STAKEHOLDER INTERACTION AND COST SAVINGS: LOW-LEVEL WASTE DISPOSAL IN TRENCHES VS. VAULTS

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ABSTRACT

Low-level radioactive waste (LLW) disposal practices at Savannah River Site have evolved from an exclusive trench disposal method to disposal in large, robust, concrete vaults. As a result of investigating the technical basis for vault disposal, it was discovered that some of the LLW materials that were disposed in vaults actually met the technical criteria for disposal in trenches. Vault disposal is much more expensive than trench disposal; therefore, trench disposal is the preferred method if it can be demonstrated to meet all technical requirements. Initially, the public, through the Savannah River Site's (SRS) Citizens Advisory Board (CAB) and the regulators, had been advocates of vault disposal because they were convinced that vault disposal was the only environmentally acceptable method for LLW disposal at SRS.

The challenge was to provide the public and the regulators with appropriate technical and credible information that would allow public endorsement of trench disposal when earlier perceptions held the notion that only vaults provided regulatory-required environmental protection.

This paper traces the strategy development, Department of Energy (DOE) approval process, and stakeholder involvement program that resulted in public endorsement of the SRS disposal of LLW in trenches, previously perceived to require isolation in robust, concrete vaults.

INTRODUCTION & BACKGROUND

In 1994, Savannah River Site (SRS) began disposal of low-level waste (LLW) in large, robust concrete vaults. At that time, the Department of Energy (DOE) LLW program was evolving from shallow land disposal in trenches to an assumption that vaults would be the only acceptable technology for LLW disposal in the humid environment of the eastern USA. Prior to the 1980s, DOE requirements focused on protecting the public from exposures of more than 100 millirem per year; however, the focus began to change in 1982 when the Nuclear Regulatory Commission (NRC) issued 10CFR61 defining acceptable, commercial LLW disposal standards.(1)

The notion of groundwater protection and waste form performance was presented by the Environmental Protection Agency (EPA), and in 1984, the Oak Ridge Environmental Impact Statement (EIS) for LLW trench disposal was withdrawn because of the EPA's voiced concerns about potential groundwater quality impacts. As a result, Oak Ridge decided to move to concrete tumulus disposal similar to the LLW disposal program in France. More attention was being paid to groundwater protection and vaults as an appropriate disposal method when the Regional Compact Host States banned trench disposal in their efforts to design commercial LLW disposal sites. In addition, in 1985, EPA published a draft rule (40CFR193) that focused on groundwater protection.(2)

In 1987, DOE-Headquarters (HQ) issued a directive to its field activities to separate LLW from the environment at humid sites. At the SRS, work was proceeding on an EIS for groundwater protection that specified vaults (and trenches) as a result of the HQ directive. However, no long-term analyses of waste form and disposal site performance had been conducted or required. The assumption was that robust vaults would afford more than adequate protection for LLW disposal.

In 1988, DOE issued new requirements for LLW disposal in DOE Order 5820.2A "Waste Management."(3) A long-term Performance Assessment (PA) was mandated to allow LLW disposal and the performance objectives that were required to be met included groundwater protection.

The SRS disposal vaults were being designed before the PA was required, and were constructed before the PA was completed. The design objectives, therefore, assumed that stakeholders would not accept trench disposal. Several design features were then developed to ensure acceptance in the National Environmental Policy Act (NEPA) process. For example, it was assumed that a barrier must exist between the waste and the environment. With concrete as the most practical barrier, it was believed that water intrusion would be minimized and a future closure cap supported.

At this time, DOE did not have an aggressive public involvement program in place, so no attempt was made to fully inform or educate the public on these issues, except through the EIS public comment process.

The PA work was conducted after the vaults were designed; therefore, the PA was actually analyzing the vault's performance instead of defining vault design criteria. As the PA was concluded, and vault operation began in 1994, disposal of large volumes (one million cubic feet per year) of slightly contaminated soil was questioned by SRS engineers and scientists. In fact, much of this soil was only suspected of contamination. Certainly, it was believed that placing essentially "clean" dirt into these extremely robust vaults was not cost effective. As a result, the PA scope was expanded to consider trench disposal of soil either suspected of contamination, or of being slightly contaminated. As a result of the PA analysis for soil, it was determined that much of the SRS LLW with low radionuclide concentrations could be disposed in trenches in an environmentally sound manner. For the first time, the technical basis for long-term performance of a LLW form was understood, and the appropriate disposal method could be selected based

on cost as well as environmental and technical performance. Cost of disposal in vaults was four to five times higher than trench disposal because of high capital costs required to construct a vault. The task to gain acceptance and approval for the more cost-effective and environmentally safe method was obvious.

