UNITED STATES
NUCLEAR REGULATORY COMMISSION
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OFFICE OF THE
INSPECTOR GENERAL

October 3, 2016

MEMORANDUM TO: Victor M. McCree
Executive Director for Operations

FROM: Steven E. Zane **\RA**
Acting Assistant Inspector General for Audits

SUBJECT: AUDIT OF NRC'S OVERSIGHT OF LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AND WASTE BLENDING (OIG-17-A-02)

The Office of the Inspector General (OIG) conducted this audit to determine if the disposal and waste blending processes at disposal facilities are done safely and effectively. OIG reviewed NRC's oversight of low-level radioactive waste (LLRW) disposal and blending processes and found that NRC provided adequate oversight through inspection activities. (For further information, see Scope and Methodology). OIG did not identify any findings. Therefore, OIG makes no recommendations. However, an opportunity for improvement exists in regard to centralizing LLRW guidance, thereby enhancing its accessibility as some stakeholders have had difficulty finding LLRW guidance.

BACKGROUND

What is Low-Level Radioactive Waste?

LLRW includes items[1] that have become contaminated with radioactive materials or have become radioactive through exposure to neutron radiation. NRC classifies LLRW at the time of disposal based on its radioactivity. NRC has specified disposal and waste requirements for three classes of waste - Classes A, B, and C - with progressively higher concentrations of radioactive material (see Table 1). As waste class increases, additional measures to control the hazard to the public are required.

Table 1: Classes of LLRW

Low-Level Radioactive Waste

Class of Waste	Definition
A	Represents the greatest volume and the lowest risk.
B	Represents much less volume but greater risk.
C	Represents the smallest volume and the greatest risk.

Source: NRC

[1] Examples of LLRW include contaminated protective shoe covers and clothing, wiping rags, mops, filters, equipment and tools, and medical waste.

Disposal of LLRW

Commercial LLRW can be disposed of in facilities licensed by either NRC or Agreement States.[2] The *Low-Level Radioactive Waste Policy Amendments Act of 1985*[3] gave the States responsibility for LLRW disposal. There are four disposal facilities – all are located in Agreement States (see Figure 1). Current LLRW disposal practices use shallow land disposal sites either with or without concrete vaults. NRC oversees the safety of these Agreement States' sites through a review process called the Integrated Materials Performance Evaluation Program.[4]

Figure 1: LLRW Disposal Facilities

Source: OIG Generated

[2] In accordance with the *Atomic Energy Act*, NRC may relinquish its authority to regulate certain byproduct material to States. The 37 States that have entered into an agreement assuming this regulatory authority from NRC are called Agreement States.

[3]The Act authorized States to form regional compacts, with each compact to: provide for LLRW disposal site access; manage LLRW import to, and export from, a compact; and exclude waste generated outside a compact. There are currently 42 states that comprise 10 compacts.

[4] The Integrated Materials Performance Evaluation Program process employs a team of NRC and Agreement State staff to assess both Agreement State and NRC regional radioactive materials licensing and inspection programs.

Blending of LLRW

Blending of LLRW means mixing wastes of different concentrations to create a product with more uniform radionuclide concentrations. The purpose of blending higher and lower activity waste is to lower the overall concentration of radioactivity. The mixture would then be suitable for disposal at more locations and at a lower cost.

NRC Offices Involved in Oversight of LLRW

The Office of Nuclear Material Safety and Safeguards is responsible for regulating activities which provide for the safe and secure production of nuclear fuel used in commercial nuclear reactors, including the disposal of radioactive waste and spent nuclear fuel.

In addition, the Office of Nuclear Reactor Regulation develops and implements rulemaking, licensing, oversight, and incident response programs for nuclear reactors. This office also provides support to regional staff that conduct inspections of LLRW at nuclear reactor sites.

Each of NRC's four regional offices plays a role in the oversight of LLRW as well. These regional offices execute established NRC policies and programs related to inspection, licensing, and enforcement for both reactor and non-reactor licensees.

