



Department of Energy

Washington, DC 20585

DNF SAFETY BOARD
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Mr. John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W.
Washington, D.C. 20004

Dear Mr. Chairman:

Enclosed is the progress report on implementation of Defense Nuclear Facilities Safety Board Recommendation 94-2 for the period from April 1, 1995, through December 31, 1995. Subsequent progress reports will be prepared and submitted quarterly.

As discussed in the progress report, the Department has gained an improved understanding of the actions and times necessary to implement the recommendation. To reflect this improved understanding, consistent with the Secretary's February 28, 1996, letter to you, we are in the process of revising the Implementation Plan (IP) and plan on submitting the revision in April. We anticipate being prepared to brief you in the next few weeks prior to the formal submittal of the revised Plan. The status table in the progress report shows projected dates for completing task initiatives from the current IP that have been missed. As appropriate, completion of these tasks will be included in the IP revision.

Also enclosed with this letter are the following deliverables associated with completed or partially completed task initiatives from the 94-2 IP that were not transmitted to you when they were finalized:

- "Inclusion of Pre-1988 Source Term and Other Sources of Radioactive Contamination in Low-Level Waste Disposal Facility Performance Assessments," (IP Task VI.B.1) was transmitted by the Deputy Assistant Secretary for Waste Management to the Operations Offices on May 31, 1995.
- "Interim Policy on Regulatory Structure for Low-Level Radioactive Waste Management and Disposal," (IP Task VI.B.2) was transmitted to the Operations Offices from the Assistant Secretaries for Environmental Management and Environment, Safety, and Health on July 21, 1995.

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95:2795



- The Performance Assessment for the Area 5 Radioactive Waste Management Site at the Nevada Test Site, Nye County, Nevada, was submitted to DOE Headquarters for Peer Review Panel review on August 1, 1995. 96:1354
- The Report entitled, Comparison of Selected DOE and Non-DOE Requirements, Standards, and Practices for Low-Level Radioactive Waste Disposal, December 1995, was developed as partial fulfillment of the deliverables under Task VI.B.6. 96:1355

If there are any questions about the progress report or deliverables, please contact Greg Duggan of my staff on (301) 903-7140.

Eugene C. Schmitt

for

Stephen P. Cowan
Deputy Assistant Secretary
for Waste Management
Environmental Management

Enclosures

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DNF SAFETY BOARD

Quarterly Report
for

Implementation Plan
Defense Nuclear Facilities Safety Board
Recommendation 94-2

Conformance with Safety Standards at
Department of Energy
Low-Level Nuclear Waste and Disposal Sites

April 1 through December 31, 1995

**Quarterly Report for
Implementation Plan
Defense Nuclear Facilities Safety Board
Recommendation 94-2**

1.0 INTRODUCTION

The Department of Energy (DOE) issued the "Implementation Plan, Defense Nuclear Facilities Safety Board Recommendation 94-2" in March 1995. This is the first report on the status of implementation of the task initiatives in the Plan that the Department is undertaking to improve its management of low-level waste (LLW). The Implementation Plan identifies initiatives in six task areas as follows:

Systems Engineering	Performance Assessments
Complex-Wide Review	Volume Projections
Regulatory Structure and Process	Research and Development

This report covers the period from the issuance of the Implementation Plan to December 1995. Subsequent reports will be issued on a quarterly basis.

2.0 OVERVIEW

2.1 General Progress

The Department of Energy has undertaken task initiatives as described in the Implementation Plan to provide a strategy and tools to improve program management of LLW, to complete performance assessments, to strengthen the regulatory process, and to undertake studies to support LLW management. In this first nine months of effort, a modicum of success has been made with the completion of 7 Implementation Plan commitments and the partial completion of 3 commitments (see section 3.0). Nonetheless, during this time, a significant number of task initiatives (17) have not been completed.

Starting in August 1995, the Department began to reevaluate how best to implement this recommendation. A number of factors made this reevaluation necessary. In June, the Defense Nuclear Facilities Safety Board (DNFSB) sent the Department its letter accepting the Implementation Plan, with conditions. These conditions affected the task initiatives that were planned in the area of performance assessments. There were also technical and regulatory issues related to including all LLW in performance assessments being discussed (see section 4.4). It had become apparent that one of the assumptions made when preparing the Implementation Plan, that a revised Order on Waste Management (Order 5820.2A revision) would be completed by the end of September 1995, was invalid. Also, as issues related to task initiatives came into focus, it was clear that more planning of resources and time to conduct studies, prepare documents, obtain reviews and resolve the issues was needed.

A significant amount of time was spent over the ensuing months to evaluate the technical basis for and the logical relationship of the various tasks in the implementation plan. The three principal areas of this evaluation were the systems engineering for low-level waste management; the development of LLW requirements and policies (i.e., policy for applicability of 5820 to CERCLA and RCRA sites) and integration of those requirements and policies into a revised order on waste management; and the assessment of sources of radioactivity at a DOE site that add to the dose resulting from an active LLW disposal facility. As the evaluations led to decisions on the approach to be used, DOE developed schedules that integrate the task initiatives. The tasks were then planned with respect to duration and resources to support a revision to the Implementation Plan. The revised technical approach and scheduling-resource allocation will be reflected in commitments to be included in a revised Plan that will be available in late April.

2.2 Organization

After issuance of the Implementation Plan, the Department established the Low-Level Waste Management Task Group (LLWMTG) in the Office of Waste Management to manage the task initiatives in the Plan. The LLWMTG comprises a leader and five program managers that report to a senior manager in the Office of Waste Management. Technical leads have been identified to aid in the planning and execution of the tasks in each of the six task areas. The LLWMTG has been augmented by staff from the Office of Environmental Restoration to facilitate implementation of initiatives applicable across the DOE organizations.

During this reporting period, the Assistant Secretary for Environmental Management realigned the organization, resulting in a change in the management responsible for implementing recommendation 94-2. As the new Deputy Assistant Secretary for Waste Management, Steve Cowan now has prime responsibility for recommendation 94-2. Mr. Cowan assigned Mark Frei, Director, Office of Central Operations, as his senior manager responsible for assuring the implementation of the recommendation; the LLWMTG reports to Mr. Frei in the revised organization.

The realignment also affected the implementation of the recommendation at the working level. The Implementation Plan indicated that the Complex-Wide Review would be directed by the Office of Compliance and Program Coordination to give the review some independence from the organization principally responsible for waste management. The realignment eliminated the Office of Compliance and Program Coordination. After consultation with DNFSB staff, the responsibility for the Complex-Wide Review was transferred under the auspices of the Office of Waste Management.

2.3 Meetings with the DNFSB and Staff

2.3.1 Meetings During this Reporting Period

There were no meetings with the entire DNFSB during the reporting period. There was a meeting with one Board member on September 28, 1995 to discuss the Complex-Wide Review.

In this reporting period DOE staff had a number of interactions with staff from the DNFSB to discuss implementation activities and issues as follows:

- Two meetings were held to discuss the scope of the Complex-Wide Review.
- DNFSB staff and DOE staff met on August 17, 1995 to discuss DNFSB staff concerns with and a modified approach to the LLW systems engineering effort.
- DNFSB staff attended the opening day of a meeting of the DOE Low-Level Waste Steering Committee (composed of Headquarters and field office representatives) on September 19, 1995.
- DOE management with newly-assigned responsibility for implementing DNFSB 94-2 met with DNFSB staff on November 13, 1995.
- DNFSB staff met with DOE staff and management on November 17, 1995 to discuss the overall implementation effort and activities supporting revision of the Implementation Plan.

2.3.2 Meetings in Future Reporting Periods

A number of interactions with the DNFSB and staff have or are expected to occur in the next few months. Those that have occurred at the time of this report or that are tentatively planned are as follows:

- DNFSB staff met with the DOE staff on January 16, 1996 to discuss recent revisions to the approach and schedule for conducting the Complex-Wide Review.
- DNFSB staff attended a January 30 to February 1, 1996 workshop on site-wide, all-source terms analyses and meeting on proposed revisions to the Implementation Plan.
- DNFSB staff and DOE staff met on February 9, 1996 to discuss details of the proposed revisions to the Implementation Plan in the area of performance assessments.
- DOE plans to meet with DNFSB staff on March 1, 1996 to discuss the systems engineering requirements review and functions analysis, and the scope of the study of the safety merits and demerits of privatizing LLW disposal.

- DOE plans to brief the DNFSB staff on the proposed revision to the Implementation Plan at the end of March or the first of April 1996.
- DOE plans to brief the DNFSB on the proposed revision to the Implementation Plan around the first of April 1996.

3.0 SUMMARY OF COMMITMENTS DUE IN THE CURRENT REPORTING PERIOD

The following table summarizes the status of commitments that were due to be completed during the current reporting period. Two indicators are provided in the first column of table. The first correlates with the commitment as numbered in the Implementation Plan. The second number corresponds to the numbering system used by the Department's Safety Information Management System (SIMS). Dates reported in the "Status" column reflect the current estimate for completion dates that will be proposed in the revised Implementation Plan.

Status of Task Initiative Due as of December 31, 1995

IP Task # SIMS ID #	Title or Description	Due Date	Status
<u>III.B.1.c</u> R94-02 027	Prepare a Project Management Plan	06/30/95	Completed.
<u>IV.B.1</u> R94-02 030.001	Prepare DOE LLW management system evaluation report.	06/30/95	Completed. Report transmitted to DNFSB 06/28/95.
<u>IV.B.2</u> R94-02 030.002	Prepare LLW Management Program Strategic Plan	09/30/95	Deferred. Will be included as part of the Program Management Plan.
<u>IV.B.3</u> R94-02 030.003	Prepare LLW management system requirements document.	12/31/95	Ongoing. Draft document reviewed internally. Comments being resolved. Completion projected for 05/01/96.
<u>V.B.1</u> R94-02 001.001	Identify personnel to staff Complex-Wide Review efforts.	07/31/95	Ongoing. Assessment Working Group and Site Assessment Teams formed. Working Group Assessment Teams to be finalized in February.