STAKEHOLDER ACCEPTANCE

By 1994, the SRS stakeholder community was becoming involved in assisting DOE with its decision-making process concerning radioactive waste, and was well aware of LLW disposal in vaults instead of trenches. Past disposal of LLW in trenches, without the benefit of a PA to predict waste contaminant performance to ensure groundwater protection, resulted in tritium contamination in the groundwater that was above drinking water standards. The task to inform and educate the public surrounding the technical complexities of performance assessments and LLW disposal regulations was the key to improving the cost of disposal while continuing to protect the environment. The public, through the Citizens Advisory Board (CAB), was greatly involved in the "cleanup" of contamination from past operations and was highly aware of contamination (such as tritium) from past LLW disposal actions. A strategy was developed and implemented to gain stakeholder acceptance by using a systems engineering approach and public interaction tools.

The program to educate stakeholders began in 1997, by briefing the CAB on the LLW disposal technical basis, the PA, and the waste forecast. The CAB is comprised of non-voting members from the EPA and the South Carolina Department of Health and Environmental Control (SCDHEC), as well as citizens from the communities nearby and down river of the SRS. With this broad range of membership, the CAB encouraged SRS to begin an education program for members of the interested public and the regulators. As a result of several briefings in 1997, CAB members expressed their concern about the 25 vaults that were predicted to be built to dispose of all LLW over the next 20 years. CAB members were relieved to hear that through operations such as volume reduction and the prudent use of trench disposal for soil, there was a potential that all the expensive vaults originally forecast may not be needed. It was extremely important in SRS's strategy for the CAB to understand and gain confidence in the Site's ability to model waste performance over the long term, therefore, setting limits for waste disposal that are protective of the environment.

To build on the presentations concerning the PA, in 1998, a series of discussions on the Composite Analysis (CA) were begun. The CA was conducted as a result of a DOE requirement to analyze the impact that other nearby sources of radioactive contamination may have on ongoing LLW disposal. The completed CA, which is a companion analysis to the PA, was designed to provide more confidence that SRS's disposal operations are controlled such that even unrelated sources of contamination that may interact with ongoing disposal operations are taken into account as limits for operations are set. As a result of the briefings on the CA, the CAB became confident with the CA and PA, and endorsed these tools as a sufficient technical basis for LLW disposal.

The foundation for educating the public concerning the technical underpinning for LLW disposal had been established. SRS determined that EPA and SCDHEC's further understanding of the technical and regulatory details would go a long way in improving overall stakeholder acceptance of the program. Therefore, both organizations were provided with copies of the PA and CA, and were fully briefed as well. Even though EPA and SCDHEC are not the formal regulatory agencies for DOE LLW disposal, it was deemed extremely important to gain their understanding and to provide answers to their questions.

During this time, SRS began the systems engineering analysis (the *System Plan*) for all SRS waste streams including LLW.(4) Based on a detailed set of criteria, the system analysis determines the preferred path for treatment and disposal of each. It also provides a comparative lifecycle cost analysis that contributes to the selection of the preferred path. After successfully receiving CAB endorsement of the technical basis for LLW disposal, the process of educating the CAB on the *System Plan* began. In subsequent briefings, the CAB was provided with information as to how the *System Plan* provides a well planned analysis of the proper path forward for each type of waste by setting technical, regulatory, environmental, stakeholder acceptance, and cost criteria to rank each alternative. Using a transuranic waste stream as an example, a presentation was developed to explain the *System Plan* approach, and was provided to the CAB in April 1999. The CAB indicated its understanding of the approach and in July 1999, strongly endorsed the systems engineering effort by submitting a formal recommendation to DOE that was specifically related to LLW waste streams.(5)

A public understanding of SRS's program was now created and stakeholders were ensured that LLW disposal was protective of the environment. In addition, SRS demonstrated that changes in methodology would be conducted in a systematic fashion, and with stakeholder input, the Site would continue to move forward with the changes. A critical step in the program included DOE senior management's endorsement of the program. However, it is noted here that DOE staff retained the lead through every step of the way.