OBJECTIVE

The audit objective was to determine if the disposal and waste blending processes at disposal facilities are done safely and effectively.

AUDIT RESULTS

NRC provides adequate oversight of LLRW disposal and blending processes through inspection activities. (For further information, see Scope and Methodology). OIG did not identify any findings. Therefore, this memorandum report does not make any recommendations. However, an opportunity exists to enhance the effectiveness and efficiency of the LLRW program through centralizing LLRW guidance, thereby enhancing stakeholder accessibility.

What Is Required

Guidance and Communication Requirements

Well-designed guidance documents serve critical functions in regulatory programs and when used properly, guidance documents can increase efficiency. The *U.S. Government Accountability Office Standards for Internal Control in the Federal Government*[5] state that effective information and communication are vital for an organization to achieve its objectives. Therefore, management should internally communicate the necessary information throughout the organization to enable personnel to perform key roles. Likewise, management should communicate information externally so that external parties can help the organization achieve its objectives and address related risks.

[5] GAO-14-704G; published September 2014

What We Found

LLRW Guidance Can Be Difficult To Find

LLRW Guidance and Related Outreach Are Adequate

NRC staff maintain open communication with internal and external stakeholders by conducting extensive outreach on current LLRW issues of interest. They accomplish this through holding a public comment period when issuing new guidance or revising regulations, holding and participating in public meetings, and conducting counterpart conference calls.

In February 2015, NRC issued the *Concentration Averaging and Encapsulation Branch Technical Position* (CA BTP) as an update to the 1995 CA BTP. Along with the updated CA BTP, NRC issued an accompanying guidance document containing responses to stakeholder comments and a technical basis for the revision. NRC subsequently provided training to the regions and Agreement States and posted a question and answer document on its public Web site to explain the implementation of the CA BTP. NRC plans to continue its dialogue and outreach with stakeholders with regard to the CA BTP.

NRC is currently in the process of revising 10 Code of Federal Regulations Part 20[6] and 10 Code of Federal Regulations Part 61.[7] Throughout this process, NRC conducted outreach to stakeholders. NRC will concurrently be issuing guidance on the new rules.

In addition, NRC headquarters staff maintain open communication with the regions on activities relating to LLRW through monthly counterpart calls. These calls serve as a forum for regional staff to gain clarification on LLRW issues.

LLRW Guidance Can Be Difficult To Find

Although LLRW guidance and related outreach are adequate, some stakeholders have had difficulty finding NRC's LLRW guidance. NRC's LLRW guidance documents are intended to aid licensees and Agreement States in implementing regulations and to

[6] Title 10 Code of Federal Regulations, Part 20, is the regulation for the standards for protection against radiation.

[7] Title 10 Code of Federal Regulations, Part 61, is the regulation for the licensing requirements for land disposal of radioactive waste.

supplement preexisting LLRW guidance. However, if stakeholders cannot locate the appropriate guidance or do not know which guidance to use, then the guidance is of minimal use.

As both external and internal stakeholders can have difficulty locating LLRW guidance, some have taken it upon themselves to create their own caches. Some Agreement States maintain their own libraries with LLRW guidance as NRC currently does not have a centralized location where it is housed. Moreover, some Agreement State staff are not aware of where several older guidance documents are located on the NRC Web site. These staff mistakenly believe that no electronic version of these documents exists. Additionally, some NRC regional inspectors create their own folders or binders of LLRW inspections and guidance. Having a centralized location for LLRW guidance would simplify this task for inspectors and increase programmatic effectiveness and efficiency.