Status of Task Initiative Due as of December 31, 1995

IP Task # SIMS ID #	Title or Description	Due Date	Status
V.B.2 R94-02 001.002	Submit site surveys to Assessment Working Group.	08/31/95	Completed. Surveys needed to support reviews were received by 11/30/95.
VI.B.1 R94-02 007	Issue directive to include pre-1988 source terms in performance assessments.	05/31/95	Completed. Directive issued to Operations Offices on 05/31/95.
VI.B.2 R94-02 008	Issue policy clarify/strengthen LLW regulatory structure.	05/31/95	Completed. Interim policy issued 07/21/95 describing responsibilities and process for PA approval.
VI.B.3.b.1 R94-02 010	Publish guidance documents addressing critical assumptions for PAs.	08/31/95	Ongoing. The critical assumptions are being addressed through four policy papers; projected to be complete 07/31/96.
VI.B.4 R94-02 014	Issue interim guidance on applicability of 5820.2A to RCRA/CERCLA sites.	09/30/95	Ongoing. Preliminary analyses have been prepared. Project issuing decision and guidance 05/31/96.
VI.B.5.b.1 R94-02 011	Add to roster of Peer Review Panel.	09/30/95	Ongoing. Initial options paper prepared and reviewed. Project completion 07/31/96.
VI.B.6 R94-02 013.001	Issue report comparing DOE and non-DOE LLW requirements and standards.	09/30/95	Partially completed. Report comparing U.S. requirements issued 12/28/95. Comparison to selected foreign requirements projected for 06/30/96.

Status of Task Initiative Due as of December 31, 1995

IP Task # SIMS ID #	Title or Description	Due Date	Status
VI.B.7.b.1 R94-02 013.002	Issue interim implementation guidance on selected LLW functions.	09/30/95	Suspended. Guidance based on 5820.2A requirements drafted and reviewed. Propose deleting activity as part of IP revision.
VII.B.1 R94-02 022	HQ preliminarily approve Hanford Grout PA (post-88 waste only).	05/31/95	Partially completed. A memo acknowledging technical acceptability of analysis sent to Operations Office on 06/01/95.
VII.B.1 R94-02 022	HQ preliminarily approve Hanford 200-W PA (post-88 waste only).	08/31/95	Ongoing*. PRP review complete. HQ to acknowledge technical acceptability only. Projected for 05/31/96
VII.B.1 R94-02 022	Submit Hanford ERDF PA (post-88 waste only) to HQ.	08/31/95	Suspended. Draft PA prepared. Presumption that CERCLA process will be shown to be adequate substitute for PA.
VII.B.1 R94-02 022	HQ preliminarily approve INEL PA (post-88 waste only).	08/31/95	Ongoing*. PRP review suspended pending HQ resolution of groundwater compliance issue. HQ and DOE-ID working on issue resolution.
VII.B.1 R94-02 022	Submit NTS Area 5 PA (post-88 waste only) to HQ.	06/30/95	Completed. PA submitted for HQ review on 08/31/95.

* DOE Headquarters will not "approve" the performance assessments at sites that have not accounted for radioactive sources that contribute to the dose from the active disposal facility. Nonetheless, a review of the technical aspects of the PAs is being done in order to provide feedback to the site analysts.

Status of Task Initiative Due as of December 31, 1995.

IP Task # SIMS ID #	Title or Description	Due Date	Status
<u>VII.B.1</u> R94-02 022	HQ preliminarily approve NTS Area 5 (post-88 waste only).	12/30/95	Ongoing.* PRP reviewing PA; additional information has been requested. Project completion 05/31/96.
<u>VII.B.1</u> R94-02 022	HQ preliminarily approve ORNL SWSA-6 (post-88 waste only).	06/30/95	Partially completed. A memo acknowledging technical acceptability of analysis sent to Operations Office on 09/08/95.
<u>VII.B.1</u> R94-02 022	HQ preliminarily approve Saltstone PA (post-88 waste only).	05/31/95	Ongoing.* Resolving issues with EH on monitoring and maintenance.
<u>VII.B.2.b.1</u> R94-02 024.001	Prepare guidance for conducting preliminary assessments.	07/31/95	Suspended. Guidance is being redirected towards composite analysis; project completion 03/31/96.
<u>VIII.B.1</u> R94-02 004	Issue LLW disposal capacity survey report.	09/30/95	Ongoing. Project issuing initial draft of volumetric capacity report 05/31/96.
<u>IX.B.1.b.1</u> R94-02 016.001	Issue preliminary LLW R&D activities catalog of needs from DNFSB.	06/30/95	Completed. Report transmitted to DNFSB 06/30/95.
<u>IX.B.1.b.2</u> R94-02 016	Issue R&D catalog of additional LLW activities.	12/31/95	Suspended. R&D activities to be resumed in FY97. Propose making it part of other R&D tasks.

* DOE Headquarters will not "approve" the performance assessments at sites that have not accounted for radioactive sources that contribute to the dose from the active disposal facility. Nonetheless, a review of the technical aspects of the PAs is being done in order to provide feedback to the site analysts.

Status of Task Initiative Due as of December 31, 1995

<u>IP Task #</u> <u>SIMS ID #</u>	Title or Description	Due Date	Status
<u>IX.B.2.b.1</u> R94-02 018.001	Issue initial LLW R&D needs statement.	09/30/95	Suspended. R&D activities to be resumed in FY97. Propose issuing a single R&D needs statement.
<u>IX.B.3.b.1</u> R94-0. 019.001	Correlate initial needs with catalogued activities.	11/30/95	Suspended. R&D activities to be resumed in FY97. Propose a single correlation activity.

4.0 TASK AREA STATUS

4.1 Systems Engineering

The LLW Systems Engineering process was initiated with a Headquarters workshop that established agreement on the mission and defined preliminary top-level functions for the DOE LLW program. The results of this effort were presented in the Low-Level Waste Management Systems Engineering Evaluation Report that was transmitted to the DNFSB on June 28, 1995.

A site specific workshop was held at Idaho National Engineering Laboratory (INEL) to verify the technical functions identified at the HQ workshop, identify the DOE program-level functions, and determine the program requirements. Agreement was achieved among the participants on the technical function definitions, the interfaces between functions (input/output), and the functional logic network (top-level process flow). The customer set and functional requirements were discussed at length with considerable divergence of opinion.

The lessons learned from the Headquarters and the INEL workshops are as follows:

- The systems engineering effort had been focused upon technical functions that are based upon "how" LLW is currently being treated, stored, and disposed.
- Programmatic functions are difficult to identify because the focus is on functions without adequate definition of requirements.
- There is considerable confusion about who the LLW customers are. As a result, the requirements of the undefined customers are not known.

- There is little consensus on what the requirements are. In general, when requirements are discussed, the focus is upon standards, regulations, and orders. The requirements based upon policy, performance, and scope are not considered and are frequently not understood.
- It was clear that the current approach was:
 - focusing on integrating existing activities rather than re-evaluating the program or meeting program mission, needs, and program/customer requirements;
 - not providing a value system to support decision making; and
 - requiring too much time to support current LLW activities and establish an integrated program.

Based upon discussions with the DNFSB staff and the results of our initial systems engineering activities, described above, DOE has determined that the LLW systems engineering approach needs to be modified. Specifically, the modified approach will identify the LLW program customers and their requirements, as well as define the requirements for policy, performance, scope, industry standards, regulations, and DOE orders.

To that end, a systems engineering workshop with Headquarters and field personnel was held in September to initiate the identification of LLW program customers and related requirements sources documents. Subsequently, a first draft of a systems requirements document was prepared and was in the review process at the end of this reporting period.

During the next reporting period, the initial review of the system requirements document and resolution of those comments will take place. Plans are to convene a video conference in late March with Operations Office representatives to discuss the resolution of the comments and the plans for finalizing the system requirements. During this time, the allocation of the system requirements to system functions will also be underway.

4.2 Complex-Wide Review (CWR)

In November, a new Task Manager was assigned to lead this effort. The major components of the organization to implement the CWR were put in place over the course of this reporting period. The Assessment Working Group (AWG) was formed to administer the review, and Site Assessment Teams (SATs) were formed and trained in conducting the Site Evaluation Survey (survey). The process of

staffing the Working Group Assessment Teams (WGATs) was initiated. WGAT nominees have been identified, and the AWG is reviewing information provided by the nominees in order to make recommendations on team assignments.

Key elements of the analysis methodology for conducting the CWR were developed or initiated. This effort included developing a working definition for an "environmental, safety, and health vulnerability." The definition is intended to identify physical as well as programmatic vulnerabilities. A survey was developed for use by the SATs in gathering information to identify conditions and weaknesses that could lead to potential vulnerabilities. The survey addresses the low-level radioactive waste management system, which includes generation, treatment, storage, and disposal. The survey was conducted by the SATs. Work on the development of the Assessment Plan to review the survey responses and conduct the independent on-site assessments was initiated. This work includes the development of review approaches and the methodology to identify and prioritize vulnerabilities. The Assessment Plan will be used by the WGATs to continue the analysis initiated through implementation of the survey.

DOE has taken a graded approach to implementing the CWR. This approach entails a detailed review of disposal facilities and practices using the following functional categories: Management and Oversight, Waste Characterization and Packaging, Performance Assessment and Site Characterization, Design and Construction, and Operations and Maintenance. In keeping with the graded approach concept, the scope for treatment and storage facilities is limited to Management and Oversight and focuses on storage/holding area capacity limits, holding time limits, path forward issues, and the results of prior or ongoing assessments. The review of the results of the prior or ongoing assessments is intended to be used as a screen for determining the need for further assessment of a treatment or storage facility. The scope for generator facilities has been limited to generator waste accumulation areas with regard to capacity limits, holding time limits, and path forward issues.

