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Savannah River Site Public and Regulatory Involvement in the Inadvertent Disposal of TRU Waste in the E-Area Low-Level Waste (LLW) Trenches

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ABSTRACT

The key to successful public involvement at the Savannah River Site (SRS) has been and continues to be vigorous, up-front involvement of the public, federal and state regulators with technical experts. The SRS Waste Management Program includes all forms of radioactive waste. All of the decisions associated with the management of these wastes are of interest to the public and successful program implementation would be impossible without including the public up-front in the program formulation. Serious problems can result if program decisions are made without public involvement, and if the public is informed after key decisions are made.

This paper will describe the regulatory and public involvement program and their effects on the decisions concerning the inadvertent disposal at the Savannah River Site (SRS) of TRU waste in the E-area LLW Facility Trenches. SRS engineers discovered that a small amount of TRU waste was disposed in the E-area LLW trenches in 2003. This discovery was obviously of considerable interest to the State and Federal Regulators, and to the public. In addition to notifications to all interested parties, the first order of business was to ensure that operations continued to be protective of the public and the environment. This paper will describe the interactions with the Department of Energy (DOE), the South Carolina Department of Health and Environmental Control (SCDHEC), the Environmental Protection Agency (EPA), and the public. In addition the technical details of the inadvertent disposal will be discussed along with the analysis of long term performance of the waste form in the E-Area LLW Trenches and how this information was communicated with all parties. As can be imagined, a decision to dispose of TRU waste onsite versus shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal is of considerable interest to the stakeholders in South Carolina. The events that lead to the inadvertent disposal will be reviewed as well as the new systems put into place to ensure that this event will not happen again in the future.

In order to determine alternatives to properly deposition this TRU waste, an evaluation of retrieval of the waste from the trench disposal was performed as well as an options risk analysis to determine the regulatory path forward should the decision be made to dispose of the TRU waste in place. An evaluation of the risks to the workers associated with retrieval was then

compared to the risks of continued disposal in the E-Area Trenches. Cost and schedule for each alternative was also compared.

This paper will describe the successful results of this technical, regulatory, and public involvement program, explore the challenges, how the accomplishments occurred, and describe the future challenges along with the road map for the future. A comparison with other similar events at other DOE sites will be discussed as well. In doing this, the SRS TRU and LLW programs must be described to give the readers an understanding of the technical complexities that must be communicated successfully to achieve constructive stakeholder participation and regulatory approval.

INTRODUCTION

During the 1970's and early 1980's the Savannah River Site produced Californium-252 neutron sources for research and testing for use in the medical treatment field and for industrial applications. The waste from that program was transferred to the SRS E-area for storage prior to disposal. It was deemed at that time that the waste was classified as transuranic (TRU) waste based on the fact that wastes with a concentration of 10 nanocuries per gram of transuranic isotopes were managed as TRU waste. At this early time of SRS operations, all records of waste characterization was conducted by recording information on hand written "burial slips". The "burial slips" were filed after they were used to document a waste transfer to storage or disposal. The TRU waste classification was changed in the mid 1990's to require that only waste with a TRU concentration of greater than or equal to 100 nanocuries per gram and with a half-life greater than 20 years would be classified at TRU waste. As SRS continued its program to interrogate legacy waste during 2001-2007, the wastes that had been stored as TRU waste were all scheduled for re-characterization to determine if they were correctly classified as TRU waste or if they were below the 100 nanocures per gram threshold.

DISCUSSION OF DISCOVERY

In 2003 engineers at SRS determined that the Cf-252 waste stream containing 278 packages was indeed being stored as TRU waste, but Cf-252 by itself, was not a TRU waste by definition. A campaign was begun to characterize this waste for disposal as a Low-Level Waste in the SRS E-Area LLW Facility. Beginning in 2003, characterization efforts were performed by engineering staff using electronic records along with a sampling of the paper records ("burial slips") that were used in the 1970's and 80's, to determined that several waste packages should be disposed as LLW and the disposals were carried out. The packages were disposed in the E-Area LLW Facility Slit Trenches after a determination that the Waste Acceptance Criteria for those Slit Trenches were met.

