

DOE ORDER 435.1 IMPLEMENTATION AND COMPLIANCE DECLARATION AT THE SAVANNAH RIVER SITE AND ACROSS THE DOE COMPLEX

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ABSTRACT

DOE issued Order 435.1, "Radioactive Waste Management," on July 9, 1999 for immediate implementation. The requirements for Low Level Mixed, Transuranic, and High Level Waste have been completely rewritten. The entire DOE complex has been struggling with how to implement these new requirements within the one year required timeframe. This paper will chronicle the implementation strategy and actual results of the work to carry out that strategy at the Savannah River Site. DOE-SR and the site contractors worked closely together to implement each of the new requirements across the SRS, crossing many barriers and providing innovative solutions to the many problems that surfaced throughout the year. The results are that SRS declared compliance with all of the requirements of the Order within the prescribed timeframe. The challenge included all waste types in SRS facilities and programs that handle LLW, MLLW, TRU, and HLW. This paper will describe the implementation details for development of Radioactive Waste Management Basis for each facility, Identification of Wastes with No Path to Disposal, Waste Incidental to Reprocessing Determinations, Low Level Waste 90-Day Staging and One Year Limits for Storage Programs, to name a few of the requirements that were addressed by the SRS 435.1 Implementation Team.

INTRODUCTION

The U.S. Department of Energy (DOE) issued DOE Order 435.1, "Radioactive Waste Management," on July 9, 1999 for immediate implementation. This new order includes the requirements that must be met for all DOE facilities, operations, and activities that manage radioactive waste.

A major cornerstone in these requirements is the development and DOE approval of a Radioactive Waste Management Basis (RWMB) for each DOE radioactive waste management facility, operation, and activity.

The Order requirements state that,

Field Element Managers are responsible for:

Ensuring a radioactive waste management basis is developed and maintained for each DOE radioactive waste management facility, operations, and activity; and

ensuring review and approval of the basis before operations begin. The Radioactive Waste Management Basis shall:

- (a) Reference or define the conditions under which the facility may operate based on the radioactive waste management documentation;
- (b) Include the applicable elements identified in the specific waste-type chapters of this manual; and
- (c) Be developed using the graded approach process.

The Order and its accompanying Manual and Guidance mentions the RWMB on approximately 121 pages, which indicates the high level of importance afforded this concept by DOE to ensure appropriate controls are in place to protect human health and the environment.

Basically most of the 435.1 requirements are reflected in the RWMB in some fashion. Several other major requirements, however, must be addressed and were addressed by the Savannah River Site Program. The major items that were addressed include:

- Waste Incidental to Reprocessing Determinations
- Waste with No Path to Disposal
- Sitewide Waste Management Program

BACKGROUND

DOE and its predecessor agencies have managed the nation's program to produce nuclear weapons, conduct research on nuclear reactors, and perform experiments on nuclear reactor equipment for over 50 years. The Atomic Energy Act of 1954 placed the responsibility for management of most of the waste generated by these programs on the DOE, and DOE is expected to manage these wastes in a manner that protects human health and the environment. The waste types routinely handled by DOE and covered by the Order are: high-level waste (HLW), transuranic waste (TRU), low-level waste (LLW), and mixed low-level waste (MLLW).

DOE began in 1990 to assess the existing Order on Radioactive Waste Management (DOE 5820.2A issued in September 1988) in an attempt to reflect advances in radioactive waste management practices internationally and to improve its requirements to provide a safety, risk, and performance-based set of requirements that were cost effective and yet protective. During this revision effort, the DNFSB (an independent organization with oversight of DOE) began an examination of DOE's low-level waste practices. In September of 1994, the DNFSB issued Recommendation 94-2, "Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites," which identified further improvements needed in DOE's LLW management program.

