Savannah River Plant Separations Department Mixed Waste Program*

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Abstract

The Department of Energy's (DOE) Savannah River Plant (SRP) generates radioactive and mixed waste as a result of the manufacture of nuclear material for the national defense program. On May 1, 1987, DOE published a ruling stating that the hazardous component of mixed waste would be regulated by the EPA or state agencies, effective June 1, 1987. The radioactive portion of the mixed waste and all nonhazardous radioactive wastes would continue to be regulated by DOE under the Atomic Energy Act.

The Separations Department is the largest generator of solid radioactive waste at the Savannah River Plant. Over the last three years, the Separations Department has developed and implemented a program to characterize candidate mixed-waste streams. The program consisted of facility personnel interviews, a waste-generation characterization program and waste testing to determine whether a particular waste form was hazardous. This program allowed the department to assess the magnitude of the impact of proposed mixed-waste regulations.

The Separations Department changed waste-handling practices and procedures to meet the requirements of the generator standards in 40 CFR 262. For each Separations Department Facility, staging areas were established, inventory and reporting requirements were developed, operating procedures were revised to ensure proper waste handling, and personnel were provided hazardous waste training. To emphasize the importance of the new requirements, a newsletter was developed and issued to all Separations supervisory personnel. Because of the characterization efforts and changes in waste-handling practices, the Separations facilities were able to meet the requirements of 40 CFR 262 by June 1, 1987.

FACILITY DESCRIPTION

The Savannah River Plant (SRP) is a plantsite over 300 square miles, located in three counties in west central South Carolina. The Savannah River Plant is owned by the Department of Energy and was built and is operated by E. I. du Pont de Nemours and Company. The site is organized into many different programmatic divisions and departments, and has many facilities dedicated to the production of special nuclear materials for the Department of Energy. The primary responsibility of the Separations Department and its facilities at the SRP is to chemically separate and purify the special nuclear materials produced in the heavy water-cooled nuclear reactors on site and to recover enriched uranium from the spent fuels.

The major products are two isotopes of plutonium, Pu-238 and Pu-239. In the production of Pu-239, depleted uranium, in the form of process tails from the DOE enrichment plants, is received in the SRP Raw Materials Area. The depleted uranium is made into targets for the reactors. The Raw Materials Area also receives recycled enriched uranium and virgin Oralloy (93% U-235) from the DOE Oak Ridge facility. The enriched uranium is alloyed with aluminum and made into fuel tubes. The fuel tubes maintain the reactivity and power in the reactors and provide the neutrons to convert U-238 into Pu-239. After irradiation, fuels and targets are then shipped in special rail cars to the Separations Areas for the recovery of the actinides.

There are two main Separations plants at the SRP (200-F and 200-H Areas) and each plant is dedicated to a specific recovery process. The main Separations buildings in each area are called Canyons and specific actinide finishing lines called B-Lines are integral to the canyon buildings. Depleted uranium targets are processed in F Canyon to recover, separate and purify the Pu-239. H Canyon is dedicated to the recovery and separation of enriched uranium, for recycle to the DOE complex; and Np-237, a byproduct produced by the irradiation of U-235. Np-237 is used as a raw material in the production of Pu-238. After recovery and separation as a nitric acid solution in the F Canyon, the

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Pu-239 is converted to a metal in the FB-Line facility and shipped offplant. The enriched uranium and neptunium are separated and purified in H Canyon, and the enriched uranium solution is now shipped to Oak Ridge for reduction to metal and recycle in the DOE complex.

The purified Np-237 serves as the raw material for the production of Pu-238. The byproduct neptunium is stored in H Canyon and converted to an oxide in the HB-Line. The oxide is transferred to Building 235-F and made into a billet for production of a target in the Raw Materials Area. After irradiation and cooling, the Np-237 targets are returned to H Canyon for separation of the Np-237 and Pu-238 produced by neutron capture during radiation. Both actinide streams are converted to oxidepowders in the HB-Line. The Np-237 rejoins the virgin neptunium produced by irradiation in the enriched uranium targets, while the Pu-238 oxide is transferred to Building 235-F for production into heat sources, principally for space applications.