The primary issue affecting progress of the CWR has been the definition of the scope of the review. During the reporting period, CWR personnel met with the DNFSB staff to discuss the scope and progress of the review. In addition, the CWR Task Manager requested the DNFSB staff to review the survey document and provide written comments. After receiving the survey, the DNFSB arranged a meeting with DOE to discuss the Board's framework for the low-level waste management system. The DNFSB's main concern is that the scope of the survey is not sufficiently comprehensive to identify vulnerabilities associated with DOE's management of low-level radioactive waste. The DNFSB believes this is especially true for waste generation, treatment, and storage. DOE will continue to work with the DNFSB and staff to resolve this concern.

Accomplishments projected for the next reporting period include the following:

- resolve the CWR scope issue;
- develop a revised CWR schedule;
- complete WGAT staffing;
- complete the Assessment Plan;
- conduct onsite reviews; and
- prepare preliminary Complex-Wide Review Report.

4.3 Regulatory Structure and Process

During the period covered by this report, significant progress was made on several of the task initiatives in the Regulatory Structure and Process area of the Implementation Plan.

The policy entitled, "Inclusion of Pre-1988 Source Term and Other Sources of Radioactive Contamination in Low-Level Waste Disposal Facility Performance Assessments," was transmitted by the Deputy Assistant Secretary for Waste Management to the Operations Offices on May 31, 1995. This policy directs the Operations Offices with LLW disposal facilities to include LLW disposed of prior to September 26, 1988 as well as other sources of radioactive contamination in the ground in performance assessments.

The "Interim Policy on Regulatory Structure for Low-Level Radioactive Waste Management and Disposal," was transmitted to the Operations Offices from the Assistant Secretaries for Environmental Management and Environment, Safety, and Health on July 21, 1995. This interim policy establishes a formalized oversight approach for DOE headquarters review and approval of low-level waste disposal facility performance assessments. An attachment to the interim policy requests comments and feedback on the structure and process for a final policy to strengthen the oversight of LLW management in the long term. It was felt at the time the policy was written that the final policy needed to wait for the Department to complete a planned realignment, and for the Advisory Committee on External Regulation to complete its recommendations to the Secretary.

A Report entitled, "Comparison of Selected DOE and Non-DOE Requirements, Standards, and Practices for Low-Level Radioactive Waste Disposal," was finalized in December 1995. The report provides detailed discussions and

tables comparing selected DOE LLW management requirements, practices, and standards with those of the Nuclear Regulatory Commission and some Agreement States and Compacts. The Implementation Plan states that this report is to include a comparison of international LLW management requirements, practices, and standards as well, and this part of the analysis will be completed in a second report.

The primary issue facing the Regulatory Structure and Process tasks throughout the reporting period was the proper interface and coordination with the revision of DOE Order 5820.2A, *Radioactive Waste Management*. When the Implementation Plan was issued in March 1995, it was assumed, based on information current at that time, that a revised Order would be issued in the Summer of 1995. Therefore, tasks in the Plan were structured around implementing this new Order, and promulgating a LLW Rule. The revised Order was not issued as planned. One key consideration in not issuing the revised Order was concerns raised by DNFSB. Thus, the tasks in the Implementation Plan were confounded by a chain of events associated with the future plans for the revision of the Order. This issue has been clarified by recent plans and schedules established for the revision of the Order, and tasks will be described in the revised Implementation Plan that will result in a coordinated effort leading to a newly revised Order that will include the results of analysis and technical findings of the 94-2 Implementation Plan.

Accomplishments projected for the next reporting period include:

- Drafts of a "Standard Format and Content Guide for U.S. Department of Energy Low-Level Waste Performance Assessments," and outlines for the "Standard Review Plan for U.S. Department of Energy Low-Level Waste Performance Assessments" and the "Maintenance of U.S. Department of Energy Low-Level Waste Performance Assessments" will be reviewed.

4.4 Performance Assessments

During the period covered by this report, numerous staff and management discussions led to an improved understanding of the appropriate activities to include in this section of the Implementation Plan. Factors prompting the debate were the conditions in the DNFSB letter accepting the Implementation Plan, and technical and regulatory concerns.

Although no performance assessments had been approved at the time the DNFSB was conducting its evaluation of DOE LLW management, by the time the Implementation Plan was issued, six performance assessments had been submitted to Headquarters and one had been approved. The Implementation Plan described

a task initiative for Headquarters to review and grant preliminary approval of performance assessments that had been developed in accordance with DOE Order 5820.2A (i.e., included only post-1988 waste). However, one of the conditions in the June 1995 DNFSB letter accepting the Plan was that no performance assessments should be approved until they do account for the composite of all LLW at a site. Accordingly, DOE has not given preliminary approval to any performance assessments since that time, although technical review of them continues. DOE Headquarters will acknowledge those performance assessments found to be "technically acceptable," recognizing that the analysis is incomplete pending consideration of the pre-1988 waste and other source terms.

The Implementation Plan also included a task initiative to conduct preliminary assessments to provide near-term evaluations of the potential for unacceptable impacts to the public when all LLW is considered. Another condition of the DNFSB letter of acceptance was that these preliminary assessments should not detract from the prompt completion of the full performance assessments. Since the preliminary assessments were separate analyses that would have diluted analysts' efforts on the full performance assessments, actions to prepare preliminary assessments were halted.

It is generally accepted that a principal element of the DNFSB recommendation is that there must be an evaluation of long-term public protection from radioactive residues to be left at a DOE site. Debate ensued over whether the performance assessment is the only tool, or the best tool, for conducting this evaluation. A widely held opinion is that the performance assessment is a tool to be used in designing a disposal facility and justifying the operational constraints (e.g., waste acceptance criteria). Assessment of the impacts of other sources of radiation (past disposals, spills, etc.) may be better addressed through a separate analysis. There was also discussion of the appropriate measures for public protection and the right location at which to evaluate protection of the public.

Long-term protection of the public from radioactivity left at a DOE site is contingent on the amount of land that remains under DOE control. Therefore, land-use planning is another consideration that affects the analysis of public protection. One proposal is that a performance assessment or the CERCLA process and the 25 mrem/yr dose limit at a location near the facility should be used to guide the design and operation of current or future disposal facilities. Then an adjunct composite analysis of sources of radioactivity that overlap with the active/planned disposal facility plume would be prepared to demonstrate that the potential dose to a person at the point of public access, the land-use boundary, would not exceed a specified limit. That limit would be less than the 100 mrem/yr public dose limit subscribed to by DOE.

The above factors will be further discussed within DOE and with the DNFSB staff during the next quarter. The objective of the discussions is to settle on the tasks initiatives that will ensure an appropriate evaluation of public protection and commit to them in the Implementation Plan.

4.5 Volume Projections

The waste volume projections tasks are intended to coordinate with other efforts to collect waste information from the DOE sites. Therefore, the plan was to draw information for LLW coming from environmental restoration sites from the Baseline Environmental Management Report (BEMR) to identify waste volumes and characteristics and planned disposal locations. Many of the BEMR data submittals were delayed until November and December. This resulted in a delay of the preparation of the report on disposal capacity committed to in the Implementation Plan. At the end of the current reporting period, data were being analyzed, the outline of the report had been prepared and writing of certain sections of the report was progressing. It is recognized that the report will not be fully developed with respect to radiological constraints on capacity until the performance assessments and composite analyses have been prepared. The plan is to add information on the radiological capacity in future revisions of the report.

During the next quarter, work will continue on the development of the disposal cell summaries. The disposal cell summaries will be combined with data received from the field in order to complete the disposal capacity report as scheduled in the revised IP.

4.6 Research and Development

The initial task in this section of the Implementation Plan, to catalog selected research and development activities, was completed in June 1995. After conducting this cataloging, it was felt that the effort could be made more efficient by waiting until the research and development needs had been defined. This avoids the cataloging of activities that may not correspond to any identified need, and therefore are not relevant to improvements to DOE management of LLW. Identifying completed or ongoing research that relates to LLW management research and development needs is proposed to become an integral part of the determination of outstanding needs, the step following the development of needs statements.

An initial effort was made to identify research and development needs. Representatives from the DOE Performance Assessment Task Team, as well as other experts in areas related to performance assessment were interviewed to

identify needs in subject areas related to performance assessment. A draft report was prepared documenting the results of the initial needs identification.

Personnel responsible for these task initiatives have determined that a number of other activities being conducted as part of the Implementation Plan (such as the Complex-Wide Review, systems engineering, and performance assessments) should be completed or further developed prior to trying to identify research and development needs and develop needs statements. This logic, and fiscal year 1996 funding constraints, have resulted in a suspension of active work in this task area until next fiscal year. Research and development activities being conducted by the Office of Technology Focus Groups, particularly the Mixed Waste and the Landfill Focus Groups, will be monitored throughout the year and factored into the identification of outstanding needs.

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United States Government

Department of Energy

memorandum

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DNF SAFETY BOARD

DATE: MAY 31 1995

REPLY TO
ATTN OF: EM-30

SUBJECT: Inclusion of Pre-1988 Source Term and Other Sources of Radioactive Contamination in Low-Level Waste Disposal Facility Performance Assessments

TO: Distribution

The purpose of this memorandum is to advise you of changes in requirements for low-level waste (LLW) disposal facility performance assessments that the Department committed to in the "Implementation Plan, Defense Nuclear Facilities Safety Board Recommendation 94-2," dated March 31, 1995. This memorandum also requests Operations Offices with disposal facilities to submit schedules for effecting the changes. This directive is to remain in effect until the appropriate requirements are incorporated into a waste management order.