The program to characterize the Californium waste stream continued into 2007 and in June of that year an engineer performing the characterization function noticed a problem. While entering Californium waste package data into the electronic data tracking system to determine the waste package's acceptance for disposal as LLW the decision was made to review the hand written paper "burial slips" to confirm that the electronic record was correct. The "burial slip" for the container under review had a note in the remarks section indicating that plutonium- 238 was present in the waste container. Upon this discovery, the two waste containers were recognized as potentially containing TRU waste and were held in TRU waste storage so that further evaluations could be done to determine if they should be disposed as LLW or shipped to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal as TRU waste. The decision was made to perform an extent of condition review and reviews of all the "burial slips" for all 278 containers included in this waste stream were reviewed. This documentation review discovered that twenty (20) of the legacy Californium waste containers could contain sufficient quantities of plutonium (Pu-238 and Pu-239) to challenge their classification as LLW. Of these twenty (20) containers,

five (5) were incorrectly disposed as LLW in the E-Area LLW Slit Trenches in 2003, Three (3) were correctly classified as LLW and disposed, and the remaining twelve (12) are being maintained in TRU storage for later shipment to WIPP as TRU waste.

As mentioned above, in the mid 1970's to early 1980's Californium waste generators used a paper form ("burial slips" to document waste package characterization data. The burial slip package data were entered at a later time into a simple electronic database call the Computer Burial Records Analysis (COBRA). The COBRA database design required multiple burial slips, i.e. –COBRA data records, if more than two isotopes were present in a waste package. In come cases, a note was made in a comments field concerning additional isotopes that were present in the waste without using another burial slip. The comment and remark data fields were not consistently inputted into COBRA. Once burial slip data were entered into COBRA, the burial slips were randomly placed in boxes and stored in a records repository. The storage of burial slips in boxes made a 100 % COBRA verification difficult when it came time to characterize waste for disposition. A senior engineer believed, based on experience and some process knowledge, that the Californium waste was a pure waste stream with only the Californium waste isotopic grouping present. The senior engineer attempted to validate this process knowledge by comparing the COBRA data to a sample of the burial slips that were stored in boxes in SRS records repository. The burial slips that were reviewed supported the process knowledge assumption that no other isotopes were associated with the Californium waste. However, the senior engineer did not review additional burial slips (as noted above, additional isotopes required additional burial slips) that would have indicated the presence of additional isotopes. Actually, there were 20 burial slips of the total 278 Californium packages that contained the information concerning the other isotopes which were not found by the senior engineer during the random sampling of the records.

ACTIONS AND EVALUATIONS

Upon discovery of the TRU waste containers in the Californium waste stream, the SRS contractor, Washington Savannah River Company (WSRC), notified DOE that five containers of radioactive waste inadvertently disposed in the E-Area Low-Level Waste Facility were determined to have TRU isotopes in concentrations greater than 100 nanocuries per gram. DOE and WSRC staff immediately began to perform the critiques and evaluations necessary to first and foremost ensure that operations continue to be protective of the public and the environment. The next order of business was to form a team to evaluate the appropriateness of retrieval of the five containers from the buried waste location in order to process it for shipment to the Waste Isolation Pilot Plant (WIPP).

It was confirmed through calculation and analysis that the disposed waste isotopic content is well within the Radiological Performance Assessment Limits for the E-Area Slit Trenches. Thus, it was determined that the LLW Facility remained in compliance with the performance assessment requirements of U.S. Department of Energy (DOE) Order 435.1 (Radioactive Waste Management) and the Disposal Authorization Statement issued under the requirements of that Order. It was concluded from this analysis that the disposed transuranic isotopes do not pose a threat to human health or the environment and, in fact, remain well within the Performance Objectives and Measures prescribed by DOE Order 435.1. In conducting this analysis the procedure was followed for development of an Unreviewed Disposal Question Evaluation

(UDQE) as required by the Performance Assessment Maintenance Plan and Disposal Authorization Statement. The UDQE documents the analysis and calculations that confirm the amount of TRU isotopes disposed are well within the limits established by the Waste Acceptance Criteria. The results of the analysis can be seen in the table below:

		Pu-238 Curies	**Pu-239 Curies**
Slit Trench #3:	1 Concrete Cask	0.712	6.4E-4
Slit Trench #5:	2 Drums	22.8	0.82
Slit Trench #6:	(1-concrete cask and 1-85 gal overpack)	17.3	1.58E-2

Note: The Slit Trench Limit for Pu-238 is 440 curies and Pu-239 is 400 curies.