In late 1995, DOE embarked on a modified method to revise the radioactive waste management requirements. (1) A systems engineering analysis was performed to identify all functions and activities necessary for managing the wastes. (2) The potential hazards that would be posed by managing these wastes were identified and activities or requirements were defined that would mitigate the hazards. (3) Existing requirements from national consensus standards were reviewed and assessed to determine if they would adequately address the identified hazards. The standards used for this evaluation were primarily from the Nuclear Regulatory Commission, the Environmental Protection Agency, or other DOE directives. (4) Proposed revisions to the DOE requirements to address the identified hazards were developed and the technical basis for each requirement was documented.

The draft DOE Order 435.1 now consists of the Order itself, a Manual that lists the requirements, the Technical Basis for the requirements, and an Implementation Guide.

IMPLEMENTATION AT SRS

A 435.1 implementation team was chartered at Savannah River Site, made up of representatives from each division that handles radioactive waste. The team developed a path forward that was based on using the SRS Standards/Requirements Identification Documents (S/RID's) process to document the compliance or non-compliance with each requirement. If a program was found to be in non-compliance with a requirement, a task team was formed to determine a compliance strategy and schedule. If the team determined compliance could be achieved prior to July 9, 2000, then the team proceeded with the task, if not, then the team was charged with developing an implementation plan. (See Chart 1)

As a result of each team working directly with the overall team lead and DOE, SRS was able to seek interpretation of the Guidance that allowed a plan to achieve compliance by July 9, 2000, for each requirement. It became extremely important to understand the Guidance as it applied to each facility's specific waste stream and existing administrative system. Without a direct link to DOE expertise both at the Field Office and in Headquarters, compliance would not have been achieved in the one-year timeframe required.

This paper will begin by discussing the RWMB compliance strategy and the major issues associated with each Requirement that addresses through the RWMB. It must be recognized that the RWMB was called out in the Guidance many times as the vehicle to be used to provide evidence of compliance with other Requirements.

THE RADIOACTIVE WASTE MANAGEMENT BASIS (RWMB)

The RWMB requirement's objective is to ensure that the hazards associated with radioactive waste management facilities, operations, and activities have been identified, their potential impacts analyzed, and appropriate controls documented, implemented, and maintained for the protection of workers, the public, and the environment. The Order allows one year for compliance and describes compliance as either:

- (1) implementing the requirements of the Order or

- (2) having an approved implementation plan or corrective action plan.

The Field Element Manager must ensure review and approval of each RWMB at his/her site. This can be an especially difficult task for a site without specific Authorization Basis (AB) documents in place such as Safety Analysis Reports and resulting administrative controls. For facilities without approved AB's, it will be more difficult to locate or create the specific analyses required. Both situations exist at Savannah River Site, from rigorous Authorization Basis documentation in facilities such as the Defense Waste Processing Facility (DWPF) to the Environmental Restoration (ER) program that primarily follows Environmental Protection Agency (EPA) regulations and, due to extremely low levels of radioactivity in the waste handled, is not required to have an AB.

The RWMB consists of the analyses and controls usually contained in an AB, and for each waste type, consists of prescribed documents associated with the waste acceptance program. For example, the waste acceptance documents required by the LLW chapter for treatment and for storage facilities are:

- the waste acceptance requirements and
- the waste certification program.

In addition to safety analysis and waste acceptance documentation, several other requirements in the Order specify that the actions to satisfy the requirement must be a part of the RWMB. Or, a method used to satisfy a requirement should be justified in the RWMB if the method is not clearly the same as that described in the Guidance.

RWMB IMPLEMENTATION

At Savannah River Site (SRS), in order to ensure that no discussion in the Order was overlooked of how to implement the RWMB and when to include information in the RWMB, a word search was performed allowing research into every paragraph where the RWMB was discussed. As a result, several issues were brought to the table for discussion with DOE. In several cases when the rationale was not clear as to how to treat the Guidance concerning the RWMB, a short documentation of the SRS implementation rationale was added to a printed copy of the particular page. This rationale was documented formally and made a part of the official record for future reference to document how compliance was achieved.