Order DOE 5820.2A, "Radioactive Waste Management," requires field organizations with low-level waste disposal facilities to prepare and maintain radiological performance assessments. However, the Order limited compliance with the performance objectives to LLW disposed of after the Order's effective date, September 26, 1988. With the issuance of this memorandum, we are establishing a requirement that Operations Offices must include within the scope of performance assessments for active and planned LLW disposal facilities an analysis of other source terms that potentially add to the doses calculated for the receptor. Therefore, LLW disposed of prior to September 26, 1988, as well as other sources of radioactive contamination in the ground (e.g., spills, leaks, liquid discharge plumes), are to be included in performance assessments.

The Office of Waste Management will continue to review and provide appropriate feedback for those performance assessments submitted to Headquarters by June 30, 1995. With the establishment of the requirement to include other source terms in the performance assessments, all of the performance assessments submitted prior to June 30 will need to be revised to address the entire source term. The following performance assessments are included in this category:

- Hanford 200-W Burial Ground,
- Hanford Grout,
- Idaho Radioactive Waste Management Complex,
- Nevada Area 5, Radioactive Waste Management Site,
- Oak Ridge Solid Waste Storage Area 6,
- Savannah River Saltstone Disposal Facility, and
- Savannah River E Area Vaults.

In the Implementation Plan, DOE committed to submitting schedules for revising the above-listed performance assessments by April 30, 1996. I believe that it should be possible to develop appropriate schedules well ahead of that date. To that end, my staff will be contacting Operations

2-

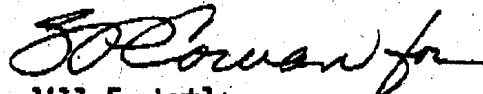
Office program managers to arrange for a meeting with appropriate field personnel to discuss the requirements and implications of the expanded scope. Field personnel should initiate planning for revising their performance assessments, with an intent of submitting a schedule to Headquarters by late summer. A specific date will be decided on at the meeting among the Headquarters and field personnel.

For those performance assessments in earlier stages of preparation, all source terms are to be included when initially submitted to Headquarters for approval. Performance assessments for the following facilities fall in this category:

- Hanford Environmental Restoration Disposal Facility,
- Hanford 200-E Burial Ground,
- Los Alamos Area 6,
- Los Alamos Mixed Waste Disposal Facility,
- Nevada Area 3, Radioactive Waste Management Site, and
- Oak Ridge L-II Facility.

As DOE proceeds with its commitments in the Implementation Plan, there will be additional guidance developed that will influence the preparation of performance assessments. Draft guidance will be shared with the field personnel for input and to ensure timely consideration during the preparation of the performance assessment.

If you have questions or need further information please have your representatives contact Greg Duggan, EM-332, LLW Management Task Group Director at (301) 903-7140 or Lydia Chang, LLW Management Task Group, Regulatory Structure Program Manager at (301) 903-7136.



Jill E. Lytle
Deputy Assistant Secretary
for Waste Management
Environmental Management

cc: (see attached)

Distribution:

Manager, DOE Albuquerque Operations Office
Manager, DOE Chicago Operations Office
Manager, DOE Ohio Field Office
Manager, DOE Idaho Operations Office
Manager, DOE Nevada Operations Office
Manager, DOE Oak Ridge Operations Office
Manager, DOE Richland Operations Office
Manager, DOE Rocky Flats Office
Manager, DOE Oakland Operations Office
Manager, DOE Savannah River Operations Office

DIST: so: Addressee
1bcc: EM-33 Rdr
3bcc: EM-332 (Subject, Rdr, Director Rdr)
2bcc: EMCC

EM-332
CHANG
[Signature]
5/31/95

EM-332
DUGGAN
[Signature]
5/31/95

EM-30
COMAN/LYTTLE

/ /95

EM-332:CHANG:MAF:5/31/95:37136:DIRECT-F.530

THIS POLICY HAS BEEN COORDINATED WITH THE FIELD.
COMMENTS RECEIVED FROM SR, NV, AND RL ONLY.

'pre 88 source terms'

memorandum

DATE: July 21, 1995

REPLY TO
ATTN OF: EM-30

SUBJECT: Interim Policy on Regulatory Structure for Low-Level Radioactive Waste Management and Disposal

TO: Distribution

Attachment 1 sets forth interim Department of Energy (DOE) policy on oversight of low-level radioactive waste (LLW) management and disposal. This policy applies to all LLW, including mixed LLW, and clarifies and amplifies the requirements in Order DOE 5820.2A.

The Department employs several mechanisms to oversee activities under its purview, of which LLW management represents a subset and LLW disposal represents a further subset. Some of these mechanisms include contractor self-assessments, DOE headquarters and Field Office assessments, and contractual provisions.

For LLW disposal, there are considerations that go beyond short-term worker and public health and safety. LLW disposal represents a long-term commitment of natural resources, and measures to reverse this commitment are normally difficult. Public health and safety and the environment must be protected for the future as well as the present.

Hence, DOE 5820.2A requires that field organizations prepare and maintain radiological performance assessments (PAs) for active LLW disposal facilities. However, DOE 5820.2A is silent about departmental processes for approving and maintaining PAs. Although an ad hoc approach is being implemented, a more formal structure is needed. In the Implementation Plan for responding to Recommendation 94-2 of the Defense Nuclear Facilities Safety Board, DOE committed to develop and issue an internal "policy that clarifies and strengthens its LLW management regulatory structure."

The attached interim policy responds to that commitment and establishes an oversight approach that is compatible with the existing Departmental organizational structure. Field elements are required to implement the interim policy and to ensure that LLW management activities are conducted in accordance with this policy. Managers shall also take steps to integrate waste management requirements into new and renegotiated contracts so that contractors are penalized or rewarded through awards or fees commensurate with the performance of their LLW management responsibilities.

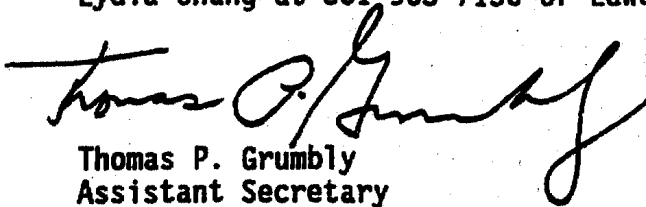
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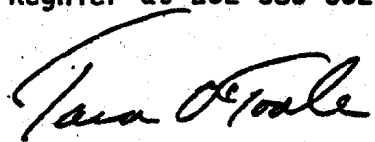
Key features of the interim policy include:

- Headquarters elements review and approve LLW disposal facility PAs, and issue disposal authorization statements that set forth requirements important for assuring compliance with LLW disposal facility performance objectives.
- Approval of LLW disposal facility PAs requires consultation with the Office of Environment, Safety and Health.
- Under the current contract reform initiative, compliance with LLW requirements is considered a primary element of performance.
- The Department can require shutdown of disposal operations based on failure to prepare an acceptable PA in a timely manner or to maintain an adequate PA maintenance program.

The policy is interim pending development of a long-term policy for LLW regulatory oversight and PA enforcement consistent with the Department's response to Recommendation 94-2, Task VI.B.5 of the Implementation Plan. Consistent with Task VI.B.4 of the 94-2 Implementation Plan, the Department is also developing a policy to clarify the Department's oversight policy for wastes from DOE environmental restoration and decommissioning activities, which are managed and disposed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act requirements or other mandates (eg. compliance orders.) This interim policy and other relevant policies on LLW management will be integrated into the Order DOE 5820.2B currently under development.

The Department is assessing alternatives for this long-term policy, and these alternatives are attached to this memorandum to solicit comment on the efficacy of different approaches (Attachment 2). Additional approaches may be suggested. The Department is completing a strategic alignment and is presently participating in a process that is investigating external regulation of DOE operations for radiological protection. Because the outcome of these activities are still uncertain, alternatives considered in Attachment 2 are limited to those that are within the Department's current implementation authority and responsibility. As a result, the proposed alternatives may change as these policy issues are resolved. If you have questions, please contact Lydia Chang at 301-903-7136 or Edward Regnier at 202-586-5027.


 Thomas P. Grumbly
 Assistant Secretary
 Environmental Management


 Tara J. O'Toole, M.D., M.P.H.
 Assistant Secretary
 Environment, Safety and Health

Attachments

Distribution:

Manager, DOE Albuquerque Operations Office
Manager, DOE Chicago Operations Office
Manager, DOE Ohio Field Office
Manager, DOE Idaho Operations Office
Manager, DOE Nevada Operations Office
Manager, DOE Oak Ridge Operations Office
Manager, DOE Richland Operations Office
Manager, DOE Rocky Flats Office
Manager, DOE Oakland Operations Office
Manager, DOE Savannah River Operations Office

ATTACHMENT 1

Interim DOE Policy on Oversight of

Low-Level Radioactive Waste Management and Disposal

1.0 Purpose

This document sets forth the Department of Energy's (DOE) interim policy on oversight of its low-level radioactive waste (LLW) management and disposal activities. The interim policy applies to the management and disposal of LLW, including accelerator-produced waste and the LLW portion of radioactive waste mixed with hazardous wastes or constituents regulated under the Resource Conservation and Recovery Act (RCRA) or the Toxic Substances Control Act (TSCA).

Field offices are responsible for managing and disposing of LLW in compliance with applicable requirements. Requirements for LLW management and disposal are contained in DOE 5820.2A. Additional requirements for protecting the worker, public, and the environment are contained in 10 CFR Part 835, Order DOE 5400.5 (and 10 CFR Part 834 when issued), and Order DOE 5400.1.