With oversight from DOE, WSRC formed a team to evaluate whether to retrieve the five containers. The evaluation included an assessment of radiological hazards relative to worker safety and the environment, industrial hazards, safety basis implications, container identification and integrity, and the human, technical and capital resources needed to accomplish retrieval. The evaluation concluded that the retrieval can be accomplished, but the range of costs and timing depends on several critical assumptions including:

The integrity of the buried waste containers
The actual location vs. the estimated location of the five containers
Weather conditions that could hamper the operation
The integrity of the container labeling
The ability to safely enter the slit trench and efficiently over pack and extract debris and containers

As stated previously, the evaluation concluded that the containers can be retrieved. It should be stressed, however, that there will be risks and exposures to the workers. The cumulative dose estimates for the retrieval project range from 4.5 REM to 27 REM depending on how quickly the containers are located. Airborne contamination concerns will force personnel to be in full protective clothing and respiratory protection between 1,800 and 10,800 man hours. The same exposure times will be experienced for industrial hazards such as potential asbestos exposure, trench collapse, and working from a man basket. It is believed that these risks are manageable, but have the potential for serious worker injury.

The overall cost and schedule is highly dependent on the successful selection of the target area for initial waste removal as one can imagine. Under the worst case scenario, that the containers are difficult to locate, labels are illegible or not intact, and safety issues are difficult to manage, it would take approximately 30 months and cost approximately $11 million dollars to complete the retrieval. If the containers are located on the first attempt, the labels are intact and able to be read, and the safety issues relatively simple to resolve, the costs could be as low as $2.1million dollars and the retrieval could be accomplished in approximately 5 months.

In parallel with the waste retrieval evaluation, alternatives were also evaluated which would allow the waste to remain disposed that may be within DOE's authority under the Atomic Energy Act of 1954, as amended and are consistent with DOE Order 435.1. An attached Options

Analysis presents the results of that evaluation and concludes that three options should be considered by DOE if the decision is made to pursue disposal of this waste in place. Those options are:

1. Appropriate action by DOE Headquarters (HQ) to determine that the inadvertent action that resulted in a relatively small amount of waste containing transuranic isotopes at concentrations above the 100 nCi/g definition for TRU waste is well within the performance assessment limits and, therefore, DOE authorizes disposal of the waste within the Disposal Authorization Statement.

Costs: $25,000. - $50,000.
Schedule: 3 months to complete analysis
3-6 months for DOE review and approval

2. DOE may direct appropriate action under DOE Order 435.1, Chapter III, Para P and in accordance with 40 CFR 191 "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" to approve the disposal of TRU Waste in a non-WIPP location.

Costs: $600,000. - $700,000.
Schedule: 10-12 months to complete analysis
6-8 months for DOE review and approval

3. The Secretary of Energy, with concurrence of the Administrator of the EPA, could approve that this waste does not need the degree of isolation that is provided by implementation of the disposal requirements of 40 CFR 191.

Costs: $700,000. - $800,000.
Schedule: 10-12 months to complete analysis
12-14 months for DOE review and approval

The results of these evaluations conclude that although retrieval could be performed, it is a hazardous operation for SRS workers and it is a very expensive undertaking for very little, if any, benefit measured as increased protection of the environment or the public from the continued disposal of this waste. As discussed earlier, the disposal of these transuranic isotopes is well within the performance assessment limits and the DOE performance objectives and measures including the requirement for groundwater protection.

INTERFACE WITH SRS REGULATORS

The South Carolina Health and Environmental Control (SCDHEC) and the Environmental Protection Agency Region IV (EPA) were informed of the discovery of the inadvertent disposal of the five containers of TRU waste very early in the process. In fact, a phone call was placed to the two offices within a few days to provide the information to allow the regulators to determine what had been discovered and to request any additional information as it became available. In

this particular case, the SCDHEC and EPA are not involved in actually regulating the E-Area LLW Facility, but they remain interested in all the activities at SRS and it is recognized by SRS as "good business" to keep the regulators informed and involved in all matters at the site. Both SCDHEC and EPA wrote letters requesting additional information concerning the discovery and SRS will provide the additional information requested as soon as it becomes available. A key component of SRS's continual efforts to maintain excellent relationships with all stakeholders is embodied in the efforts here. All analyses and information requested either have been or will be provided so that the regulatory organizations can be in a position to understand and comment on (if they decide to do so) the decisions that DOE makes concerning this event.

