

- The facility would be designed to facilitate dismantlement, removal, and packaging of contaminated equipment
- Lifting lugs would be used on equipment to facilitate remote removal from the process cell
- The piping systems that would carry hazardous products would be fully drainable.

2.8 Other Decision-Making Factors

2.8.1 NATIONAL ACADEMY OF SCIENCES REVIEW COMMITTEES FINAL REPORTS

In June 1999 the Under Secretary of Energy requested that the National Academy of Sciences – National Research Council provide an independent technical review of alternatives for processing the HLW salt solutions at SRS. In response to the request, the Council appointed a “Committee on Cesium Processing Alternatives for High-Level Waste at the Savannah River Site” to review DOE’s work to identify alternatives for separating cesium from high-level waste at SRS. This committee conducted the review and provided an interim report in October 1999 and a final report in October 2000. In October 2000 the Council appointed a “Committee on Radionuclide Separation Processes for High-Level Waste at the Savannah River Site” to review DOE’s efforts to evaluate and select a process for separating radionuclides from soluble high-level radioactive waste at SRS. This second committee conducted its review and provided an interim report in March 2001 and a Final Report in June 2001. Summaries of the reviews conducted by these Council committees are provided below.

2.8.1.1 Committee on Cesium Processing Alternatives for High-Level Waste at the Savannah River Site

The Committee on Cesium Processing Alternatives for High-Level Waste at the Savannah River Site was composed of experts in fields of nuclear reactor and the fuel cycle technology, nuclear chemistry and separations, environmental sciences, and nuclear waste disposal. DOE had requested that a preliminary report be provided by the end of September 1999 to identify any significant issues or problems with the alternatives that could be factored into the Draft SEIS. The committee issued an interim report in October 1999 and a final report in October 2000, prior to the issuance of the Draft SEIS. The final report (NAS 2000) endorsed in general the selection of the four candidate processes considered as alternatives for salt disposal, concluding that each of the processes was potentially appropriate and no obvious major processing options were overlooked. Recommendations for addressing the technical uncertainties associated with each of the alternative were identified, with schedule constraints and potential regulatory restrictions noted.

The following describes the tasks requested by DOE, the conclusions reached by the Committee in the final report, and the subsequent actions taken by DOE:

Task 1: Assess identification of a comprehensive set of processes for separation of cesium from HLW salt solution.

- *Committee Conclusions:* A comprehensive set of cesium separation processes was identified and no additional effort on process identification was recommended.
- *DOE Actions:* The Committee had no recommendations; therefore, DOE took no subsequent action.

TC

TC

Task 2: Evaluate the technical soundness of the screening procedure and resultant selection of appropriate alternatives.

- *Committee Conclusions:* Although deemed complex and based mainly on expert judgment employing qualitative factors, the screening procedure did result in four potentially appropriate processing alternatives.
- *DOE Actions:* Because the Committee determined that the screening procedure resulted in four potentially appropriate processing alternatives, DOE took no subsequent action.

Task 3: Identify significant barriers to implementation of any alternative, taking into account state of development and potential for integration into the existing SRS HLW system.

- *Committee Conclusions:* A carefully planned and managed research and development (R&D) program would be required for the three cesium separation alternatives (Small Tank Precipitation, Ion Exchange, and Solvent Extraction, each including monosodium titanate treatment for strontium and actinide removal), until enough information is available to make a defensible down-select decision. Good-faith discussions with regulators should be conducted to determine if the fourth alternative, Direct Disposal of cesium in Grout, would be feasible, should all other processing options prove technically or economically impractical. A more fully integrated approach involving tailoring of HLW salt processing in accord with the composition of wastes in individual tanks could prove beneficial. And lastly, the DOE should charter external expert review and oversight groups to provide needed R&D direction and support for management decisions.
- *DOE Actions:* A program plan for technology research and development

(PNNL 2000) was issued in May 2000 to address the technical uncertainties associated with each of the salt processing alternatives and provide adequate information for making a down-select decision. DOE evaluated the R&D activities identified in the program plan and determined that each R&D recommendation from the Council was adequately addressed in the program plan. DOE has evaluated these R&D activities and identified those activities that would need to be completed to support a technology down-selection decision. The activities were prioritized and completed in April 2001.

Preliminary discussions with regulators (Nuclear Regulatory Commission, SCDHEC, and EPA-Region IV) indicate general acceptance of the Direct Disposal in Grout concept, provided DOE could establish that the final waste form does not require management as HLW. However, if Direct Disposal in Grout were selected as the preferred alternative, additional discussion with the regulating agencies would be necessary to address regulatory issues. Current DOE policy requires removal of "key radionuclides" from HLW to the maximum extent technically and economically practical, before permitting disposal as "waste incidental to reprocessing" in a low-level waste shallow-land disposal facility. DOE considers cesium to be a "key radionuclide" in HLW.

L11-4

L6-3
L8-10

DOE agrees with the concept of applying an integrated systems engineering approach to salt processing. The HLW System at SRS is fully integrated and managed in accord with the broad range of operational and regulatory constraints to meet acceptance criteria for the Defense Waste Processing and Saltstone facilities. This approach is reflected in the *High-Level Waste System Plan* (WSRC 2000a) and used in all HLW system planning and production activities, including the evaluation of salt processing options. Studies undertaken to conserve tank space and optimize salt processing for final disposal have considered special tailoring of

operations for wastes of different composition. While there is variability in salt waste, a review of waste characterization data for all receipt and storage tanks indicates that saltstone grout produced from the lowest-activity tank would challenge the basis for the current saltstone operating permit. Additionally, strategies based on multiple process facilities tailored to individual tanks or groups of tanks are not considered to be viable from a cost perspective or environmentally sound when decontamination and decommissioning impacts are considered. Further evaluations of waste processing options will continue through the HLW system planning process in parallel with technology development and down-selection activities.