Several mechanisms are in place by which DOE oversees LLW management and disposal activities, and monitors compliance with DOE requirements. These mechanisms include contractor self-assessments and reporting procedures and assessments by DOE headquarters and site representatives. Enforcement mechanisms for compliance with LLW requirements largely involve contractual provisions. Requirements for occupational radiation protection of DOE workers codified in 10 CFR 835, are subject to additional enforcement mechanisms pursuant to the Atomic Energy and Price-Anderson Amendments Acts. Similar enforcement mechanisms will be applied to 10 CFR 834 when it is promulgated.

Although compliance with most DOE requirements can be assessed directly, some cannot. In particular, paragraphs III.3.a.2 through III.3.a.4 of DOE 5820.2A contain performance objectives for which compliance cannot be demonstrated in the normal sense. These performance objectives pertain to protection against future release of radioactive material into the environment or possible exposures of future hypothetical individuals. To help provide a reasonable expectation that compliance with the performance objectives will be achieved, DOE requires (paragraph III.3.b.1) that field offices having disposal facilities prepare and maintain site-specific radiological performance assessments (PAs). However, the Order is silent about procedures for approval of PAs and their maintenance.

Therefore, the following policy prescribes an oversight approach that, compatible with the existing Departmental organizational structure: (1) distinguishes functions and responsibilities among field and headquarters organizations, (2) formalizes processes for oversight of LLW disposal activities, emphasizing processes for review, approval, and maintenance of disposal facility PAs, and (3) addresses enforcement mechanisms.

The described policy is interim. The Department is assessing alternatives for a longer-term policy for oversight of LLW disposal activities, in coordination with other Departmental initiatives.¹ Some alternatives would require modifications to Departmental organizational structures.

2.0 Scope

This policy applies to LLW generated, managed and disposed of at DOE facilities, including accelerator-produced LLW and LLW when it is mixed with hazardous materials or constituents regulated under RCRA or TSCA (the hazardous components of mixed waste are subject to RCRA or TSCA requirements). Its applicability to wastes from DOE environmental restoration and decommissioning activities which are managed and disposed in accordance with the requirements of RCRA, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or other mandates (e.g., compliance orders) will be clarified in separate policy and guidance statements.

3.0 References and Definitions

3.1 References

U.S. Department of Energy, General Environmental Protection Program, Order DOE 5400.1, 9 November 1988.

U.S. Department of Energy, Radiation Protection of the Public and the Environment, Order DOE 5400.5, 8 February 1990.

U.S. Department of Energy, Radioactive Waste Management, Order DOE 5820.2A, 26 September 1988.

U.S. Department of Energy, Waste Management, Order DOE 5820.2B, to be published.

¹Other Departmental initiatives include the development of revisions to DOE 5820.2A, the development of interim policies and assumptions for preparation of LLW performance assessments, and pilot projects to improve oversight of environment, safety, and health activities.

U.S. Department of Energy, Procedural Rules for DOE Nuclear Activities, 10 CFR Part 820.

U.S. Department of Energy, Radiation Protection of the Public and the Environment, 10 CFR 834 (to be promulgated).

U.S. Department of Energy, Occupational Radiation Protection, 10 CFR Part 835.

3.2 Definitions

Definitions provided in DOE 5820.2A are supplemented with the following additional definitions:

Disposal authorization statement. A document that sets forth the conditions of design, construction, and operation of a LLW disposal facility to ensure compliance with the performance objectives of DOE 5820.2A, Chapter III. It functions similarly to a facility license issued by the Nuclear Regulatory Commission or an Agreement State, although its scope is not as broad.

Performance assessment maintenance program. A process for reducing uncertainties in predictions about the long-term performance of a disposal facility based on iterations between experimental (e.g., field data acquisition and test facilities to verify waste, engineered barrier, or cover performance, or to confirm critical assumptions made in the performance assessment) and model improvement efforts.

4.0 Concepts

4.1 LLW Disposal Facilities, PAs, and PA Maintenance

LLW disposal represents a very long-term commitment of natural resources (e.g., land), and measures to reverse this commitment are normally difficult and expensive. Because of this, and because public health and safety and the environment must be protected over the future as well as during the present, the Department employs a multi-faceted approach for worker, public, and environmental protection. Chapter III of DOE 5820.2A sets forth four performance objectives that establish the overall goals for LLW disposal, and also prescribes several requirements intended to provide greater assurance of compliance with the performance objectives.

These include requirements on disposal facility siting and control,² design, operation, waste characteristics, monitoring,³ closure, and preparation and maintenance of performance assessments.

Preparation and maintenance of disposal facility PAs represent critical activities. The PA is a significant mechanism by which the long-term efficacy of a LLW disposal facility is judged, and is used (among other inputs) for setting some waste acceptance criteria and some disposal facility design and operational requirements. But because the results of the PA contain technical uncertainties, a PA maintenance program is needed to provide greater confidence in the results of the analyses and in the protection of public health and safety and the environment. Acquisition and consideration of field data represents a necessary component of the PA maintenance program.

Hence, PA development and refinement represents a continuous process during the life of a disposal facility. Initial PAs must be approved by the Office of Environmental Management before construction and operation of LLW disposal facilities. Initial approval must be based on the PA review and a conclusion that there is sufficient reason to believe, with the information available, that there is a reasonable expectation⁴ that the facility will comply with the LLW performance objectives. Over the lifetime of the disposal facility, the PA must be maintained and upgraded as additional information about the waste, site, and performance assessment model parameters is obtained. At closure of the disposal facility, a final PA which analyzes all waste that has been placed in the disposal facility must be prepared and approved.

²The Department (or its successors), will control and maintain LLW disposal facilities until the disposal facilities can be released. DOE requirements for release of property are provided in DOE 5400.5 (and eventually 10 CFR 834). Because DOE 5400.5 requires that potential doses to the public from release of property must be reduced to levels as low as reasonably achievable below DOE's annual dose limit of 100 mrem from all radiation sources, many LLW disposal facilities may never be suitable for unconditional release.

³Paragraph III.3.k of DOE 5820.2A requires, among other things, design of disposal facility monitoring programs to detect changing trends in facility performance to allow for application of corrective actions before exceeding performance objectives. The monitoring program must be designed to measure operational effluent releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and disposal site parameters affecting long-term site performance. Paragraph III.3.b indicates that monitoring should be used to validate or modify the models used in performance assessments.

⁴ The requirement of reasonable expectation is met if analyses which are based on plausible exposure scenarios that are not likely to underestimate doses demonstrate compliance with the performance objectives. Scenarios and parameters are discussed in more detail in guidance for developing performance assessments.

4.2 Principles of DOE Oversight

The Department's oversight structure for LLW management is based on three principles:

- o Independent Review and Oversight.
- o Contractual and regulatory compliance mechanisms.
- o Separation and delegation of authorities.

Independent Review and Oversight. Independence is heightened by a formal review mechanism for LLW disposal facility PAs that is independent of the field office responsible for the disposal facility. The mechanism includes consultation with a DOE office different from the one responsible for implementing DOE LLW management programs. Lack of progress in preparation and initial acceptance of disposal facility PAs are identified as bases for exercise of shut-down authority, as is lack of adequate programs to maintain PAs once they have been reviewed and accepted.⁵

Contractual and Regulatory Compliance Mechanisms. There are two primary enforcement mechanisms applicable to activities undertaken at DOE sites when those activities result in, or cause, non-compliance with DOE Orders and regulations. These mechanisms are contractual and regulatory.

Through contract reform, the Department will use contract enforcement as a means for ensuring compliance with nuclear safety requirements. New and renegotiated contracts will include applicable DOE Acquisition Regulation Clauses relating to nuclear safety requirements including award fee determination factors related to the status of compliance issues. Good compliance performance can increase award fee considerations, while poor performance can cause the opposite. Under this policy, compliance with low-level waste requirements will be considered a primary element of environmental performance.

In addition, pursuant to paragraph 20 of DOE 5480.1B, the Assistant Secretary for Environment, Safety and Health has the authority to recommend curtailment or suspension of operations when a determination is made that a clear and present danger exists.

The regulatory mechanism is the statutory mandate embodied in the Price-Anderson Amendments Act of 1988 and codified in 10 CFR 820 (Procedural Rules for DOE Nuclear Activities). This rule sets forth the procedures governing the conduct of persons involved in DOE nuclear activities with respect to compliance with DOE's nuclear safety requirements.

⁵The Department is evaluating ways to further augment regulatory independence.

Although 10 CFR 830 (Nuclear Safety Management) does not apply to LLW disposal facilities, all DOE sites are subject to 10 CFR 835 (Occupational Radiation Protection) and, when promulgated, 10 CFR 834 (Radiation Protection of the Public and Environment). Violations of these rules will be subject to enforcement (i.e., Notices of Violation and when appropriate, civil penalties) as described in 10 CFR 820.

Separation and Delegation of Authorities. Oversight authority is separated among headquarters and field elements. Headquarters elements generally reserve oversight authority over those matters that would involve (1) decisions that may result in significant current or future release of radioactive materials to the environment, or exposures to members of the public, (2) decisions that could result in precedents or policies that could affect more than one Department site, (3) decisions that could result in significant commitments of present or future resources, including economic and natural resources, and (4) decisions that involve sensitive public policies or institutional concerns. Other oversight authorities are generally delegated to field elements.

Regarding LLW management, existing oversight mechanisms will continue. Regarding LLW disposal, field elements are responsible for determining and overseeing compliance with applicable requirements in DOE 5820.2A and other directives and regulations. Field elements are also responsible for preparation and maintenance of PAs, and for development of waste acceptance criteria derived from performance assessments and other considerations. Headquarters independently assesses the adequacy of the PAs and PA maintenance programs, as well as compliance with performance objectives (and other requirements as needed), and approves siting and construction of new LLW disposal facilities.