A task team was formed to implement the RWMB requirement sitewide. Two approaches have been developed based on the examples contained in the Guidance. One approach is based on an already existing system at SRS called the "Authorization Agreement" (AA). The AA is a DOE approved list of documents that makes up the set of requirements that form the authorization basis for DOE's approval for a facility or set of facilities to operate. The RWMB documents were added to the AA. DOE approval was requested and granted.

A second approach is to develop a list of documents that make up the AB and add the required documents that complete the RWMB for a facility or set of facilities. This approach works well for facilities that do not have approved AA's and are not required to have AA's. This second

approach also works well for programs such as Environmental Restoration, where no AB documents exist. The hazards analyses that are required for EPA risk assessments or for SRS job hazards analyses (JHA) were listed as the RWMB documents along with the waste characterization program.

In this concept, DOE was requested to approve the list of documents that make up the RWMB. Each document on the list has its own review and approval process in and of itself. DOE's approval constituted approval that the correct documents are in place and the appropriate levels of review and approval are in place for each document. DOE review and approval of each document in the RWMB was not required. The contractor management, for example, may approve the Waste Acceptance Criteria (WAC), if DOE agreed that the contractor's review/approval process was adequate and appropriate.

Eighteen RWMBs were written and approved by DOE at SRS. They cover multiple facilities that handle all of the waste types.

ISSUES

Several specific requirements require justification or inclusion in the RWMB. The following is a discussion of each requirement that falls into this category.

DOE G 435.1-1 III.D. (p. III-18). As part of the RWMB, site personnel should implement a system or process for tracking the waste inventory at a storage, treatment, or disposal facility.

The above statement is contained in the Guidance, and is not a requirement. However, it was felt that an explanation of how this was to be carried out would be prudent. At SRS's TRU and LLW facilities, tracking inventory is required by the AB through the Safety Analysis Report and Technical Safety Requirements to protect inventory source term assumptions. Also, the Waste Acceptance Criteria (WAC) requires inventory tracking to be assured that radionuclide inventory limits are not violated. The AB and the WAC are specified in the RWMB, therefore, the Guidance is satisfied. The requirements from the AB and WAC are implemented through facility procedures and an electronic database.

DOE G 435.1-1 III.M.(2)(b) p. III-121 Facility Design.

The following facility requirements and general design criteria, as a minimum, apply:

Ventilation...

Compliance with the above requirement is demonstrated by analyses that support the level of filtration provided on a TRU waste management facility, and if airborne effluent monitoring data are available, a demonstration of compliance with the site established operational guidelines for the facility. In addition, acceptable implementation is demonstrated by analysis,

monitoring data, or both... The analysis and rationale for the selected controls must be documented in the RWMB.

The sentence that states “the analysis and rationale for the selected controls must be documented in the RWMB.” is in the Guidance, not the requirement. Thus, at SRS the decision was to state that the AB and SAR contain the analysis used to select the correct controls to satisfy this requirement. The AB is a part of the RWMB.

This same requirement is included in the LLW Chapter and the same rationale is used for implementation.

**DOE G 435.1-1 p. III-152
III.Q. Monitoring**

The following requirements are in addition to those in Chapter 1 of this Manual:

- (1) All Waste Facilities. Parameters that shall be sampled or monitored, at a minimum, include: temperature, pressure (for closed systems), radioactivity in ventilation exhaust and liquid effluent streams, and flammable or explosive mixtures of gases. Facility monitoring programs shall include verification that passive and active control systems have not failed.**

(The same requirement exists for LLW and TRU.)

The above requirement is accompanied by the following Guidance.

Parameters Specified

The minimum parameters specified in the above requirement (temperature, pressure, flammable/explosive mixtures of gases) were selected based on their potential significance in predicting and identifying undesirable conditions. Each facility RWMB should include an evaluation of the applicability and significance of the minimum parameters. Compliance with this requirement is demonstrated if...and a justification exists in the approved RWMB for those specified parameters, which are not monitored or sampled.

