

**Development and Maintenance of a Comprehensive  
Radioactive Waste Management Basis – 16349**

Kristen L. Willis\*, Robert L. Black\*  
Idaho National Laboratory, Idaho Falls, Idaho  
kristen.willis@inl.gov, rob.black@inl.gov

**ABSTRACT**

In accordance with DOE Order 435.1, "Radioactive Waste Management," radioactive facilities and activities must have a documented basis of operation consisting of procedures, and physical and administrative controls that ensure protection of workers, the public, and the environment. To fulfill this requirement, Department of Energy (DOE) facilities are required to have an approved Radioactive Waste Management Basis (RWMB) which provides assurance that controls are developed, documented, and implemented for management of radioactive waste. The required elements of the RWMB vary with the type of waste management operation or facility and the types of hazards associated with the facility. Therefore, a graded approach is used per DOE guidance.

The Idaho National Laboratory Waste Management Program (WMP) has developed and implemented a thorough RWMB for each of its five operational areas in addition to facility specific DOE Order 435.1 compliance tables which served as a tool for developing each RWMB. With approximately 40 facilities generating and/or managing radioactive waste, the WMP has encountered several challenges in keeping RWMBs current and accurate, in addition to ensuring facilities are continually maintaining compliance in evolving conditions in support of programs and projects in a continuously expanding research environment.

Prior to initial radioactive waste generation, nuclear facility management must demonstrate compliance via the facility safety basis and approved laboratory-wide and facility specific documents which are then incorporated into the RWMB and subsequently approved by the DOE-Idaho Operations field office designated point of contact.

The WMP has incorporated several areas of improvement to its RWMB management strategy to help facilities maintain compliance in new and changing conditions. Improvements included providing ad hoc facility management training for new facility managers, adding a reviewer from the WMP during the environmental checklist process, and performing annual RWMB reviews which involve not only facility management, but also Waste Generator Services support personnel, and other support organizations, as applicable.

## **INTRODUCTION**

The Idaho National Laboratory (INL) is operated by Battelle Energy Alliance (BEA) under contract with the U.S. Department of Energy's Office of Nuclear Energy (DOE-NE). As the DOE-NE national nuclear laboratory, INL serves a unique role in civilian nuclear energy research and development. INL is also an on-going multi-program laboratory. The dynamic research activities which occur across the laboratory lead to a variety of waste streams being generated, i.e. contact-handled (CH) and remote-handled (RH) low-level waste, CH and RH transuranic waste, and mixed waste. Several facilities may also generate waste streams which require special considerations due to high radiation levels (thousands of Rem).

To ensure protection to workers, the public, and environment the U.S. Department of Energy requires an approved radioactive waste management basis that must do the following:

- Reference or define the conditions under which a facility may operate based on the radioactive waste management documentation
- Include the applicable elements identified in the specific waste type chapters of the manual (DOE Manual 435.1-1)
- Be developed using the graded approach process.

Consistent with the graded approach provided in the DOE guidance, the required elements of the RWMB vary with the type of waste management operation or facility and the types of hazards associated with the facility. Therefore, the elements that are included in the guidance for each waste type chapter of the manual are not to be considered a complete list of elements. For example, the elements determined to be applicable to the RWMB for a facility may include the facility safety basis; authorization basis; operational procedures; radiation protection controls and procedures; waste characterization and certification plan; waste acceptance criteria; waste tracking and records management; waste storage and staging requirements; facility monitoring; quality assurance; and regulatory permits and appropriate documentation for permitted facilities.

## **DISCUSSION**

The INL WMP has developed an RWMB methodology using a series of compliance tables specific to Low-Level and Transuranic Waste for each facility that generates or manages radioactive waste. There are approximately 140 requirements which are examined, each requiring a response of applicability along with how the facility complies with those requirements; generally via safety basis/hazards analysis documents, laboratory-wide, and facility specific administrative controls.