DOE established in March 2000 a Technical Working Group (TWG) to manage technology development of treatment alternatives. The TWG is composed of staff from DOE's Office of Project Completion, Office of Science and Technology, Office of Technical Program Integration, and the Savannah River Operations Office. The TWG is responsible for managing and overseeing the development of a Research & Development Program Plan, creating technology road maps, establishing separations technology down-selection criteria, project integration, ensuring execution, and technical oversight of technology development efforts. The TWG is supported by DOE's Tanks Focus Area for execution of R&D activities, and a Technical Advisory Team for independent review of technology implementation.

Task 4: Assess the adequacy of planned R&D activities to support implementation of a single preferred alternative.

- *Committee Conclusions:* Several recommendations are made for additional R&D to address remaining scientific and technical uncertainties for each of the

four salt processing options. These recommendations generally include:

- Resolution of technical questions concerning reaction kinetics of the monosodium titanate process for removal of strontium and actinides, as advanced for all alternatives
- Improved understanding of the tetraphenylborate decomposition process, especially catalytic reactions responsible for benzene generation
- Evaluation of cesium desorption and resin deactivation in alkaline solutions as encountered in the Ion Exchange process
- Continued development of the Solvent Extraction process to resolve potential solvent instability, recycle, and contaminant problems, and to establish availability of the extraction agents in quantities required for large-scale processing
- Establishing regulatory acceptance for the Direct Disposal (of cesium) in Grout alternative.

- *DOE Actions:* R&D activities to address each of the Committee's recommendations for additional R&D work on remaining scientific and technical uncertainties were included in, and implemented in accordance with, the R&D Program Plan (PNNL 2000), issued by DOE's Tanks Focus Area in May 2000. R&D activities necessary to support a technology down-selection decision are complete. DOE has no plans to pursue regulatory acceptance of the Direct Disposal in Grout alternative.

TC

2.8.1.2 Committee on Radionuclide Separation Processes for High-Level Waste at the Savannah River Site

In reviewing DOE's efforts to evaluate and select a process for separating radionuclides from soluble high-level radioactive waste, the Com-

TC

TC

mittee on Radionuclide Separation Processes for High-Level Waste at the Savannah River Site was tasked to: (1) evaluate the adequacy of the criteria that will be used to select from among the candidate processes under consideration; (2) evaluate the progress and results of the research and development work that was being undertaken on the candidate processes; and (3) assess whether the technical uncertainties have been sufficiently resolved to proceed with downsizing the list of candidate processes. The committee issued an interim report in March 2001 (NAS 2001a), which addressed only the first task. The committee's interim evaluation concluded that DOE's selection criteria were reasonable and appropriate and were developed in a transparent way, while also concluding that some criteria did not appear to be independent of others, and some criteria appeared unlikely to discriminate among the process alternatives. The committee briefed the DOE Assistant Secretary for Environmental Management in May 2001 on the final results of their evaluation. The committee's final report was submitted in June 2001. The committee concluded that solvent extraction posed the fewest technical uncertainties for removing cesium from the HLW salt (NAS 2001b).

2.8.2 DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATION 2001-1

A recent survey of SRS radioactive high-level waste (HLW) management operations by the Defense Nuclear Facilities Safety Board (DNFSB) addressed emergency problems in handling and storage of liquid wastes due to the projected shortage of HLW tank space (DNFSB 2001). The DNFSB provides safety oversight for the DOE defense facilities operations. The survey resulted in recommendations to implement several measures to maintain adequate safety margins in HLW storage, including reassessment and vigorous acceleration of the schedule for operation of a salt processing facility. Developing an integrated plan for tank space management to maintain safe

operating margins pending startup of salt waste processing was recommended. Measures proposed, analogous to those projected for the No Action scenario in the SEIS, included reducing or eliminating the DWPF liquid low-level waste stream, recovering ITP process tanks for waste storage, resolving existing HLW evaporator problems and assessing the need for additional evaporator capacity, and possibly constructing additional waste tanks. The DNFSB recognized that implementation of such measures is in progress, but urged special focus to avoid delays that could result in reduced safety. DOE and the DNFSB are discussing the elements of an implementation plan that would be acceptable to the Board.

2.8.3 SELF-PROTECTING HLW CANISTERS

TC

Direct Disposal in Grout would not be consistent with DOE's recent Record of Decision (65 FR 1608; January 11, 2000) for disposition of surplus weapons-grade plutonium, which states that some of the plutonium will be immobilized in HLW canisters for eventual geologic disposal. Implementation of this approach requires the availability of a sufficient quantity of cesium-containing HLW to vitrify around the canisters of plutonium. The Direct Disposal in Grout alternative would not produce vitrified HLW that would support this option, because the cesium would not be in the vitrified waste stream.

The U.S. Nuclear Regulatory Commission and the International Atomic Energy Agency consider material emitting more than 100 rads per hour at 1 meter to be sufficiently self-protecting to require a lower level of safeguarding. Canisters containing cesium would emit hundreds of rads per hour, and thus be self-protecting. Canisters without radioactive cesium would emit 1 to 2 rads per hour at 1 meter, which is well below the self-protecting standard. Such canisters produced using the Direct Disposal in Grout alternative would not meet the Spent Fuel Standard without the addition of another radiation source. DOE would have to evaluate alternatives to resolve this issue before selecting the Direct Disposal in Grout alternative.