The program had now reached a critical juncture. The stakeholders were well informed and had confidence in the basis for the disposal actions and how changes would be made. The *System Plan* coupled with an analysis of the disposed waste and the waste forecast, showed that several waste types were low enough in radionuclides to meet the PA limits for trench disposal even though they had been slated for vault disposal. It was determined that if the waste currently scheduled for vault disposal that met the trench disposal limits were to be disposed in the trench, the vault would not be filled to capacity for an additional nine to ten years. This action, of course, would avoid a significant capital expenditure projected for the Fiscal Year (FY) 2009 budget. It was also concluded that the types of waste that could exit vault disposal for the trench contained compacted job control waste, non-compactable waste, and large equipment. The DOE-SR Manager and Assistant Manager were briefed prior to gaining approval to brief DOE-HQ. At every level, DOE management agreed the program was technically and

economically sound, but requested public endorsement before proceeding with the program.

With DOE-SR and HQ support, DOE and WSRC/BNFL staff prepared a briefing to explain in simple (but hopefully elegant) terms, the analysis that demonstrated the most cost-effective and environmentally acceptable alternative for LLW that met the trench disposal limits derived from the PA, was to dispose of this waste in the trench.(6) Coupled with this line of reasoning, was the fact that more robust vault space should be reserved for waste with higher levels of radioactivity.

It was shown that the vault was being filled with bulk volume of waste; however, the curie inventory limit was not being challenged. At that time, 67 percent of the vault volume had been filled, but only 37 percent of the curie inventory limit was being used. Therefore, if waste was disposed in the trench (that meets the trench limits) instead of the vault, the vault would not be filled for ten to fourteen years beyond current projections, thus avoiding a significant capital expenditure.

The CAB passed Recommendation #94 on July 27, 1999, that concurred with the System Plan to use the trenches for disposal of LLW meeting the trench waste acceptance criteria.(7) (See attachment.) This was truly a "win-win" situation for SRS and its stakeholders. DOE and U.S. taxpayers were now able to continue with DOE's critical post cold war missions, i.e., properly managing its radioactive waste while doing it in the most cost-effective manner. The CAB asked DOE to estimate the cost savings from this action. Based on a forecast of waste to be disposed in the vault that could now be disposed in the trench, the savings will total approximately $63 million over 20 years of operation.

The implementation of this recommendation has been carefully managed to ensure that technical integrity is retained and stakeholder confidence preserved. Every step in the process has been fully documented, and the CAB has been and will continue to be kept fully informed.

CONCLUSION

Stakeholder acceptance of any program involving nuclear activities must be carefully planned and executed. Because of the complexity and volume of issues typically involved in such a program, it may take several years to implement; however, in order to build trust with the public, open, honest, and timely communications are imperative. Not only will confidence and integrity among stakeholders be developed, but also their involvement in the DOE-decision making process is fast becoming critical in the pursuit of SRS and DOE-complex business goals.

REFERENCES

1. Code of Federal Regulations, Title 10, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Nuclear Regulatory Commission. 1982.

2. Code of Federal Regulations, Title 40, Part 193, (DRAFT) "Radiation Protection Standard for Low-Level Radioactive Waste Disposal." Environmental Protection Agency. (Not released as of 10/11/2000).

3. Department of Energy Order 5820.A, "Waste Management." Issued 1988.

4. "System Plan for the Solid Waste Division," U. S. Department of Energy, Savannah River Site, Aiken, SC, WSRC-RP-98-00226. Volume III, Revision 0, October 30, 1998.

5. Savannah River Site Citizens Advisory Board, Recommendation No. 94, "Solid Waste Division System Plan Low-Level Radioactive Waste Disposal," July 27, 1999.

6. Goldston, W. T., Noll, W. L., "Solid Waste Division System Plan, Low-Level Radioactive Waste Disposal (LLW)," A presentation prepared at Westinghouse Savannah River Company/British Nuclear Fuels Ltd. and Department of Energy, Aiken, SC, July 27, 1999.

7. Savannah River Site Citizens Advisory Board, Recommendation No. 94, "Solid Waste Division System Plan Low-Level Radioactive Waste Disposal," July 27, 1999.