Why This Occurred

LLRW Guidance Documents Are Numerous and Scattered

Numerous LLRW Guidance Documents

OIG conducted a search for publicly available LLRW guidance[8] and found 50 LLRW guidance documents related to disposal and blending. The table in Appendix A shows the results of this search. This table is not a comprehensive list of all LLRW guidance and only represents a portion of the LLRW guidance available to NRC staff and external stakeholders. NRC staff referred to this "high volume" of LLRW guidance as "overwhelming." The large amount of guidance can create difficulty for staff in terms of recognizing which guidance is relevant to the topic or issue at hand. External stakeholders, as well, have had issues finding the appropriate guidance specific to a particular case or scenario.

[8] OIG defines LLRW guidance as publicly available documents including, but not limited to, NUREGs, Regulatory Guides, SECYs, and Branch Technical Positions.

LLRW Guidance Documents Are Scattered

The difficulty NRC staff and external stakeholders face when searching through numerous LLRW guidance documents is further compounded by the fact that guidance is stored on multiple Web pages. The LLRW guidance stored on NRC's public Web site is separated by document type – NUREGs, Regulatory Guides, and SECYs – with each housed on a separate Web page. While each of these Web pages provides information about an aspect of the LLRW program, there is no central location where all LLRW-related information and guidance documents are located. Moreover, some LLRW guidance documents are not even available on NRC's public Web site and can only be accessed through external Web sites. This results in NRC staff and external stakeholders searching a variety of Web sites and Web pages to locate comprehensive information about a particular topic or question.

NRC also stores LLRW guidance in Agencywide Documents Access and Management System (ADAMS) [9] that is available to both internal and external stakeholders. Despite the availability of guidance in ADAMS, according to many stakeholders, the system is difficult to use, "cumbersome," and "unless you know what you are looking for, you may not be aware it [a guidance document] even exists."

Observation

Difficulty Locating Guidance Documents

Due to the numerous quantity and scattered nature of LLRW guidance documents, some stakeholders have had difficulty finding LLRW guidance. While LLRW guidance and related outreach are adequate, an area for improvement exists with regard to centralizing LLRW guidance, thereby enhancing stakeholder accessibility. Many NRC stakeholders support this initiative and believe that centralizing LLRW guidance would be beneficial. Addressing this observation may further enhance the effectiveness and efficiency of NRC's LLRW program.

NRC staff have identified a task to update and consolidate LLRW guidance, which will be discussed in a future Commission paper.

[9] ADAMS is the official recordkeeping system through which NRC provides access to all of the agency's publicly available documents.

AGENCY COMMENTS

An exit briefing was held with the agency on September 29, 2016. NRC management stated their general agreement with the report. Prior to this meeting, agency management reviewed the draft report and provided a comment, which has been incorporated, as appropriate, into this report.

SCOPE AND METHODOLOGY

The audit focused on whether NRC has the requisite processes in place to assure proper oversight of the disposal and waste blending processes at disposal facilities. We conducted this performance audit at NRC headquarters (Rockville, MD) and Region III (Lisle, IL) from May 2016 to August 2016. Internal controls related to the audit objective were reviewed and analyzed. Throughout the audit, auditors were aware of the possibility or existence of fraud, waste, or abuse in the program.

OIG reviewed relevant criteria such as the Office of Management and Budget Circular M-07-07, "*Final Bulletin for Agency Good Guidance Practices*," the Government Accountability Office's "*Standards for Internal Control in the Federal Government* ," and *NRC's Principles of Good Regulation*. OIG also reviewed the *Low-Level Radioactive Waste Policy Amendments Act of 1985*, 10 Code of Federal Regulations Part 61 – "Licensing Requirements for Land Disposal of Radioactive Waste," and 10 Code of Federal Regulations Part 20 – "Standards for Protection Against Radiation."

OIG identified and reviewed regulatory issue summaries, regulatory guides, generic letters, NUREGs, and SECY papers to identify available guidance relating to the disposal and blending of LLRW at disposal facilities.

In addition, OIG reviewed inspection manuals and procedures regarding the inspection requirements for NRC's oversight of disposal and blending of LLRW at both reactor and non-reactor sites.