Again the RWMB contains the AB and SAR; therefore, the SAR's evaluation was used to select the parameters to monitor. This is sufficient for LLW. However, at the SRS TRU storage facilities some containers are not vented, may contain flammable gases, and are not specifically monitored for flammable/explosive gases. They are analyzed in the SAR and do not require monitoring. In this case, the decision was to develop a document that would describe the basis for the correct monitoring posture and list this document in the RWMB. This is considered a conservative approach, not required but prudent. The problem here is that most of the 435.1 requirements are performance based. This one is not; rather, it specifies minimum parameters

that shall require monitoring. The situation in TRU waste storage described here is fully analyzed in the SAR and, thus, is contained in the RWMB.

A similar situation exists in the LLW Chapter. The requirement for monitoring is the same (DOE M 435.1, IV, R.) in that it specifies the parameters that shall be monitored. In the SRS Effluent Treatment Facility, temperature is not monitored in each process step. The facility is a category 3 facility and, thus, does not require a "full" SAR. Basically, the strategy is to keep radionuclide inventory below category 3 levels so the source term used in the hazards analysis is bounding. Again, a document was prepared and made a part of the RWMB as justification that the correct monitoring has been selected to control the process and mitigate the hazards.

Environmental Restoration (ER) Groundwater Treatment Facilities

Environmental Restoration at SRS operates two groundwater treatment facilities. They are operated in accordance with a RCRA permit issued by the State of South Carolina Department of Health and Environmental Control (DHEC). The waste from those facilities (job control, sludges, and ion exchange resin) is contaminated, because the water treatment process captures and concentrates radionuclides such as I-129. The groundwater itself that is pumped from the underlying aquifer, treated, and returned, is contaminated with solvents that require treatment. Therefore, the facility is a RCRA permitted facility that generates radioactive waste. The facility was determined to need a RWMB that addressed the "Generator" requirements, not the "Treatment" requirements. As a Generator of LLW, the Groundwater Treatment Facility must comply with 435.1 requirements for Generators. Since the operation of the facility is permitted by SCDHEC as a RCRA facility and its purpose is to treat non-radioactive groundwater, the 435.1 requirements for treatment facilities do not apply.

One Year Storage Limit prior to LLW Disposal [DOE M 435.1, IV.N.(2)] for waste with a path to disposal

The Order specifies that LLW cannot be stored longer than one year prior to disposal. At SRS, and most large DOE sites, this presents a challenge. The method that was used to obtain approval to store LLW beyond one year was to develop an implementation plan that details the plan to gain compliance with the one-year limit, determine how long it will take to gain compliance, and justify that storage beyond one year is safe and environmentally sound. This information was placed in the RWMB.

The requirement itself states that "...LLW shall not be stored longer than one year prior to disposal, except for storage for decay, or as otherwise authorized by the Field Element Manager."

The Guidance provides a method to obtain Field Element Manager authorization as follows:

Compliance with this requirement is demonstrated by the existence of a RWMB for the storage facility approved by the Field Element Manager that includes the timeframes that the wastes are allowed to be stored, the necessary

justifications for storage for decay, and the necessary technical evaluations if storage is to extend significantly beyond the one-year timeframe.

Therefore at SRS, the RWMB included a document that provides the risk assessment and justification for storage of LLW (with a path to disposal) beyond one year.

Requirement: 90 Day Limit on Staging LLW
Chapter IV.N.(7) LLW Staging

Staging of low-level waste shall be for the purpose of the accumulation of such quantities of waste as necessary to facilitate transportation, treatment, and disposal. Staging longer than 90 days shall meet the requirements for storage above and in Chapter 1 of this Manual.

At SRS it was a goal to provide only one LLW storage area on the site. That LLW storage area was to be the Solid Waste Division's LLW facilities in the center of the site. This strategy then required all of the SRS generators of LLW to meet the requirement to limit staging to 90 days prior to shipment to the Solid Waste LLW storage facilities or provide justification for staging beyond 90 days.