An example compliance table excerpt:

TABLE I RWMB Compliance Table Example

<b>MFC-765, Fuels Conditioning Facility</b>	
<b>Chapter IV, LLW Requirements</b>	<b>Facility Compliance Information</b>
<p>A. <u>Definition of Low-Level Waste</u>. Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the <i>Atomic Energy Act of 1954</i>, as amended), or naturally occurring radioactive material.</p>	<p>This requirement provides the criteria for determining which DOE radioactive waste is to be managed as Low Level Waste (LLW) in accordance with DOE Manual 435.1-1, Chapter IV.</p> <p>Radioactive waste managed at this facility under the requirements of this chapter is not managed under the requirements of DOE Manual 435.1-1, Chapter II or Chapter III.</p>
<p>B. <u>Management of Specific Wastes</u>. The following provide for management of specific wastes as low-level waste in accordance with the requirements in this Chapter:</p>	<p>See (1), (2), (3), and (4) below.</p>
<p>(1) <u>Mixed Low-Level Waste</u>. Low-level waste determined to contain source, special nuclear, or byproduct material subject to the <i>Atomic Energy Act of 1954</i>, as amended, and a hazardous component subject to the <i>Resource Conservation and Recovery Act</i> (RCRA), as amended, shall be managed in accordance with the requirements of RCRA and DOE O 435.1, <i>Radioactive Waste Management</i>, and this Manual.</p>	<p>This facility manages mixed LLW. The documents cited below demonstrate compliance with this requirement.</p> <p>This facility manages mixed LLW in Satellite Accumulation Areas (SAAs). Management of SAAs is addressed in LWP-17410, “<i>Management of Waste Storage Areas</i>” and overall management of mixed waste is addressed in MCP-17000, “<i>Waste Generator Services Waste Management</i>”.</p> <p>OI-6620 establishes and implements administrative requirements and provides instructions for management of the in-cell mixed LLW waste managed at this facility.</p>
<p>(2) <u>TSCA-Regulated Waste</u>. Low-level waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed in accordance with requirements derived from the <i>Toxic Substances Control Act</i>, as amended, DOE O 435.1, <i>Radioactive Waste Management</i>, and this Manual.</p>	<p>NA; this facility does not manage TSCA-regulated waste.</p>
<p>(3) <u>Accelerator-Produced Waste</u>. Radioactive waste produced as a result of operations of DOE accelerators is low-level waste and shall be managed in accordance with DOE O 435.1, <i>Radioactive Waste Management</i>, and this Manual, and all applicable Federal or State requirements.</p>	<p>NA; this facility does not manage accelerator-produced waste.</p>
<p>(4) <u>11e.(2) and Naturally Occurring Radioactive Material</u>. Small quantities of 11e.(2) byproduct material and naturally occurring radioactive material may be managed as low-level waste provided they can be managed to meet the requirements for low-level waste disposal in Section IV.P of this Manual.</p>	<p>NA; this facility does not manage naturally occurring radioactive material.</p>
<p>C. <u>Complex-Wide Low-Level Waste Management Program</u>. A complex-wide program and plan shall be</p>	<p>DOE Manual 435.1-1 §I.2.B and §I.2.D apply to the Assistant Secretary for Environmental Management</p>

<b>MFC-765, Fuels Conditioning Facility</b>	
<b>Chapter IV, LLW Requirements</b>	<b>Facility Compliance Information</b>
developed as described under <i>Responsibilities</i> , 2.B and 2.D, in Chapter I of this Manual.	and the Deputy Assistant Secretary for Waste Management, respectively.
D. <u>Radioactive Waste Management Basis</u> . Low-level waste facilities, operations, and activities shall have a radioactive waste management basis consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment. The following specific waste management controls shall be part of the radioactive waste management basis:	The RWMB provides the regulatory framework for management of radioactive waste at INL. It specifically identifies facility management and implementing documents for the generation, storage, treatment, and disposal of radiological waste.
(1) Generators. The waste certification program. From DOE G 435.1-1 Chapter IV:  For a facility that generates low-level waste, the radioactive waste management basis is to include the program for certifying that waste meets the waste acceptance requirements of the facility(ies) to which the waste will be sent.	SAR-403 serves as the safety basis documentation for the facility and establishes it as a Hazard Category 2 nuclear facility.  LST-390 provides the limits, boundaries, conditions, and rules under which activities involving fissionable materials are carried out.  OI-6605 provides instructions for performing in-cell tracking and logging using the Mass Tracking System to document the contents and source term for each waste container.  OI-1302 specifies material accountability requirements for managing special nuclear material in FCF and provides the instructions necessary to meet the requirements using the Mass Tracking System database.
(2) Treatment Facilities. Certification program. The waste acceptance requirements and the waste [ <i>sic</i> ] From DOE G 435.1-1 Chapter IV:  Facilities that store or treat low-level waste are to have approved waste acceptance requirements (see DOE M 435.1-1, Section IV.G) prior to the issuance of a radioactive waste management basis.  A facility that stores or treats waste also is generally expected to have a waste certification program. Waste from these facilities will have to be certified as meeting the waste acceptance requirements of the facility to which it will be transferred, and the facilities have the potential for generating radioactive waste (e.g., secondary processing streams from treatment, monitoring and sampling, radioactive release cleanup). Consequently, storage and treatment facilities should also have an approved waste certification program as part of their radioactive waste management basis.  As part of the radioactive waste management basis, site personnel needs to implement a system or process for tracking the waste inventory at a storage, treatment, or disposal facility.	NA; waste is not treated at this facility.