To determine whether LLRW disposal and blending is done safely and adequately, OIG conducted a search of the Nuclear Materials Events Database to identify any relevant

events that occurred within the past 10 years. OIG also conducted outreach regarding Differing Professional Opinions and Non-Concurrence Process cases related to LLRW disposal or blending.

In order to compile a list of publicly available LLRW guidance documents (see Appendix A), OIG conducted an independent search for LLRW guidance. OIG also reached out to NRC and Agreement State staff in order to identify any additional LLRW guidance documents that OIG did not find.

OIG interviewed NRC staff and management to gain an understanding of roles and responsibilities as they relate to NRC oversight of disposal and blending of LLRW. Auditors interviewed headquarters staff from the Office of Nuclear Material Safety and Safeguards and the Office of Nuclear Reactor Regulation and staff from Regions I, II, III, and IV. OIG also traveled to Region III in Lisle, Illinois, to conduct interviews with NRC regional inspectors. In addition, auditors interviewed staff from four Agreement States.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The audit was conducted by Sherri Miotla, Team Leader; Ziad Buhaissi, Audit Manager; John Thorp, Senior Technical Advisor; Regina Revinzon, Auditor; George Gusack, Auditor; and Meredith Johnson, Management Analyst.

Table 1: Publicly Available LLRW Guidance

No.	Title	Date	Link
Disposal			
1	NUREG-0782, *Draft Environmental Impact Statement in 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste*	September 1981	http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0782/
2	NUREG-0902, *Site Suitability, Selection and Characterization: Branch Technical Position - Low-Level Radioactive Waste*	April 1982	http://www.nrc.gov/docs/ML0530/ML053010325.pdf
3	NUREG-0945, Vol. 1, *Final Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste*	November 1982	http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0945/
4	NUREG-1199, Rev. 2, *Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility*	January 1991	http://www.nrc.gov/docs/ML0225/ML022550605.pdf
5	NUREG-1200, Rev. 3, *Standard Review Plan for the review of a License Application for a Low-Level Radioactive Waste Disposal Facility*	March 1994	http://www.nrc.gov/docs/ML0613/ML061370484.pdf
6	NUREG-1241, *Licensing of Alternative Methods of Disposal of Low-Level Radioactive Waste*	December 1986	http://www.nrc.gov/docs/ML0530/ML053010322.pdf
7	NUREG-1274, *Review Process for Low-Level Radioactive Waste Disposal License Application Under Low-Level Radioactive Waste Policy Amendments Act*	August 1987	http://www.nrc.gov/docs/ML1321/ML13217A156.pdf
8	NUREG-1293, *Quality Assurance Guidance for a Low-Level Radioactive Waste Disposal Facility*	April 1991	http://pbadupws.nrc.gov/docs/ML1124/ML11242A180.pdf
9	NUREG-1300, *Environmental Standard Review Plan for the Review of License Application for a Low-Level Radioactive Waste Disposal Facility*	April 1987	http://pbadupws.nrc.gov/docs/ML0530/ML053010347.pdf
10	NUREG-1388, *Environmental Monitoring of Low-Level Radioactive Waste Disposal Facility*	December 1989	http://pbadupws.nrc.gov/docs/ML0530/ML053010320.pdf
11	NUREG-1556, *Consolidated Guidance About Materials Licenses*	March 2016	http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/
12	NUREG-1573, *A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group*	October 2000	http://www.nrc.gov/docs/ML0037/ML003770778.pdf
13	NUREG-1623, *Design of Erosion Protection for Long-Term Stabilization*	September 2002	http://www.nrc.gov/docs/ML0225/ML022530043.pdf
14	NUREG-1757, Vol. 2, *Consolidated Decommissioning Guidance*	September 2006	http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1757/