The Implementation Team working with DOE decided to provide the generators with internal guidance on what was required to justify LLW staging beyond 90 days. The letter providing this internal guidance was issued to each generator organization and then used to assist in guiding DOE approval if the generator organization was unable to meet the staging limit of 90 days.

Basically, the 435.1 Guidance provides for staging LLW longer than 90 days. Staging longer than 90 days must be justified as part of the facility's RWMB and, through the RWMB approval, approved by the Field Element Manager. As stated in the Guidance, "There needs to be flexibility in the implementation of the 90-day staging requirement due to the complexities of management of LLW and the unpredictability of events as the affect planned operations. Thus, malicious compliance with the 90-day limit is not necessary, nor is it intended that no additional time can be allowed past 90 days.

In order to provide the appropriate justification for staging beyond 90 days, the internal guidance included a list of items that must be covered in the RWMB or referenced in the RWMB:

- Justification of the need to stage beyond 90 days
- A recovery plan and schedule to allow 90-day staging in the future
- The maximum allowed staging period without notification to DOE
- Location of staging areas defined
- Identification of requirements that were sufficient to protect the workers, public, and the environment such as:
 - Waste Acceptance Criteria
 - waste tracking
 - container integrity assurance

Therefore, each generator facility that was unable to meet the 90-day staging limit provided justification as part of their RWMB.

Requirement for Storage Integrity of TRU and LLW [DOE M 435.1, III.N.(2) and IV.N.(3)]

The Storage Integrity requirement must be addressed for TRU and LLW. In the Guidance, it states that:

A principal element of proper storage is ensuring that containers are protected from degradation and perform their intended function until disposal. This requires that containers be protected from mechanical damage and from environmental conditions that could degrade the confinement provided by containers.

This could lead to requiring storage of all LLW and TRU indoors (inside for weather protection). However, the Guidance for LLW and TRU also provides an example that reads as follows:

Example 2: Due to a large backlog of low-level waste, Site X is required to store low-level waste outside until it can be treated and/or disposed. The waste is stored in containers which prevent the entrance of precipitation (lid with lips extending down over the sides) and which resist corrosion (painted carbon steel). Controls are in place to limit mechanical damage from vehicles and other operations in the area. The containers are inspected on a monthly basis for deterioration and repaired as necessary to maintain containment of the waste (e.g., painted, contained). Personnel are only in the outside storage area during periods of inspections, container maintenance, and container movement. The outside storage has been analyzed and documented to provide adequate protection for the expected storage time. This storage maintains the integrity of the waste and minimizes worker exposure.

Therefore, the path forward chosen at SRS is to develop a document that demonstrates the storage integrity requirement is met in the storage areas that exist outside. This document will be made a part of the RWMB, and is expected to pull information from already conducted hazard analyses, the SAR, and resulting Administrative Control Technical Safety Requirements.

The justification that demonstrates this requirement is met for LLW is a “sister” to the justification for storage of LLW beyond one year. In order to justify storage beyond one year, the container integrity must be analyzed and demonstrated to be sufficient to meet the storage integrity requirement.

Waste with No Path to Disposal

Chapter I.2.F.(19) The Field Element Managers are responsible for:

Ensuring a process is developed and implemented for identifying the generation of radioactive waste with no identified path to disposal, and reviewing and approving conditions under which radioactive waste with no identified path to disposal may be generated. Headquarters shall be notified of the decision to generate a waste with no identified path to disposal.

Although not as voluminous as the Guidance on the RWMB, this topic was well covered in 435.1. Several Implementation Team meetings were held to understand the 435.1 Guidance and formulate a path forward. It was determined that three basic categories of waste with no path to disposal could be developed and each had a unique path forward to ensure compliance was achieved.

