND DISSOLUTION OF MELTON VALLEY STORAGE TANK WASTE*

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## Sludge Washing and Dissolution of Melton Valley Storage Tank Waste

### Task Description

The focus of this task is on experimental and modeling research and development to support the comprehensive sludge/supernatant processing flowsheet work being conducted for the Underground Storage Tank Integration Demonstration. The primary emphasis here is on Hanford tank waste disposal involving dissolution of the sludge before pretreatment. Understanding the compositions of the dissolving solutions is important for planning further treatment strategies, such as the various extraction options and vitrification. Actual wastes from the Melton Valley Storage Tanks (MVST) at Oak Ridge National Laboratory are used for experiments on sludge washing and dissolution.

### Technology Needs

There are two aspects of sludge treatment that should be well delineated and predictable: (1) the distribution of chemical species between aqueous solutions and solids and (2) potential problems due to chemical interactions that could result in process difficulties or safety concerns.

The DOE site tank waste disposal strategy should include mixing the sludge with an acid or base before further treatment. The chemical interactions both within the sludge and between the sludge and process chemicals must be better understood to plan subsequent treatment strategies, such as vitrification, TRUEX, or any of the other high-level waste separation technologies.

### Accomplishments

The combination of tests on actual MVST sludge, tests on sludge simulants, and modeling of sludge chemistry provides a broad evaluation of sludge and supernate processing. This information is useful for both MVST and Hanford tank wastes. Frequent discussions between staff from ORNL and Pacific Northwest Laboratory helps ensure that results of these studies are applicable to sludge treatment at both sites. Two letter reports on thermodynamic modeling and initial sludge tests have been issued.

It is likely that treatment of waste tank sludge will begin with washing, followed by basic or acidic leaching. Both acidic and basic leaching of Melton Valley Storage Tank (MVST) sludge are being evaluated by tests with MVST sludge and by modeling. Tests of acidic leaching have shown that the distribution of species between the aqueous phase and solids can be altered by changing the pH of the leachate. However, some species, notably cesium and plutonium, are difficult to dissolve, even in acid concentrations up to 6 *M*. In addition, the acid leaching studies have demonstrated that gels or particulate solids form in leachates that are left undisturbed for time periods up to several months.

Caustic leaching at room temperature with 3 *M* NaOH and 6 *M* NaOH was not very effective in removing metals from the sludge solids. Only $\sim 5\%$ of the aluminum was leached, and very little phosphate dissolved in caustic solution. MVST sludge contains relatively high concentrations of calcium, and this calcium likely played a part in retarding dissolution of aluminum and phosphate.

## Benefits

The management of approximately 400,000 gallons of highly radioactive alkaline nitrate wastes at ORNL can benefit from washing to partition fission products (e.g., cesium and strontium) from the resulting wastes. This smaller volume of partitioned actinides could be transferred to existing waste processing facilities at other sites for vitrification, thus eliminating the need for MVST TRU fixation at ORNL. The resulting low-level waste can then be handled either onsite or in a low-level waste repository instead of having to go to the WIPP.

The technologies tested in this project would potentially benefit all DOE sites that must manage alkaline nitrate waste liquids/sludges. An outstanding example of this is Hanford tank wastes. If vitrified without separation, approximately 200,000 canisters of waste would be generated at a cost of approximately $150 billion. Separations technology can reduce the number of canisters by about a factor of 10, with most of the waste volume becoming low-level waste that is more easily and inexpensively managed via onsite disposal. This could result in direct savings of tens of billions of dollars and reduce the amount of waste sent to a repository. This technology also applies to meeting regulatory commitments at Hanford.

## Collaboration/Technology Transfer

Pacific Northwest Laboratory
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