DOE expects that a coordinated approach will be needed across the DOE Complex to ensure consistency in the quality of the PA maintenance programs, and use of resources in a cost-effective manner.

5.0 Interim Policy

5.1 Interim Policy

Field organizations having LLW disposal facilities shall ensure preparation and maintenance of site-specific radiological performance assessments (PA) for the disposal of waste. The PAs are to be prepared and maintained to provide a reasonable expectation of compliance with the performance objectives stated in paragraph III.3.a of DOE 5820.2A.⁶ The following paragraphs amplify and clarify DOE's requirements for preparation, review, acceptance, maintenance, and approval of PAs, specify headquarters and field shut-down authorities for inadequate progress in preparing and maintaining PAs, and address contracting provisions:

⁶Except that reasonable expectation of compliance with paragraph III.3.a.1 of DOE 5820.2A may be demonstrated by reference to other documentation such as Safety Analysis Reports.

- a) At the request of the Deputy Assistant Secretary (DAS) for Waste Management, LLW disposal facility PAs shall be reviewed by an oversight and peer review panel (PRP). The PRP shall ensure consistency and technical quality around the DOE complex in the development and application of performance assessment models that include site-specific geohydrology and waste composition.
- b) The PRP shall be selected by the DAS for Waste Management, and shall be composed of DOE, contractor, and other specialists in performance assessments,⁷ with participation by representatives from the Office of Environment, Safety and Health and from operations offices.
- c) For new LLW disposal facilities, PA's shall be reviewed by the responsible field element and submitted to the DAS for Waste Management before construction begins. Documentation from PRP reviews⁸ shall accompany the PA, as will other information as needed to assess disposal facility performance (such as the closure plan and safety analysis report for the disposal facility). Waste Management staff will evaluate the PA and PRP reviews, consult with the Office of Environment, Safety and Health, and make a recommendation to the Assistant Secretary for Environmental Management regarding compliance with the performance objectives of DOE 5820.2A, Chapter III. If warranted, the Assistant Secretary for Environmental Management authorizes construction of the disposal facility.

If construction is authorized, the DAS for Waste Management will prepare a disposal authorization statement that sets forth those conditions for design, construction, and operation of the disposal facility that are appropriate to assure compliance with the LLW performance objectives. (Also see paragraph (d).)

- d) For existing LLW disposal facilities that continue to accept waste for disposal, PA's shall be reviewed by the responsible field element and submitted to the DAS for Waste Management for initial acceptance according to a schedule provided by the DAS for Waste Management (see Figure VII.1, Implementation Plan for Recommendation 94-2, March 31, 1995). Documentation from PRP reviews shall accompany the PA, as will other information as needed to assess disposal facility performance (such as the closure plan and safety analysis report for the disposal facility). Waste Management staff will evaluate the PA and PRP reviews, consult with the Office of Environment, Safety and Health, and make a recommendation to the DAS for Waste Management about compliance with the performance objectives of DOE 5820.2A, Chapter III.

⁷Current practice is to invite representatives from the Department's Environmental Restoration Program to participate in the PRP, and to invite representatives from the Nuclear Regulatory Commission and Environmental Protection Agency to participate as advisors.

⁸Such as written minutes of meetings, written recommendations about the technical quality of the PAs, and supporting documentation.

Upon PA acceptance, the DAS for Waste Management shall prepare a disposal authorization statement that sets forth those conditions for operation of the disposal facility (including any changes to design and construction of future disposal units or modifications to existing disposal units) that may be appropriate to ensure compliance with the LLW performance objectives. (Also see paragraph (e).) If the PA is not accepted, the responsible field office shall, as appropriate, have the PA or support analysis revised and/or take steps (e.g., curtail disposal operations, change waste acceptance criteria and so forth) to ensure that the public and environment are protected and the performance objectives are met.

e) Although DOE 5820.2A requires, for purposes of compliance with the performance objectives, that PAs only address LLW disposed after 26 September 1988, the Department is modifying its policies to require that PAs analyze the radiological impacts of LLW disposal facilities considering a complete source term (i.e., LLW disposed in an active disposal facility both before and after 26 September 1988 as well as significant other sources of radioactivity caused by Department operations and potentially contributing to the dose assessment at the point of compliance for the active disposal facility). These policy modifications are addressed elsewhere (e.g., the 31 May 1995 memorandum from J. Lytle, Deputy Assistant Secretary for Waste Management, to Distribution).

f) Field offices having a disposal facility PA accepted by the DAS for Waste Management shall conduct a PA maintenance program during the operational period of the disposal facility. In addition, PAs shall be reviewed and revised when changes in waste forms or packaging, radionuclide inventories, facility design, closure concepts, or the understanding of the site or other features may change the conclusions of the existing PA (e.g., concentration limits or waste acceptance criteria derived from the results). On an annual basis, or as otherwise required, Field Offices will make a determination of the continued adequacy of the PA based on waste receipts, the results of monitoring or test programs, and other relevant factors. The determination must be documented and made available for inspection.

g) Before final closure of the disposal facility, or as otherwise directed, a final version of the PA shall be prepared, reviewed by the responsible field element, and submitted to the DAS for Waste Management for approval. Submittal of the final PA shall be accompanied by the final closure plan for the disposal facility prepared in accordance with paragraph 3.j. of Chapter III of DOE 5820.2A.

h) Field Offices may institute changes to the specifications in the disposal authorization statements provided that the changes (1) do not alter the conclusions of the PA with respect to protection of health and safety and the environment, or compromise compliance with Departmental directives, policies, or regulations, (2) do not lead to a significant (e.g., 10%)⁹ increase in actual or projected releases to the environment from the disposal facility, or (3) are not otherwise proscribed without authorization. Otherwise, Field Offices should request approval for the changes in accordance with paragraph (i). In any event, changes to the specifications in disposal authorization statements must be documented and made available for inspection.

i) Field Offices shall provide (biennially or as otherwise directed from the date of initial PA acceptance) a summary of waste disposal operations with respect to the conclusions and recommendations of the PA. The summaries will include (1) an assessment of the waste receipts (radionuclides, forms) in comparison to those projected for the period in question (or in comparison to authorized limits), (2) a summary of the results of tests or research programs identified in the PA or elsewhere, (3) an assessment of the continued adequacy of the PA, (4) recommendations for changes to design and operation or future research or test work, and (5) a summary of changes, if any, to the conditions of operation of the disposal authorization statement. Monitoring results shall be included or referenced if integrated into the Annual Site Environmental Reports consistent with Orders DOE 5400.1 and DOE 5400.5.

j) Changes to the specifications in disposal authorization statements may be instituted by the DAS for Waste Management or may be requested by Field Offices. Changes instituted by the DAS for Waste Management would normally be provided initially to Field Offices in draft form to allow for comment, clarification, and discussion before imposition of implementation plans. Decisions on requests for changes would normally be made using principles and criteria that were used to initially authorize disposal operations.

k) The Assistant Secretary for Environmental Management or Field Offices may suspend some or all operations at a LLW disposal facility in the event that the PA for that disposal facility has not been prepared and accepted within schedule, or the PA has not been adequately maintained. The Assistant Secretaries for Environment, Safety and Health and for Environmental Management or the Field Office have similar authorities if there is a clear and present danger to the workers, public or environment.

⁹The 10% criterion is based on judgment, selected on analogy to proposed 10 CFR 834.404, which requires a report documenting any event that results in doses to members of the public that exceed 10 mrem (10% of the primary dose limit of 100 mrem).

1) Field Offices shall take steps as part of the Department's contract reform initiative to integrate LLW management requirements into new and renegotiated contracts so that contractors are penalized or rewarded through awards or fees commensurate with the performance of their low-level waste management responsibilities.

5.2 Responsibilities

The responsibilities of headquarters offices include:

- a) Issue policies, requirements, standards, and guidance that affect the Complex as a whole, or on a site-specific basis as required to ensure protection of health and safety and the environment. (EM-1, EH-1 and EM-30 in consultation with EH-4)
- b) Review and approve LLW disposal facility PAs and, as needed, other documentation important for protection of health and safety and the environment. (EM-1 through EM-30 in consultation with EH)
- c) Develop and approve the disposal authorization statements, and significant changes therein. (EM-30 in consultation with EM-4)
- d) Conduct independent oversight reviews and assessments. (EM-20 and EH-2)
- e) Enforce compliance with nuclear safety requirements consistent with the Atomic Energy and Price-Anderson Amendments Acts and 10 CFR Part 820. (EH-3)
- f) Exercise shut-down authority if warranted by failure to prepare an acceptable PA or to conduct an adequate PA maintenance program (EM-1), or as provided under existing authority to protect health and safety and the environment. (EM-1 and EH-1)

The responsibilities of field offices include:

- a) Within the context of disposal authorization statements, review and approve waste acceptance criteria for LLW management and disposal facilities, monitoring programs, PA maintenance programs, NEPA environmental assessments, and Safety Analysis Reports, and other documentation consistent with field office authority.
- b) Conduct readiness reviews and verify through self-audits or other mechanisms that LLW management requirements are being met.
- c) Ensure preparation of LLW disposal facility performance assessments and other required compliance documentation.

d) Exercise shut-down authority if warranted by failure to prepare an acceptable PA or to conduct an adequate PA maintenance program, or as provided under existing authority to protect health and safety and the environment.

e) Enforce requirements consistent with contract law and contract reform; incorporate into new contracts and renegotiated existing contracts, provisions that will reward or penalize contractors monetarily based on the performance of their LLW management duties.

f) Ensure that LLW management activities are conducted in compliance with DOE radiation protection requirements.

g) Coordinate with DOE enforcement personnel (Office of Environment, Safety and Health) regarding compliance with nuclear safety requirements consistent with the Atomic Energy and Price-Anderson Amendments Acts and 10 CFR Part 820.