No.	Title	Date	Link
Disposal			
15	NUREG-1804, Rev. 2, *Yucca Mountain Review Plan*	July 2003	http://www.nrc.gov/docs/ML0320/ML032030389.pdf
16	NUREG-1853, *History and Framework of Commercial Low-Level Radioactive Waste Management in the United States: ACNW White Paper*	January 2007	http://www.nrc.gov/docs/ML0706/ML070600684.pdf
17	NUREG-1854, *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations*	August 2007	http://www.nrc.gov/docs/ML0723/ML072360184.pdf
18	NUREG-2175, *Guidance for Conducting Technical Analyses for 10 CFR Part 61*	March 2015	http://www.nrc.gov/docs/ML1505/ML15056A516.pdf
19	NUREG/BR-0204, Rev. 2, *Instructions for Completing NRC's Uniform Low-Level Radioactive Waste Manifest*	July 1998	http://www.nrc.gov/docs/ML0718/ML071870172.pdf
20	NUREG/CP-0195, *Proceedings of the Workshop on Engineered Barrier Performance Related to Low-Level Radioactive Waste, Decommissioning, and Uranium Mill Tailings Facilities*	August 2010	http://www.nrc.gov/docs/ML1123/ML11238A056.pdf
21	NUREG/CR-1759, *Data Base for Radioactive Waste Management*	November 1981	http://www.nrc.gov/docs/ML0918/ML091870517.html
22	NUREG/CR-2642, *Long-Term Survivability of Riprap for Armoring Uranium Mill Tailings and Covers: A Literature Review*	April 2012	http://www.osti.gov/scitech/biblio/5361595-long-term-survivability-riprap-armoring-uranium-mill-tailings-covers-literature-review-references
23	NUREG/CR-2675, *Relevance of Biotic Pathways to the Long-Term Regulation of Nuclear Waste Disposal*	1982	http://www.osti.gov/scitech/servlets/purl/5169168
24	NUREG/CR-3276, *Geomorphic Controls on the Management of Nuclear Waste*	1983	https://searchworks.stanford.edu/view/4585112
25	NUREG/CR-3395, *Influence of Cover Defects on the Attenuation of Radon with Earthen Covers*	November 1983	http://www.osti.gov/scitech/servlets/purl/5411352
26	NUREG/CR-3533, *Radon Attenuation Handbook for Uranium Mill Tailings Cover Design*	April 1984	http://static1.squarespace.com/static/562e7cefe4b0b5cbdd53eb74/t/56cb81bba3360c04a13b9fd9/1456177603277/NUREGCR-3533.pdf
27	NUREG/CR-4370, Vol. 2, *Update of Part 61 Impacts Analysis Methodology*	January 1986	http://pbadupws.nrc.gov/docs/ML1002/ML100250917.pdf
28	NUREG/CR-5453, *Performance Assessment Handbook for Low-Level Radioactive Waste Disposal Facilities*	February 1992	http://www.osti.gov/scitech/servlets/purl/7117572/
29	NUREG/CR-5615, *Low-Level Radioactive Waste Disposal Facility Closure*	November 1990	http://static1.squarespace.com/static/562e7cefe4b0b5cbdd53eb74/t/56cb821bb654f9e7cb8c37d9/1456177732799/NUREGCR-5615.pdf
30	NUREG/CR-5737, *Hydrogeologic Performance Assessment Analysis of the Commercial Low-Level Radioactive Waste Disposal Facility Near West Valley, New York*	June 1991	http://www.nrc.gov/docs/ML0037/ML003726086.pdf