The Separations Department also has a Receiving Basin for Offsite Fuel (RBOF) where uranium fuels from research and test reactors are stored to await campaigning into the Canyon processes for actinide recovery.

BACKGROUND

Source, special nuclear, and byproduct material are exempt from the RCRA hazardous waste regulations as written in 1976. A United States Federal District Court decision (Leaf vs. Hodel) in April 1984 required the DOE Oak Ridge facility to comply with the state of Tennessee's hazardous-waste regulations and water quality regulations. The court decision outlined requirements for purely hazardous waste generated in DOE facilities. The Atomic Energy Act defined the requirements for purely radioactive waste. No indication was given in the court decision for the proper requirements of handling waste which is both hazardous and radioactive.

Realizing that the next lawsuit might well involve mixed hazardous and radioactive waste, DOE and EPA formed three task forces in 1984. The task forces were assembled to develop a sound definition of byproduct that would clarify which of the DOE radioactive and hazardous wastes, if any, should comply with the hazardous waste regulations. The waste from the Separations facilities at SRP was initially determined to be byproduct based on the initial definitions proposed by the task forces since it was generated in the process of the recovery of special nuclear materials. Therefore, at the time, there was no regulatory requirement to handle mixed waste in accordance with RCRA.

In 1986, SRP and the Separations facilities ceased shallow land burial of low-level and intermediate-level mixed waste and began storing the waste at the generating facilities. Low-level and intermediate-level waste mainly consists of shoe covers, rags, wipes, plastic, failed equipment and any other solid waste that might be generated by facility maintenance. Some of the waste may or may not contain chemicals based on the manner in which it was generated.

On May 1, 1987, DOE published a new byproduct definition, effective June 1, 1987, that established that all hazardous components of radioactive waste would be regulated by the EPA and the state regulatory agencies. The new byproduct definition included all categories of waste including solid low-level, solid TRU and high-level liquid wastes. The previous exclusion of TRU and high-level wastes in the other draft byproduct definitions was dropped. The program that the Separations Department developed encompasses the handling and storage of low level, intermediate level, and TRU waste in the Separations facilities. The program was developed from long-term characterization efforts and short-term program structure development.

SEPARATIONS BYPRODUCT MIXED WASTE PROGRAM OVERVIEW-3/86 TO 5/87

In March 1986, SRP began segregating mixed and byproduct waste for storage at the generating facilities. Separations also began to segregate byproduct mixed waste at this time. Facility procedures were revised to require the proper identification, containerization, labeling and storage of the byproduct waste. Storage areas at the facilities were designated and identified. The storage locations were inspected routinely during regular environmental audits of the facilities by the internal Separations environmental group to monitor the condition of the containers and the storage area. This intermediate period of byproduct mixed waste handling - March 1986 to May 1987 - helped in the transition to mixed waste handling under RCRA.

All Separations TRU waste-generating facilities, such as HB-Line and FB-Line, have been required to handle TRU waste according to the WIPP (Waste Isolation Pilot Plant) certification criteria since March 1986. One requirement for shipping waste to WIPP is to identify and estimate the volume of any hazardous components in the TRU waste. Although no special hazardous waste handling requirements were necessary to handle TRU waste, the facilities that generate it had been previously trained to identify and document hazardous TRU waste well before the new byproduct definition included it. Therefore, implementation of the RCRA requirements for TRU waste was facilitated by the already-existing WIPP requirements.

MIXED WASTE GENERATOR PROGRAM ELEMENTS

There are many different requirements to assess in developing and implementing a mixed-waste program that will meet regulations and ensure its success. The following

elements, some developed and implemented over several years and others in only one month, were included in the Separations Mixed Waste Program and are discussed in more detail in sections that follow:

- Characterization of potential mixed-waste streams to determine the magnitude and components of the mixed-waste stream
- Procedure revision in 1986 to ensure proper byproduct waste handling and storage, and again in 1987 to include hazardous waste requirements of the May 1987 byproduct redefinition
- Staging areas designated for the temporary storage of mixed waste at the Separations facilities
- Documented inspections conducted weekly in all staging areas
- Contingency plans developed to address actions required in emergency situations
- Current inventory records at both the facility and in a centralized department location of all waste generated and stored in the staging areas, with quarterly reporting to SCDHEC, South Carolina's environmental regulatory agency
- Training, including general and facility-specific requirements, to all personnel who might handle mixed waste, with required annual retraining
- Recordkeeping system for training records and inspections
- Potential non-compliance areas identified and handling requirements examined because of the highly-radioactive nature of certain mixed waste, and since some regulatory requirements might not be met
- Independent post-implementation examination to assess the quality of program development and implementation, and ensure that all requirements of the regulations were met.