Legacy Waste was defined as waste that was in storage as of July 9, 2000, and there were no plans to generate more of this waste. The 435.1 Guidance provided the path that was implemented by the SRS team. The Guidance says, "...waste streams generated in the past with no path to disposal which are now in storage, and waste streams without a path to disposal that are currently being generated are intended to be addressed in the Site-wide Radioactive Waste Management Programs." It goes on to say that the requirement for approval by DOE is intended for newly generated waste streams only. Therefore, the SRS site-wide program, defined as the Solid Waste System Plan, now includes a section on Waste with No Path to Disposal in which all legacy waste in this category is assessed.

For wastes with no path to disposal that SRS intends to continue generating the team requested that each generating facility provide in their forecast of future wastes, an assessment of whether or not the wastes would meet the current Waste Acceptance Criteria (WAC). If it was determined that a waste stream would not meet the WAC, information was gathered to develop the document required to request the DOE Manager's approval to generate the wastes. At a minimum, the information provided to DOE to allow a consideration for approval to continue to generate included:

- The programmatic need to generate the waste
- Characteristics and issues preventing disposal
- Safe storage information
- Plans for achieving final disposal

The information was developed and DOE approval was obtained to continue to generate several waste streams that do not currently have a disposal path.

In order to identify and assess the potential generation of waste with no path to disposal, SRS strengthened procedures already in place that require generators to forecast wastes that may not meet the WAC, projects to identify waste characteristics in the design reviews that include Solid Waste Division, and the required review by Solid Waste Division of National Environmental Policy Act (NEPA) documentation concerning new waste streams.

WASTE INCIDENTAL TO REPROCESSING

Chapter I.2.F.(18) The Field Element Managers are responsible for:

Ensuring that waste incidental to reprocessing determinations are made by either the “citation” or “evaluation” process described in Chapter II of this Manual.

The Order provides that certain waste streams generated during the management of high-level wastes may not be required to be managed as high-level wastes (HLW), and therefore, can be managed as low-level wastes (LLW) or transuranic wastes (TRU). The Order prescribes a process that when used will document the decision to manage these waste streams created during the handling of HLW as LLW or TRU. This process is called the “waste incidental to reprocessing determination.” These determinations can be accomplished either by the “citation” or “evaluation” process described in the Order.

At SRS, the HLW (liquid HLW that exits the reprocessing facilities) is stored in underground tanks, stabilized into a glass matrix, and analyzed in laboratories. A program was developed that provided all the information required for a “citation” determination for items such as job control wastes, allowing this type waste to be managed as LLW. Also, the program provided a procedure for how “evaluation” determinations would be performed in the future for items such as process equipment. DOE approved this program and it has been implemented.

Application to others in the DOE Complex

The methods for implementing DOE Order 435.1 at SRS attempt to use the graded approach. As far as possible, SRS used existing analyses, procedures, programs, and documents to satisfy the requirements for an RWMB. A difficulty encountered is the frequent use of the RWMB as a vehicle to provide justification for an approach to satisfy a requirement. This is felt to be an excellent application of the graded approach, but a search of the Order is required to ensure that each time the RWMB is used in the Guidance, it is clearly identified and addressed.

Using the S/RID's process at SRS is a convenient way to provide a crosswalk that demonstrates that each of the DOE M 435.1-1 requirements is met. The Guidance indicates that such a crosswalk is desirable, and if the S/RID process was not used, then some other method would be needed. Each division at SRS fills out the S/RIDs and obtains DOE approval of the tables that provide the crosswalk.

Other facilities in the DOE complex could use the approach documented in this paper to prepare a RWMB and the recommended crosswalk that demonstrates each 435.1 requirement is met.

CONCLUSIONS

SRS became one of the first sites in the DOE-Complex to declare compliance with the new DOE Order 435.1 “Radioactive Waste Management.” The programs put into place were not only compliant, but they were cost effective as well. Due to using a carefully crafted graded approach

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that paid close attention to the wisdom imparted by the Guidance, SRS was able to achieve compliance at a cost well below original estimates.