As part of the compliance table matrix for each facility, detailed programmatic facility descriptions and capabilities are also identified as a prelude to the compliance table. This compilation of facility information has provided unforeseen advantages in several areas. The format has been used/leveraged during facility waste acceptance criteria development, verifying inter-facility transfer appropriateness as well as tracking facility capabilities.

Following the development and issuance of the RWMB compliance tables for applicable INL facilities, we also identified several areas of improvement which were implemented into the RWMB program to ensure continued compliance with DOE Order 435.1. Areas of improvement include the following:

*Training.* Facility Managers and Nuclear Facility Managers are vital to appropriate implementation and execution of the RWMB. The INL WMP relies on these individuals to communicate any waste management changes, i.e. operational or new research activities which may occur in their facilities and have the potential to generate a waste stream not identified or approved in their respective RWMB. The requirements to consider for managing a nuclear facility are numerous. By performing periodic assessments we were able to identify individuals who had inadequate knowledge of the compliance issues and requirements related to their RWMBs. To remedy this, the WMP provided one-on-one training and continue do so for all new management who lack an awareness and/or understanding of waste management requirements in their facilities.

*Annual Reviews.* Per DOE guidance, an RWMB should be reviewed periodically, or when changes occur to a facility, operational activities, or changes to the requirements within DOE O 435.1 or DOE M 435.1-1. Due to the dynamic research environment at the INL and level of new programs and projects seen on a yearly basis, the WMP recognized annual reviews were more effective to ensure accuracy with stated facility specific and laboratory-wide procedures, detailed facility descriptions, and compliance requirements. Per DOE Guide 435.1-1, "The review should evaluate whether the existing documentation still adequately identifies the hazards associated with a radioactive waste management basis facility, operation, or activity; the analysis of the potential impacts of those hazards is still valid; and the controls that are in place for protection of workers, the public, and the environment address the hazards". The annual review process establishes communication between the WMP, facility management, and waste generator services support personnel which is documented as part of the approval process. This level of communication between applicable organizations and the WMP also provides an opportunity to review facility specific waste management procedures/documents.

*Environmental Checklist.* BEA's Environmental Checklist process is the starting block for applying the National Environmental Policy Act (NEPA) requirements at the INL and determining the required level of environmental review for a project or activity. The environmental checklist provides a brief but thorough description of the project or action, including the type of action (for example, new activity or facility, construction, process or facility modification, maintenance, research and development, work for others), description of activities, work phases, location of work activity, purpose and need, and projected start and end dates. This information provides an advantageous opportunity to identify upcoming research or operational projects which may generate waste as part of the activity. The environmental checklist can then be quickly screened with the current RWMB to identify any changes and approvals which may be needed before the work even begins. We have found this to be the most effective improvement to the RWMB management process.

## **CONCLUSION**

DOE facilities must ensure an RWMB is developed, approved, and implemented prior to beginning activities which may generate radioactive waste. In addition, the RWMB should be updated and maintained to ensure accuracy for the duration of the facility managing radioactive waste. The level of rigor can be determined by using a graded and defense-in-depth approach per DOE guidance. The INL WMP has developed a thorough and comprehensive RWMB management strategy due to the number of facilities generating radioactive waste with each facility have unique capabilities and serving a dynamic mix of research and development programs and projects. Improvements to the RWMB management strategy have been very effective at adding several layers of defense to ensure adequate controls are in place to curb the likelihood of, or the consequences from, a problem that could arise from managing radioactive waste. DOE facilities which manage radioactive waste and operate with RWMBs could potentially benefit from similar improvements.

## **REFERENCES**

DOE Guide 435.1-1, "Implementation Guide for use with DOE M 435.1-1"

DOE Order 435.1, "Radioactive Waste Management"

DOE Manual 435.1-1, "Radioactive Waste Management Manual"