

# ***Plutonium/Uranium Extraction (PUREX) Process Waste Stabilization – U.S. Department of Energy Savannah River Site***

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## **Problem/Situation**

Currently the U.S. Department of Energy is evaluating various sorbents to solidify plutonium/uranium extraction (PUREX) process waste at the Savannah River Site in South Carolina.

Legacy PUREX waste is stored at the New Solvent Storage Facility at Savannah River and derives from an organic-aqueous isotope separation process at the site. The PUREX process used solvents consisting of tributyl phosphate and kerosene to extract plutonium and uranium from spent nuclear fuels for reprocessing. Most of the plutonium and uranium was extracted from the PUREX solvents, which were then reused for cost effectiveness. However, over time, degradation rendered the solvent useless, but the resulting organic solvent waste still contains traces of plutonium, uranium, fission products, various RCRA metals, and other regulated constituents.

Originally, the plan was to burn the 25,000 gallons of radioactive and metals-laden PUREX in the Consolidated Incineration Facility at the Savannah River Site. That facility was shut down, thus, forcing Savannah River to identify alternative treatment methods.

## **Solution – Research and Results**

In FY03 and FY04 MSE Technology Applications developed a plan to test several commercially available sorbents to solidify the spent “LEGACY” PUREX waste stream. The testing mirrored a variety of conditions the solidified waste stream would be exposed to during shipping and storage that would be in compliance with land disposal requirements for low-level radioactive waste.

At the MSE Technology Applications, Mike Mansfield Advanced Technology Center in Butte, Montana, MSE tested four sorbents previously validated with Transuranic and Mixed Waste Focus Area-supported testing at Savannah River. Several mixing and deployment strategies were evaluated to stabilize the spent PUREX waste. MSE’s work included determining the optimum waste loading for each of the sorbents and performing several different liquid release tests at ambient and elevated temperatures, gas generation testing, leachability testing, and long-term stability testing at the optimum waste loadings.



Based on work performed in FY03 on “LEGACY” PUREX waste, additional scope was added to test F-Canyon PUREX waste. This testing resulted in a successful treatability study with actual F-Canyon PUREX waste stream at Waste Control Specialists in Andrews, Texas. Three thousand two hundred gallons, out of the 50,000 gallons of F-Canyon waste, were successfully solidified in November 2004.

Testing continues in FY05 for the “LEGACY” PUREX waste stream. Final testing at the 55-gallon scale-up level and PUREX organic/aqueous testing will be completed in FY05, enabling solidification of the “LEGACY” PUREX in FY06. Due to the success of the PUREX projects, MSE will be testing sorbents to solidify four additional waste streams for the Savannah River Site in FY05.

## **Benefits**

MSE’s test results led to the selection of a proprietary binding material for the solidification of F-Canyon PUREX and in FY05, 50,000 gallons of F-Canyon PUREX waste will be treated at Waste Control Specialists in Texas, and shipped to the Nevada Test Site for disposal. Based on FY05 testing, 25,000 gallons of “LEGACY” PUREX will also be solidified for disposal in FY06.

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### **For additional information contact:**

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