ATTACHMENT 2

Oversight Structure Alternatives for LLW Disposal

Alternatives for a long-term oversight structure are summarized in Table 1-1 discussed below. The Department is presently assessing the appropriateness of continued self regulation and the need for external regulation. The Department is also completing a strategic alignment. The out come of the review of external regulation options and the final strategic alignment may significantly impact the alternatives DOE will actually implement over the long-term; however, because it is not possible to predict the out come of these efforts, the discussions below are limited to alternatives that address DOE's current responsibilities.

1. **Continue the interim policy.**

In this alternative, the long-term policy resembles the interim policy set forth above.

2. **Transfer all review and approval functions to the field offices.**

This option would transfer all review and approval functions to the field offices. EM-30 (Office of Waste Management) and EH-4 (Office of Environment) would continue to be responsible for developing policy, requirements and guidance for waste management and radiation protection. EM-30 would continue to fund the PRP and EM would participate with the field offices in reviews or audits to verify that requirements are being implemented. As in option 1, EH-2 (Office of Independent Oversight), EH-3 (Office of Nuclear and Facility Safety), or EM-20 (Office of Compliance and Program Coordination) would be responsible for independent oversight and enforcement. The policy would include compliance with DOE LLW management requirements in contract reform such that award fees will decrease if facilities do not comply. Appropriate field offices, EM-1, or EH-1 may issue shut-down orders if significant health and safety risks are identified and are not acceptably mitigated.

3. **Establish a separate oversight structure.**

This option establishes a separate oversight structure that is akin to a regulatory licensing process. The oversight and enforcement functions would be independent of the Deputy Assistant Secretary responsible for implementing low-level waste programs. The approval necessary to construct and operate a new low-level waste disposal facility would be the responsibility of EM-1 (alternatively EH-1, or both EM-1 and EH-1) and would be granted upon the recommendation of a Low-Level Waste Review and Authorization Board (LWRAB).

Alternatives for composition of the Board include:

- (1) A permanent board having membership from EM-20, EH-2, EH-3, and EH-4, and appointed by EM-1 or the Secretary.
- (2) An ad hoc board appointed by the Secretary or by EM-1 for each review or series of reviews.
- (3) A standing body that is part of a DOE line organization and is totally responsible for review and authorization of LLW management activities. It would function in a similar manner as a State or Federal licensing or permitting agency.

To alleviate current resource problems which, at least in part, are responsible for many problems with the current program, and to facilitate an independent review, the LWRAB would be supported by contractors or DOE staff that are knowledgeable in the radiation protection and low-level waste management requirements to which DOE sites are or will be subject. Field offices would be responsible for preparing and submitting PAs and other materials necessary to demonstrate that the design, operation, and closure of a disposal facility design will be acceptable. The LWRAB would review the material and approve authorization documentation that permit a field office to begin facility construction and operation. The authorization is effectively a license for the LLW facility.

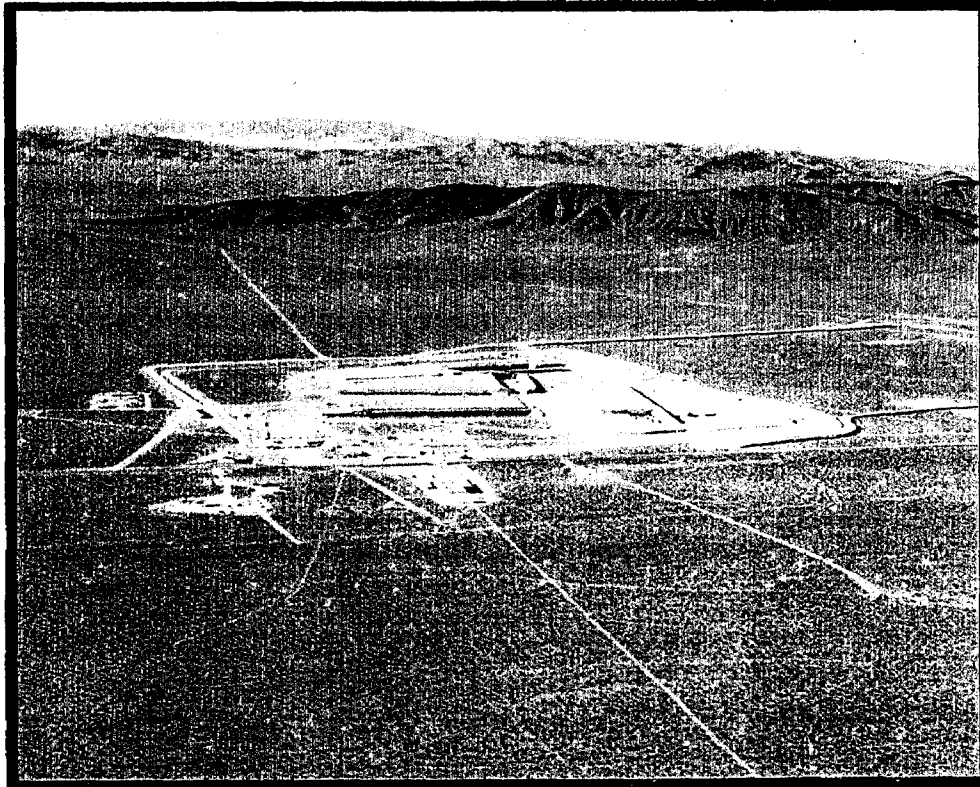
EM-30 and EH-4 would continue to be responsible for preparing waste management and radiation protection policy, requirements and guidance. Field offices and EM-30 would be responsible for verifying through self audits or other means that the LLW management requirements are being met and for taking corrective actions if they are not. Field offices could approve minor changes to the PA's and associated requirements resulting from the PA maintenance programs. Changes that significantly affect the results or performance criteria would require LWRAB approval.

Alternatives for the oversight and enforcement functions under this option are EH-2, EH-3 or EM-20, or an independent group assigned to the LWRAB. The responsible office would conduct periodic reviews of operating and developing facilities to ensure that all requirements are being met. The field office would be responsible for mitigating non-compliance issues. The policy statement would include compliance with DOE LLW management requirements in contract reform such that award fee would decrease if facilities do not comply. Appropriate field offices, EM-1, or EH-1 could also issue shut-down orders if significant health and safety risks are identified and not acceptably mitigated.

Table 1-1. Alternatives for Oversight Structure Policy Statement

Responsibilities	1. Interim Policy	2. Field Approval	3. Oversight Structure
PA Approval	EM-30, EH concurs, Tech Support from PRP	Field Elements	LWARB
Other approvals	Field Elements	Field Elements	<u>Minor changes to PA</u> - Field Element. <u>Significant changes to PA</u> - LWARB
Verify requirements are met	Field Elements and EM-30	EM and Field Elements	Field Elements and EM-30
Independent oversight or enforcement functions	Possibilities - EH-3, EH-2 and/or EM-20 (likely EH-2 integrate Low-level waste into its oversight program. EH-3 responsible for PAA Enforcement. Field Office conducts contractual enforcement.)	Possibilities - EH-3, EH-2 and/or EM-20 (Same as option 1)	Possibilities - EH-2, EH-3 and/or EM-20 or an independent group assigned to the LWARB.
Policy statement	Award fee based on compliance with DOE LLW management requirements. EM-1 or EH-1 may issue shut-down orders if significant ES&H risks are not acceptably mitigated	Award fee based on compliance with DOE LLW management requirements. EM-1 or EH-1 may issue shut-down orders if significant ES&H risks are not acceptably mitigated	Award fee based on compliance with DOE LLW management requirements. EM-1 or EH-1 may issue shut-down orders if significant ES&H risks are not acceptably mitigated
Develop policy, requirements and guidance for Wst Mngmnt and Rad Prot	EM-30 and EH-4	EM-30 and EH-4	EM-30 and EH-4
PRP funding	EM-30	EM-30	EM-30
Approval to construct and operate	EM-30	Field Office	EM-1, EH-1 or both and granted upon the recommendation of LWARB

**PERFORMANCE ASSESSMENT
FOR THE
AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE
AT THE NEVADA TEST SITE, NYE COUNTY, NEVADA**



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EXECUTIVE SUMMARY

This report documents the methodology and results of a performance assessment conducted for the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS). The United States Department of Energy (USDOE) has established policies and guidelines for the disposal of radioactive waste in USDOE Order 5820.2A (USDOE, 1988a), which requires each disposal site to prepare and maintain a site-specific performance assessment. A performance assessment is a systematic analysis of the potential risks posed by waste management systems to the public and to the environment, and the comparison of those risks to the established performance objectives. The performance objectives contained in USDOE Order 5820.2A are:

1. Protect public health and safety in accordance with standards specified in applicable Environmental Health (EH) Orders and USDOE Orders.
2. Assure that external exposure to the waste and concentrations of radioactive material which may be released into surface water, groundwater, soil, plants, and animals results in an effective dose equivalent that does not exceed 25 mrem yr^{-1} to any member of the public. Releases to the atmosphere shall meet the requirements of 40 Code of Federal Regulations (CFR) 61. Reasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as reasonably achievable (ALARA).
3. Assure that the committed effective dose equivalents received by individuals who inadvertently intrude into the facility after the loss of institutional control (100 years) will not exceed 100 mrem yr^{-1} for continuous exposure or 500 mrem for a single acute exposure.
4. Protect groundwater resources consistent with federal, state, and local requirements.

The potential risks posed by the disposal site were assessed by estimating the release and transport of radionuclides from the buried wastes to the accessible environment where they may present a radiological hazard to members of the public.