Characterization

The most important phase of the development of the mixed waste program was waste characterization and assessment. In 1984, the Separations Department began to determine the extent of mixed-waste generation and handling in the facilities. Separations is the largest generator of all types of solid and liquid radioactive waste at SRP, and the largest user of chemicals. Initially, it was felt that Separations could have the greatest potential on plant for generating mixed waste. Therefore, proper characterization was necessary to ensure all mixed waste was identified.

The characterization of Separations mixed waste occurred in three phases. The first phase consisted of facility estimates by experienced personnel. They were asked to determine the amount of chemical-bearing waste generated in the facility. A brief overview of hazardous waste identification was given to these personnel to ensure chemical awareness. The facility personnel initially estimated that greater than 50% could contain chemicals, so the amount of waste that would need to be handled as mixed waste based on that estimate would be very large (greater than 100,000 cubic feet per year). It was determined that this estimate was probably very conservative and that the volume of mixed waste was actually less. Therefore, a more detailed characterization phase was developed.

The second phase of the characterization program consisted of developing and implementing a logsheet program to determine the characteristics of the waste being generated. The facility personnel were required to complete a logsheet for all low-level, solid radioactive waste that included a description of the physical, chemical and radioactive contents. The logsheet program was implemented for six months to ensure that enough data was gathered. Results of the logsheet program showed that only 5% of the low-level, solid waste would be chemical bearing. This figure is an order of magnitude lower than originally determined by facility estimates.

The Separations processes use large amounts of nitric acid. Permanganates are also used as decontamination agents in the Separations facilities. The most common chemical bearing waste form, based on the logsheet data, would be nitric acid absorbed on wipes, rags or mopheads, and then neutralized prior to disposal. Nitrates and permanganates are defined as oxidizers by the RCRA regulations. However, Separations personnel were not convinced that either particular waste form, nitrates or permanganates absorbed on rags, should be considered hazardous. Therefore, the third phase of the characterization program was initiated: testing of particular waste forms to determine hazardous characteristics.

The Bureau of Explosives (BOE) was hired to test the Separations nitrate-bearing and permanganate-bearing wastes to determine if they were hazardous. The Bureau of Explosives had developed a proposed test method for the Department of Transportation (DOT) to determine whether a material should be classified as an oxidizer (under DOT and RCRA regulations).

The test method is based on assessing the flame height, burning time and burning rate of the material. Typical simulated waste forms (chemicals absorbed on wipes, rags, and mopheads) were sent to the BOE for testing. Control samples (wipes, rags, and mopheads with no chemicals) were burned and the burning characteristics were assessed. The chemical-bearing waste forms were also burned, and the burning characteristics were compared to the control samples. In all cases, the test material did not show any flame or burning characteristics indicative of an oxidizer. Therefore, it was determined that the Separations waste

forms (nitrates and permanganates absorbed on rags, wipes, and mopheads) should not be considered oxidizers. The results of these tests eliminated a large percentage of the Separations chemical-bearing waste from mixed-waste classification.

Other tests were performed on another Separations waste form: mercuric nitrate absorbed on wipes. Simulated waste forms were sent for EP toxicity testing and in all cases, failed. This particular waste form is handled as a mixed waste. Other tests are presently proposed, such as testing of silver nitrate-coated beryl saddles and lead-lined glovebox gloves, to determine whether they were EP toxic. The beryl saddles are ceramic column packaging used for the removal of iodine from the offgas of the Separations dissolvers. The results of these proposed tests could reduce the amount of waste considered as mixed waste.