Attachment

Savannah River Site
Citizens Advisory Board

Recommendation No. 94

Solid Waste Division System Plan
Low-Level Radioactive Waste Disposal

Background

The purpose of the Solid Waste System Plan (Ref. 1 & 2) is to perform a comparative analysis of options for treating and disposing of different kinds of solid waste, to select a preferred option and to provide a management plan for allocation of scarce resources. A portion of this plan deals with the preferred option for the management and disposal of low-level radioactive solid waste (LLW; in Ref. 3) and is the subject of this motion.

The Department of Energy has sole regulatory authority for the disposal of LLW under the Atomic Energy Act of 1954 and issues regulations for LLW disposal through DOE Orders 5820.2A and 435.1.

LLW is being disposed in the E-Area Vault Facility in the Savannah River Site (SRS) E-Area near the center of SRS. This 200-acre facility contains vaults and trenches for disposal of LLW. Performance Assessments (PA) and Composite Analysis (CA) have been performed on the vaults and the trenches. The PA and CA analyze the potential release and migration of radionuclides from the vaults and the trenches over a 10,000 year period. All possible pathways to humans are analyzed to ensure protection of human health and the environment. The performance objectives that must be met by the PA and CA include protection of the groundwater. The groundwater must be shown to meet drinking water standards for the entire 10,000 year period. The PA and CA analyses provide the basis for developing Waste Acceptance Criteria (WAC; maximum number of curies of each radionuclide contained in a vault or trench) for LLW going into these facilities.

Currently, only material with very low radionuclide concentrations - soil, rubble, wood, and stabilized ash from the Consolidated Incineration Facility (CIF) - is disposed in the earthen trenches; other LLW, regardless of radionuclide content, is disposed in a vault.

The System Plan (Ref. 1) analyses found that current disposal practices are overly conservative. The PA and WAC indicate that disposal of low activity LLW in the vault is needlessly using expensive vault space when instead it could meet the WAC for the trenches. The analyses found that about 50 percent of the LLW now going to the vaults would meet the trench WAC. Vault space could then be reserved for high activity LLW.

If the vaults are reserved for high activity LLW and the trenches are used for disposal of low activity LLW meeting the trench WAC, the need for another vault will be pushed out 10 years. Otherwise, work towards designing and budgeting another vault needs to start next year. The System Plan recommends using the trenches for disposal of LLW meeting the trench WAC.

The SRS Citizens Advisory Board is concerned about SRS funding and supports actions that minimize expenditures while still protecting human health and the environment. We believe that the PA and the trench WAC provide a sound technical basis for protecting human health and the environment and that disposing of low activity LLW in trenches does not pose a threat to human health or the environment. The Board believes that the System Plan approach of using scientific/technical criteria and systems engineering is an excellent way to analyze options for treatment, storage and disposal of LLW.

Recommendation

The SRS Citizens Advisory Board (CAB) concurs with the System Plan recommendation to use the trenches for disposal of LLW meeting the trench WAC. The CAB also recommends that SRS:

1. Present to the CAB by February 10, 2000, the performance of the E-Area LLW disposal facility from the available data (e.g., waste receipts, monitoring, testing and research) as it compares to the assumptions and results of the PA and CA reports.

2. Present to the CAB by February 10, 2000, the operations cost and time savings expected by implementing the System Plan recommendation.

3. Present to the CAB by February 10, 2000, and annually thereafter, a comparison of PA and CA results with comparable methods from the scientific community. The CAB understands that the PA and CA have undergone extensive ISPR and cross-validation; we encourage SRS to perform additional Independent Scientific Peer Review (ISPR's) of the PA and CA on a regular basis to continue to assure the public and the scientific community of the robustness of these models.

References

1. System Plan for the Solid Waste Division, Westinghouse Savannah River Company Report WSRC-RP-98-00226, Rev. 1, February 22, 1999.

2. Brief on the Solid Waste Division (SWD) System Plan, Presentation to the ER & WM Subcommittee, CAB, by Peter I. Hudson, April 14, 1999.

3. Solid Waste Division System Plan, Low-Level Radioactive Waste Disposal (LLW), Presentation to the ER & WM Subcommittee, CAB, by W. T. (Sonny) Goldston, July 13, 1999.

Recommendation No. 94
Adopted July 27, 1999