SRS is currently in the process of evaluating all of the options available to DOE in dispositioning the waste with DOE Headquarters in Washington, D.C. It should be noted that SCHEC and EPA are not, in this case, the regulators in the classic since. DOE has the authority granted under the Atomic Energy Act of 1954, as amended, to dispose of radioactive waste under DOE purview. In addition, 40CFR191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste*, section 191.12, Definitions, identifies the DOE as the "Implementing Agency" for any other disposal facility and all other implementation responsibilities for the Waste Isolation Pilot Plant, under this part, not given to the Agency". DOE expects to utilize both of these documents in evaluating the appropriate disposal path for this waste. Once the decision has been made on the disposition path for the waste, DOE will be glad to share the appropriate information utilized to make this decision with them and discuss any concerns they may have.

PUBLIC INVOLVEMENT IN WASTE MANAGEMENT AT THE SAVANNAH RIVER SITE

As discussed above, the Technical Staff at SRS through their work associated with the disposal of plutonium isotopes as low-level waste under DOE Order 435.1, "Radioactive Waste Management" found that plutonium isotopes could be disposed safely and within low-level waste disposal performance objectives at much higher concentrations that the transuranic (TRU) limits of 100 nanocuries per gram. The DOE Order 435.1 and the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act specifies that radioactive waste contaminated with TRU isotopes above 100 nanocures per gram can be characterized, packaged and shipped to the WIPP in New Mexico for disposal. These same requirements, however, allow for non-WIPP disposal of TRU waste if certain requirements can be met and if certain approvals are obtained.

Armed with this information the technical work was begun to perform the detailed calculations to demonstrate that TRU contaminated waste at the Savannah River Site could be dispositioned within the required performance objectives to ensure that the environment and the public would be protected for thousands of years. A very vigorous Public Involvement Program associated with TRU waste disposition already existed at the Savannah River Site in support of the work being done to ship as much TRU waste as possible to WIPP.

The SRS Public Involvement Program became centered on the SRS Citizens Advisory Board (CAB) and through its public meetings other interested members of the public. The SRS TRU

Program now works primarily with the Waste Management Committee (WMC) of the SRS CAB as well as with members of the public to address SRS's TRU waste management operations.

The CAB is comprised of 25 individuals from South Carolina and Georgia who are chosen by an independent panel of citizens from approximately 250 applicants. The board members reflect the cultural diversity of the population affected by SRS. The members, who serve two- or three-year terms, represent all walks of life, including the business world, academia, local government, environmental and special interest groups, and the general public. Two of the members specifically represent economically disadvantaged persons. In addition the South Carolina Department of Health and Environmental Control (SCDHEC) and the Environmental Protection Agency Region IV (EPA) personnel are represented at the CAB meetings as Ex-Officio Members. Of course this brings the opportunity to have the regulators involved in the discussions of the various SRS issues.

The methodology for public input has been provided through the CAB and the CAB's agreed bylaws that require a response from DOE along with reports of progress to resolve issues associated with a recommendation. A review of the References in this paper can point out the record of extensive public involvement with the CAB that was conducted to educate and request input on the SRS TRU waste activities.

PUBLIC INVOLVEMENT ON THE INADVERTANT DISPOSAL OF TRU WASTES

In several public meetings with the CAB the stakeholders were informed and kept involved in the discovery of the inadvertent disposal of TRU waste in the E-Area Slit Trenches. In addition to the discussions, an actual "burial slip" was shown to the CAB members along with a timeline to detail exactly what happened to cause the errors that occurred. Perhaps more importantly the results of the calculations that determine that the TRU waste is well within the Performance Assessment limits, thus protective of human health and the environment were provided. It is deemed extremely important to educated and inform the public as soon as possible after such an event to maintain confidence in the safe operations and the integrity of the staff at SRS.