No.	Title	Date	Link
Disposal			
31	NUREG/CR-5927, Vol. 1, *Evaluation of a Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Evaluation of Modeling Approaches*	August 1993	http://pbadupws.nrc.gov/docs/ML1103/ML110380388.pdf
32	NUREG/CR-6305, *BLT-EC (Breach, Leach, Transport, and Equilibrium Chemistry), a Finite-Element Model for Assessing the Release of Radionuclides from Low-Level Waste Disposal Units*	August 1995	http://digital.library.unt.edu/ark:/67531/metadc619413/m2/1/high_res_d/108216.pdf
33	NUREG/CR-6346, *Hydrologic Evaluation Methodology for Estimating Water Movement Through the Unsaturated Zone at Commercial Low-Level Radioactive Waste Disposal Sites*	January 1996	http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6346/cr6346.pdf
34	NUREG/CR-6567, *Low-Level Radioactive Waste Classification, Characterization, and Assessment: Waste Streams and Neutron-Activated Metals*	August 2000	http://www.nrc.gov/docs/ML0037/ML003752437.pdf
35	NUREG/CR-6805, *A Comprehensive Strategy of Hydrogeologic Modeling and Uncertainty Analysis for Nuclear Facilities and Sites*	July 2003	http://www.nrc.gov/docs/ML0324/ML032470827.pdf
36	NUREG/CR-6825, *Literature Review and Assessment of Plant and Animal Transfer Factors used in Performance Assessment Modeling*	August 2003	http://www.nrc.gov/docs/ML0326/ML032680646.pdf
37	NUREG/CR-6941, *Soil-to-Plant Concentration Ratios for Assessing Food-Chain Pathways in Biosphere Models*	August 2007	http://www.nrc.gov/docs/ML0727/ML072780220.pdf
38	NUREG/CR-7025, *Radionuclide Release from Slag and Concrete Waste Materials: Part 1: Conceptual Models of Leaching from Complex Materials and Laboratory Test Methods*	December 2010	http://www.nrc.gov/docs/ML1035/ML103550580.pdf
39	NUREG/CR-7028, *Engineered Covers for Waste Containment: Changes in Engineering Properties and Implications for Long-Term Performance Assessment*	December 2011	http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr7028/
40	Regulatory Guide 3.64, *Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers*	June 1989	http://www.nrc.gov/docs/ML0037/ML003739876.pdf
41	Regulatory Guide 4.15, Rev. 2, *Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) - Effluent Streams and the Environment*	July 2007	http://www.nrc.gov/docs/ML0717/ML071790506.pdf
42	Regulatory Guide 4.18, *Standard Format and Content of Environmental Reports for Near-Surface Disposal of Radioactive Waste*	June 1983	http://www.nrc.gov/docs/ML0037/ML003739515.pdf

No.	Title	Date	Link
Disposal			
43	Regulatory Guide 4.19, *Guidance for Selecting Sites for Near-Surface Disposal of Low-Level Radioactive Waste*	August 1988	http://www.nrc.gov/docs/ML0037/ML003739520.pdf
44	SECY-12-0003, *Draft Final Policy Statement on Volume Reduction and Low-Level Radioactive Waste Management*	January 2012	http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2012/2012-0003scy.pdf
45	*Technical Analysis Supporting Definition of Period of Performance for Low-Level Waste Disposal*	2011	http://www.nrc.gov/docs/ML1110/ML111030586.pdf
46	RIS 2015-02, *Reporting of H-3, C-14, Tc-99, and I-129 on the Uniform Waste Manifest*	February 2015	http://www.nrc.gov/docs/ML1427/ML14272A217.pdf
Blending			
47	SECY-10-0043, *Blending of Low-Level Radioactive Waste*	April 2010	http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2010/secy2010-0043/2010-0043scy.pdf
48	*Final Waste Classification and Waste Form Technical Position Papers*	May 1983	http://www.nrc.gov/docs/ML0336/ML033630755.pdf
49	*Concentration Averaging and Encapsulation Branch Technical Position*	February 2015	http://www.nrc.gov/waste/llw-disposal/llw-pa/llw-btp.html
50	FSME-11-024, *Summary of Existing Guidance for Reviewing Large-Scale Low-Level Radioactive Waste Blending Proposals*	March 2011	http://www.nrc.gov/docs/ML1104/ML110480839.pdf

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