Staging Areas

The Separations facilities have designated five staging areas around the Separations facilities. A staging area is the Savannah River Plant term for a temporary storage location at the generating facility where waste must be stored prior to shipment to a permitted treatment, storage or disposal facility. Three of the staging areas are designated to contain low-level waste. The most common hazardous constituents in low-level waste are lead, oil and mercury. The remaining two staging areas are designated for the storage of TRU waste. The most common hazardous components in this waste are lead, oil and calcium metal. All staging areas are inspected weekly, and the inspections are documented. Contingency plans have been developed for the areas. Often the major concern in the event of an emergency in the staging areas is the release of radioactivity rather than the chemical hazards.

Training

Annual hazardous waste training is required for generators and handlers of mixed waste. A training and awareness program was developed and provided to Separations personnel to meet the intent of the training requirements. A newsletter was issued to all Separations management in early May to inform them of the new requirements based on the May 1 byproduct definition. With top Separations management support and very efficient scheduling by all the Separations facilities, the majority of the Separations personnel with mixed waste responsibilities were trained by *June 1.*

By June 5, approximately 95% (400) of the people that required training were trained. The training was documented, and the records are being kept both in the personnel training file and a central location for EPA and state review.

The training included a brief overview of the previous byproduct definition, the requirements of RCRA, hazardous waste identification, generator requirements and facility-specific requirements. Facility specific requirements were discussed such as what type of mixed waste might be generated in that facility, proper handling techniques, location of facility staging areas and contingency plan details. The importance of waste minimization was discussed. Cost of waste disposal and future regulatory liability were discussed and personnel were made aware of what they could do to help minimize the amount of mixed waste generated

Potential Noncompliance Areas

The Separations facilities occasionally generate highly-radioactive waste which must be handled to protect personnel from radiation exposure. Handling this waste based on Atomic Energy Act requirements sometimes conflicts with some of the RCRA practices. Protecting the worker from radiation and contamination exposure is the foremost concern when handling this waste. Because of the levels of radioactivity, some RCRA requirements, such as inspections and generator storage, might conflict with AEA practices for protecting personnel from radiation exposure. Highly-radioactive waste normally generated by Separations includes silver nitrate-coated beryl saddles removed from the dissolver offgas iodine reactors, lead counterweights from canyon piping, and hazardous, chemical--bearing material used to clean up leaks. This type waste may normally radiate over one (1) roentgen per hour. Presently, Separations is handling this waste to meet as many RCRA requirements as possible for generators without compromising worker protection and safety. However, all detailed requirements cannot be met, such as weekly inspections. The conflicting issues between the AEA and RCRA have been identified, and will be resolved between DOE and EPA to ensure that the spirit of both sets of requirements are met.

Post-Implementation Audit

During June, an audit of the mixed waste program was performed to examine for proper development and implementation. The audit was performed to ensure that all the requirements of the regulations were being followed and implemented consistently and logically. The audit was performed by the facility custodian, a department environmental representative and an independent plant environmental representative. The independent review is necessary to lend objectivity and credibility to the results of the examination. The audit included a review of the training program and documentation, a review of the contingency plans, a review of facility operating procedures for handling mixed waste and inspecting the staging areas, an examination of the staging area inspection documentation, and a tour of the staging areas.

The major observations made during the audit centered around methods of improving the facility procedures to

assist environmental auditors during periodic reviews. There were also some minor observations dealing with record forms and the methods that inspections were documented by personnel.

Overall, the most beneficial result of the audit was to see what was done correctly and how it could be improved.

CONCLUSION

Many elements are required for the development and implementation of a mixed waste program; the most important of which is a carefully-planned characterization of the waste forms to determine the magnitude and hazardous characteristics. A post-implementation examination is essential to determine the success of program implementation. Development of a mixed waste program for the Separations facilities did not happen in one month (May 1987) but has been developing for several years. The new byproduct definition of May 1987 only required that the Separations facilities do formally what was done informally for many months prior. Anticipation of regulations, characterization, and management and facility support enabled the Separations facilities to come into substantial compliance with the RCRA hazardous waste regulations by June 1, 1987.