As we discussed the challenges with the CAB in our public meetings the CAB became concerned that there may be significant risk to the SRS workers to retrieve the containers of TRU waste. The CAB noted in Recommendation 249:

"In this case (the inadvertent TRU waste disposition in E-Area trenches), the SRS CAB recognized the limited quantity of waste that would require retrieval and the relatively insignificant an minimal impact of the additional radionuclides to the E-Area Performance Assessment limits. In addition the actual quantity of transuranic isotopes in the waste is suspect due to the limited analytical technology at the time of generation and the use of conservative engineering knowledge to estimate TRU concentrations in waste; therefore, the actual classification of the waste (as TRU with concentrations greater than 100 nanocures per gram) is questionable."

Then the CAB made the following Recommendations:

"Before a final decision is made by DOE on which option (retrieval vs. disposal in place) will be implemented, the SRS CAB requests the following on or before November 16, 2007:

1. DOE-SR conduct a thorough evaluation of the risks, costs, safety, and environmental impacts associated with both options, justify how each option meets DOE Orders and regulations, demonstrate how each option is protective of the public and the environment, and share the results with the SRS CAB.
2. DOE-SR identify the results from the Root Cause Analysis and the necessary corrective actions they will take to prevent the recurrence of any future inadvertent TRU waste disposal and share these results with the SRS CAB."

SRS did just as the CAB requested. They presented all of the information requested in Recommendation 249 and will continue to keep the CAB informed as future decisions are made. The important lessons here are that with proper education, the stakeholders can make informed decisions and be part of the decision making process, thus helping all of the DOE programs maintain a positive public image.

This was an important step in educating the public that retrieval of TRU waste for shipment to WIPP is not necessarily the least hazardous method of dispositioning this type of waste. The predominate view of the public before the educational process began, of course, was that any nuclear waste that can be removed from the state of South Carolina, the better. It required very patient educationally oriented meetings to allow understanding of the real risks associated with each option.

As a result of CAB Recommendation 249, the CAB has participated and will continue to participate with DOE-SRS to explore the possibility of disposal of TRU waste at locations other than WIPP that would pose no significant increase in risk and could be more cost effective. As this team continues its work, Savannah River Site will continue to hold public meetings through the CAB to educate and update the CAB on the status of deliberations surrounding the progress toward disposition of all of the legacy TRU waste.

Through this avenue the idea of non-WIPP disposal of TRU waste as a real possibility to reduce the risk to Savannah River Site workers was veted in a non-confrontational manner. The CAB review of the TRU Waste program continues with considerable interest. Frequently there have been public meetings that included updates on the progress and challenges.

CONCLUSIONS

The TRU waste program continues to focus on shipping all of the legacy waste to WIPP. There is, however, recognition that there may be a relatively small inadvertent disposal of TRU contaminated waste that may present an unacceptable risk to Savannah River Site workers to retrieve the waste from under ground and prepare it for shipment, and thus may require the appropriate performance assessments and approvals for non-WIPP disposal. As a result of positive feedback from the public involvement to date and the requests to hear more about the possible alternatives, Savannah River Site is continuing to provide educational opportunities for the public to provide feedback to the program. It will remain a key to the success of the overall

program to safely disposition all the legacy TRU wastes, that the public find the disposition paths to be acceptable. This is the best possible result from handing public involvement of a very sensitive set of issues. An educated public that can understand the alternatives for waste disposition and their associated risks without judging through preconceived, uninformed, notions about what should or should not happen is the only way to achieve acceptance by the public of difficult, possibly controversial decisions.

The DOE at SRS is currently evaluating all the options identified in this paper with the appropriate DOE Headquarter Organizations to ensure a risked based decision is made that will be protective of the public, environment and workers and will be compliant with DOE and other Federal/State regulations.

REFERENCES

1. "Transuranic (TRU) Waste Inadvertently Dispositioned in LLW Slit Trenches," presentation to the WM Committee by Howard Pope, DOE, and W. T. Goldston, WSRC August 21, 2007.
2. "Transuranic (TRU) Waste Inadvertently Dispositioned in LLW Slit Trenches," presentation to the WM Committee by Howard Pope, DOE, and W. T. Goldston, WSRC September 24, 2007.
3. DOE Order 435.1 Radioactive Waste Management.
4. EPA, 1993. "Final Rule, 40 CFR 191, Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transurnic Radioactive Wastes"
5. *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended