Savannah River Site (SRS)
Unaddressed or Partially Addressed Technology Needs

All SRS Needs can be found on the WWW at
http://www.srs.gov/general/sci-tech/tech-prog/index.htm.

Solid Waste Management

Technologies to Increase Transuranic Waste Transportation System Curie, Size, and Weight Limits (SR-1001)

A need exists to develop technologies that increase the curie, size, and weight limits for transportation of Transuranic waste, and to reduce the treatment requirements prior to transportation. Technologies for prevention or safe removal of hydrogen gas generation due to radiolysis of organics are also needed. Specific technology development areas include: writing national standards for TRU transportation, non-intrusive real-time capability to determine flammability potential for shipment containers, improved diffusion of potentially flammable gas through layers of confinement, hydrogen getter/recombiner technology, technology to develop organisms that eat plastics, analytical/test models that take credit for design of packaging to contain explosion, and package venting methodologies. The technologies must be capable of supporting transportation of a minimum of ten 55-gallon drums, each containing up to 1,000 curies of radioactivity within an organic waste matrix.

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Treatment for Mixed Waste Soils to Immobilize Radionuclides and RCRA Constituents for Disposal (SR-1002)

Cost-effective treatment of hazardous constituents and disposal of large volumes of MW soils forecasted to be generated from the D&D and ER activities. Soils may contain a wide range of hazardous constituents including organics, solvents, heavy metals, and semi-volatiles, as well as a wide range of radionuclides including tritium, alpha and beta-gamma emitters. WMEIS identified sorting of the soils to separate the contaminated soil from the uncontaminated fraction, and vitrification of the contaminated soils to treat the organic hazardous constituents and to immobilize the inorganic hazardous and the radioactive constituents as preferred treatment. Treatment technology should minimize the generation of secondary waste.

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Improvements to Physical, Chemical, and Radionuclide Qualification of Solid Waste (SR-1003)

Savannah River Site produces and stores Mixed Low-Level, and Transuranic Wastes contained in 55-gallon drums, carbon-steel boxes, and various sized stainless-steel containers. The waste in these containers needs to be characterized both for RCRA constituents and for radionuclide constituents to ensure the safe storage, treatment, and disposal of these wastes in accordance with regulatory requirements. Characterization of a wide range of waste streams with different requirements is needed. All mixed wastes must be characterized for RCRA metals, volatiles, and semi-volatiles at the minimum limits set forth in regulations. Additionally, the identity and amount of radionuclides present must be determine for operations and safety.

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High-Level Waste

Tank Heel Removal (SR-2001)

Residual heels of sludge and debris remain on the bottoms of some of the waste tanks after the bulk waste removal is performed. The tanks are one million gallon nominal capacity with a diameter of 75 to 85 feet, depending on the type of tank. The types of debris and residual waste include hardened sludge, zeolite, silica, and reel tapes. Conventional waste-removal techniques utilizing slurry pumps and transfer jets/pumps do not suspend and remove this type of waste. As much as 40,000 gallons of residue can remain after a conventional waste-removal campaign. As such, methods must be explored and developed to successfully remove these heels.

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Alternate Salt Removal Technologies (SR-2002)

Saltcake is formed through successive evaporation cycles of alkali waste. Total waste volume is reduced during storage of waste in a less mobile form. However, the saltcake must be redissolved and transferred to the In-Tank Precipitation Facility for further processing. Traditional salt removal involves installing large 150 HP slurry pumps into the tank to vigorously mix the contents into solution. The tanks are one million gallon nominal capacity with a diameter of 75 to 85 feet, depending on the type of tank. It costs approximately $6-10 million per tank to perform salt removal on a waste tank using the slurry pump method. It is desired to consider less cost intensive and less invasive methods to redissolve the salt.

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In Situ Methods for Characterization of Tank Wastes (SR-2003)

Develop in situ methods that provide characterization information without physically removing and transporting material from the waste tanks. Characterization for corrosion chemistry control (i.e., nitrate, nitrite, hydroxide, chloride, fluoride, sulfate, PO_4, $AlOH_4$, C_2O_4, CO_3) is one need. Characterization for retrieval and waste pretreatment is also needed (e.g., fissile isotopes of U and Pu, Cs-137, Sr-90, Na^+, K^+, density, and weight percent solids). In situ methods need to be able to function in a radiation field and highly alkaline environment saturate with nitrate, nitrite, carbonate, and aluminate.

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Environmental Restoration

In Situ Grouting of Underground Tanks Formally Used for Storage of Radioactive Solvents (SR-3005)

Twenty-two inactive underground radioactive waste solvent storage tanks (S1-S22) located in the Old Burial Ground 643-E must be closed in place. The grout must provide structural support for backfill over the tanks and a RCRA style cover up to 20 feet in thickness to be installed over the Old Burial Ground. The grout must be capable of hardening in the presence of tributyl phosphate. The grouting program should utilize a number of lifts to reduce loading on tank walls and heat generation.

Contact: Bob Blundy @ 803-952-6788

In Situ and Ex Situ Groundwater Treatment Technologies for Radionuclides, VOCs and Hazardous Constituents in Unconsolidated Subsurface Sediments (SR-3007)

At Savannah River Site, radionuclide and hazardous constituent contaminant plumes cover hundreds of acres and are not amenable to conventional pump-and-treat technologies. Current treatment technologies demand a train of treatment processes and generate excessive secondary waste. Therefore, there is a great need for in situ or ex situ treatment technologies for radionuclides and hazardous constituents in unconsolidated subsurface sediments (i.e., sandy/clayey soils). The treatment technologies should be cost effective and prevent migration of contaminants through immobilization, containment, or remediation. Contaminants of concern include elevated levels of strontium, radium, gross alpha, carbon 14, CCl_4, lead, mercury, and arsenic.

Contact: Ahmet Suer @ 803-952-8306

Dense Nonaqueous Phase Liquids (DNAPL) Remediation Technologies in Deep Unconsolidated Subsurface Sediments (SR-3008)

At Savannah River Site, DNAPL remediation of large plumes contaminated with TCE, PCE, and PCBs is a major challenge. Conventional pump-and-treat technologies are not amenable to DNAPLs, and DNAPLs provide a continuous source for groundwater contamination. At Savannah River, DNAPLS range 40 ft to 200 ft depth from the surface in deep, unconsolidated subsurface sediments. These treatment technologies should treat DNAPLS below and above the groundwater level, and eliminate secondary waste. They should minimize the spread of DNAPLs and be capable of handling large plumes (hundreds of acres) containing billions of gallons of contaminated groundwater.

Contact: Ahmet Suer @ 803-952-8306

Decontamination and Decommissioning

Dismantlement of Concrete-Encased Piping (SR-4008)

A cost-effective technology is needed that can remove drain lines securely embedded in thick, reinforced concrete, while minimizing the spread of contaminants that were found in the piping and the amount of secondary waste generated.

Contact: Jeff Lee @ 803-557-9857

Dismantlement of Large and/or Complex Equipment and Structures (SR-4001)

Savannah River Site has five reactors and two canyon buildings. Each of these structures is a heavily reinforced concrete building. Improved dismantlement technologies are necessary to demolish these structures quickly and safely. In addition, reinforced concrete stacks may need to be demolished. This type of operation requires an improved explosive technology. The dismantlement technology selected should be a reliable, low maintenance, preferably remote method that can easily dismantle large and/or complex structures in a radioactively hot or hazardous material environment. The technology should be able to precisely segment metal and concrete, as well as rubblize concrete when necessary. Secondary waste and aerosol generation should be minimized, and any secondary waste generated should be automatically collected, volume reduced, and containerized for disposition. The technology should be able to work at heights up to 40 feet.

Contact: Jeff Lee @ 803-557-9857

Asbestos Treatment to Allow Reuse (SR-4006)

An innovative, in situ technology is needed to treat transite paneling such that facility demolition requirements are eliminated and facilities possessing transite panels can be made available for reuse. The technology should decontaminate the transite panels in a non-destructive way. The asbestos fibers on the panels shall be immobilized/treated in such a way as to eliminate the possibility of these fibers getting airborne. Generation of secondary wastes should be kept to a minimum. The panel decontamination and treatment is to be performed in a surplus facility with a minimum amount of job site preparation.

Contact: Jeff Lee @ 803-557-9857

Nuclear Materials Stabilization (NMS)

NMS needs are currently being revised and new needs statements are being developed. These needs are not currently in the WWW. They will be included in the near future.

Nonintrusive Measurement Technology for Pressure Indication in Pu Storage Containers

Plutonium oxide will be packaged and stored in two nested, welded stainless-steel containers. The packages will be sealed at atmospheric pressure. Moisture that is adsorbed on the oxide surfaces will be broken down over time by the alpha radiation. This will cause the pressure in the container to increase. The Plutonium Storage Standard (DOE-STD-3013-96) requires that there be a capability to detect pressure in the internal container prior to it reaching 100 psig. The Standard requires two welded barriers for the plutonium, so an intrusive measurement of the pressure is not acceptable.

Contact: Norm Barnett @ 803-952-3556

Chemical Technique for Absorbing/Recombining Hydrogen Generated in Actinide Processing Vessels

During aqueous processing of actinides, hydrogen is generated by both radiolysis of the nitric acid solution and by chemical means (e.g., dissolution of calcium metal in nitric acid). It is required that the hydrogen concentration in the vapor space be maintained less than 1 volume percent. Currently, this is achieved by purging the vapor space with air. A chemical technique to reduce the hydrogen concentration would allow for elimination or a significant reduction in purge air flow. The candidate material must be resistant to nitric acid and radiation, and must not be poisoned by other gases present (e.g., NO_x).

Contact: Norm Barnett @ 803-952-3556

Improved Model for Liquid Radioactive Releases from Pu Processing Facilities

The current model for liquid radioactive releases (LADTAP II) from NMS&S facilities assume that all radionuclides in the release are immediately transported to the Savannah River. This model assumes that no material is deposited in transit, and that none of the radionuclides are bound by the soil. An improved computer model is needed to more realistically calculate the fraction of the radionuclides that would reach the river. This new model would have to receive Department of Energy approval.

Contact: Norm Barnett @ 803-952-3556

Spent Nuclear Fuel/Deactivation

Technology for Wet Storage of Spent Nuclear Fuels (SR-6001)

Savannah River Site stores spent nuclear fuels, primarily aluminum-based fuels, in water basins. These basins provide fuel coolant and irradiation shielding for the stored fuels and, for the few fuels that contain cladding breaches, a barrier against the release of radionuclides. The storage basis must be maintained and operated under conditions that maximize the continued integrity of non-breached fuels and limit the potential for release from degraded fuel assemblies. The spent nuclear fuels must be stored in the basins until it is ready for processing or, alternatively, for direct disposal to the repository. It is anticipated that the spent nuclear fuels will be stored in basins for a period of an additional 10-15 years. To ensure safe storage of the spent nuclear fuels, it is imperative that the spent nuclear fuel condition be monitored through a corrosion surveillance program. Further, the life of the spent nuclear fuels should be predicted on a fundamental basis, taking into consideration the degradation mechanisms involved. The water chemistry must be monitored and online probe technology must be developed and implemented. Acceptance criteria for the fuel must be developed, as well as canning technologies for the storage of failed or highly-degraded fuel. Finally, an understanding of the effect of microbial activity on corrosion must be established and low-cost probes to monitor microbial activity must be developed.

Contact: Dick Murphy @ 803-557-9737

Technology for Repository Storage of Spent Nuclear Fuels (SR-6002)

Aluminum-clad spent nuclear fuel used in research, test, and production reactors are currently stored in basin pools at the Savannah River Site. Further, as part of the U.S. Non-Proliferation Policy concurring Foreign Research Reactor spent nuclear fuel, Savannah River is expected to receive spent nuclear fuel over the next several decades. Much of the production reactor aluminum spent nuclear fuel will be processed through the Savannah River Separations facility. The high-level waste produced in the Separations operations is then processed into glass through a vitrification process. This glass waste form is qualified to be stored in the Yucca Mountain Repository. However, the aging canyon facility and the extended periods over which Savannah River Site is expected to receive spent nuclear fuel make it likely that the spent nuclear fuel will have to be disposed of in the Repository using alternative technologies to the Separations process presently used, which was part of agreements and commitments made by DOE to local stakeholders during implementation of the U.S. non-proliferation policy. A new waste form technology for aluminum spent nuclear fuel will have to be qualified for a repository. The technical feasibility, timeliness, and cost will be the principal factors driving the selection of the waste form technology. The most promising near-term options include direct disposal, co-disposal, and dilution technologies. Also dissolve/vitrify, electrometallurgy, and plasma arc are identified as potential advanced treatment options requiring evaluation. Processed to achieve dilution of the U-235 in the fuel must be investigated, including melting, consolidation/pressing, or chop-consolidation.

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Technology for Interim Dry-Storage of Spent Nuclear Fuels (SR-6003)

Savannah River Site stores spent nuclear fuels in basin pools. These spent nuclear fuels are clad with either aluminum alloy, stainless steel, or zircaloy, many of the spent nuclear fuel storage practices and facilities may not be suitable for a 40-year interim storage period. Interim dry storage is an option being evaluated for the storage of these fuels for the next 40-50 years. Technology development associated with conditioning, characterization, drying, and establishing the envelope of operation will hence be required. Much of the technology for conditioning and dry storage, such as the acceptance criteria for dry storage and the heat transfer and criticality analysis for dry storage, have been completed in recent years. The technology, however, needs to be validated and verified by tests using prototype spent nuclear fuel. Any conditioning necessary for interim storage will be performed at the receiving site. Consequently, development and standardization of characterization technique will also be required prior to a conditioning treatment and storage in a dry storage facility. The characterization requirements for the transition from wet storage to dry storage involving non-destructive and assay techniques also need to be established. Finally, a characterization database needs to be developed and maintained to form the basis for a license application.

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