FACILITY DESCRIPTION

The NTS is a USDOE-operated facility occupying 3,500 km² of arid Basin and Range topography in southern Nye County, Nevada. The NTS was used as the continental nuclear weapons testing site from 1951 to 1992. The Area 5 RWMS is located within Frenchman Flat, a closed alluvium-filled basin in the southeastern corner of the NTS. The closest permanent settlement to the RWMS is Indian Springs, 42 km to the southeast.

In 1961, the Area 5 RWMS began disposal of low-level radioactive waste generated at the NTS. The RWMS began accepting waste from offsite USDOE generators for disposal in 1978. From 1983 to 1989, high-specific activity waste was disposed of in deep augered shafts known as Greater Confinement Disposal (GCD). Mixed waste was disposed of in a single unlined pit from 1987 to 1990. Since the inception of USDOE Order 5820.2A in 1988, the Area 5 RWMS has disposed of low-level waste and mixed waste in shallow unlined trenches and pits. A single GCD borehole has received waste since 1988. The Area 5 RWMS is currently receiving low-level wastes from the NTS and offsite USDOE generators. This performance assessment is limited to wastes disposed from the inception of USDOE Order 5820.2A to the estimated date of closure.

The Area 5 RWMS lies within a region transitional between the Mohave Desert and the Great Basin Desert. The climate is characterized by many cloudless days each year, low precipitation and high daily temperatures. Frenchman Flat receives an average annual precipitation of approximately 12 cm. Potential evapotranspiration greatly exceeds precipitation.

The stratigraphy beneath the RWMS can be classified into eight primary units. These units are composed of clastic rocks and carbonate rock in the bottom sections, and volcanic rocks and alluvium in the upper sections. The RWMS lies directly upon approximately 360 to 460 m of alluvium derived predominately from the Tertiary volcanic rocks exposed in the nearby mountain ranges. Beneath the alluvium lies a layer of interbedded ash-flow tuff, estimated to be over 550 m thick, and an undetermined thickness of carbonates, which extend down to the Precambrian basement rocks.

The surface hydrology at the NTS is characterized by ephemeral runoff occurring after infrequent storm events. The sub-surface hydrology is characterized by a deep groundwater regime overlain by a very thick unsaturated zone. The saturated zone beneath the RWMS lies within the valley fill alluvium, about 240 m below the surface. The water table is

essentially flat, indicating that there is no significant horizontal flow beneath the RWMS in the saturated zone.

The alluvium within the unsaturated zone is very dry, having a volumetric water content of approximately 12 percent at depth. The dry conditions are the result of evapotranspiration greatly exceeding precipitation. Chloride and stable isotope analyses indicate that infiltration is very rare. Indeed, the evaporative demand is so high at the surface that the tendency for liquid flow in the top 35 m of alluvium is toward the surface, rather than downward to the aquifer. Thus, leachate from the waste is extremely unlikely to contaminate the uppermost aquifer beneath the RWMS. Below 35 m in the vadose zone, liquid will tend to move downward at extremely slow rates. In the unlikely event that leachate were to move below 35 m, it was estimated that it would take approximately 65,000 years for the liquid to reach the water table under the current hydrologic regime. Retardation due to sorption reactions would greatly increase this transport time for most radionuclides.

The alluvium above the waste disposal cells is normally near its residual water content of approximately 8 percent. Radionuclide transport by upward advection or upward diffusion is believed to be insignificant at these low ambient water contents because of the extremely small unsaturated hydraulic conductivities expected. Modeling of infrequent infiltration events suggests that precipitation rarely travels deeper than 0.3 m beneath the surface, scarcely penetrating the alluvium. Therefore, the infrequent existence of wetter conditions in the near surface is not expected to enhance radionuclide transport.

The arid nature of the site also affects potential land use. The land surrounding the NTS remains mostly uninhabited because of limited water resources and government ownership. The population density of the surrounding counties is only 0.5 persons km^{-2} , much less than the 28 persons km^{-2} reported for the lower 48 states. Agriculture in Nevada is limited by the arid climate, infertile soils, and mountainous topography. Only 2.1 percent of the total land area in southern Nevada is used for agriculture. Production of livestock is the most common agricultural activity, accounting for approximately 90 percent of the land in farms. No economically significant mineral resources are known to exist within the vicinity of the Area 5 RWMS. Future development of Frenchman Flat appears unlikely assuming current land use patterns continue.

LONG-TERM SITE PERFORMANCE

The performance assessment has evaluated exposure scenarios for members of the general public and for hypothetical inadvertent intruders. Exposure scenarios for the general public

provide a reasonable, yet conservative, estimate of the performance of the undisturbed site. Intruder scenarios are hypothetical events evaluated to set conservative waste concentration limits.

Release and Pathway Scenarios for the General Public

Two exposure scenarios for the general public were developed based on current land use patterns in southern Nevada. The first scenario, the transient occupancy scenario, assumes that members of the general public visit the site for recreational or commercial activities, but do not permanently reside near the site. The second scenario, the open rangeland scenario, assumes that a ranch has been established at the nearest available site with water and that range fed cattle have access to the closed disposal site.

The dose to the general public under the assumptions of the transient occupancy scenario was estimated for a screened list of non-volatile radionuclides at 100 years, 10,000 years, and at the time of the maximum dose. In the first 10,000 years after closure, the total effective dose equivalent (TEDE) from all non-volatile radionuclides would be less than 1 mrem yr⁻¹ to a person spending up to 2,000 hours per year at the Area 5 RWMS. The dose is mostly due to external exposure from the short-lived progeny of ²²⁶Ra and inhalation of ²³⁸U. Since estimated doses are linear in time of occupancy, it is possible to estimate the dose per hour spent at the site. Individuals visiting the site 10,000 years after closure are expected to receive a TEDE of approximately 3×10^{-4} mrem for each hour spent at the site.

The release of volatile radionuclides was evaluated separately. These calculations were done under the extremely conservative assumption that gaseous radionuclides were released at a maximum rate, based on diffusion in the air-filled pores and diluted into a 2 m atmospheric mixing zone. The TEDE from ³H, ¹⁴C, and ⁸⁵Kr combined was less than 0.01 mrem yr⁻¹ at 100 years.

Doses were evaluated under the assumptions of the open rangeland scenario for two offsite locations with water resources, Indian Springs and Cane Springs. The maximum TEDE within the 10,000-year compliance interval was less than 0.2 mrem yr⁻¹ and occurred at 10,000 years. The doses at the two offsite locations are approximately equal because most of the dose is attributable to ingestion of beef and milk produced at the Area 5 RWMS. Approximately 85 percent of the dose at 10,000 years is attributable to the ingestion of ²³⁸U, ²³⁴U, and ²¹⁰Pb and its short-lived progeny in milk.

Volatile radionuclides were again evaluated separately. Volatile radionuclides were assumed to be released from the site by diffusion and advected through the atmosphere to the offsite location. Due to the great dilution, the TEDE is much smaller than $0.001 \text{ mrem yr}^{-1}$.

The radon flux was estimated for two inventories, the average inventory disposed of by shallow land burial and the estimated inventory for Pit 6. Pit 6 is expected to receive thorium wastes that have the potential to generate ^{222}Rn as ^{230}Th decays. The thorium is destined for a deeper or lower cell. Routine low-level waste (LLW) will be disposed of in the upper cell.

The flux of ^{222}Rn released from the disposal site was assumed to be directly proportional to the activity concentration of ^{226}Ra in the buried wastes. For the shallow land burial inventory, the activity concentration of ^{226}Ra will increase very slowly over the next 10,000 years, not reaching a peak for several million years. The predicted flux remains below the performance objective of $20 \text{ pCi m}^{-2} \text{ s}^{-1}$ throughout the 10,000-year compliance interval. The flux exceeds the performance objective in approximately 30,000 years and reaches a peak of $156 \text{ pCi m}^{-2} \text{ s}^{-1}$ in 3.5×10^6 years.

The ^{226}Ra inventory in the lower cell of Pit 6 will increase and reach a maximum within 10,000 years. The activity concentration in the upper cell was assumed to be equal to the average shallow land burial activity concentration. The increased depth of burial of the thorium waste effectively attenuates the radon flux. Consequently, the Pit 6 radon flux is predicted to be the same as for the shallow land burial inventory.

The results for the release and pathway scenarios evaluated to estimate doses to members of the general public are summarized in Table 1.

Table 1. Performance assessment results for members of the general public.

Performance Objective	Performance Assessment Result
25 mrem yr ⁻¹ from All Pathways	0.6 mrem yr ⁻¹
10 mrem yr ⁻¹ from Airborne Emissions Excluding Radon	0.2 mrem yr ⁻¹
Average Annual ^{222}Rn Flux Less Than $20 \text{ pCi m}^{-2} \text{ s}^{-1}$	6 pCi m ⁻² s ⁻¹
Protect Groundwater Resources	Zero Release to Aquifer in 10,000 Years

The performance assessment results in Table 1 provide reasonable assurance of compliance with the performance objectives for members of the general public. The two scenarios considered, the transient occupancy scenario and the open rangeland scenario, could involve exposure of the same individuals. The TEDE for the two scenarios combined is less than 1 mrem yr⁻¹, well below the 25 mrem yr⁻¹ performance objective.

Intruder Scenarios

Intruder scenarios are hypothetical events analyzed to set activity concentration limits for wastes suitable for disposal in the near surface. Three intruder analyses, one acute and two chronic, were analyzed. They were the drilling scenario (acute), the intruder-agriculture scenario (chronic), and post-drilling scenario (chronic).

The drilling scenario is a short-term exposure scenario, where an intruder is exposed to contaminated drill cuttings while drilling a water well at the site. An inadvertent intruder drilling through a shallow land burial trench or pit is estimated to receive a TEDE of 0.15 mrem at 100 years and 0.17 mrem at 10,000 years.

The intruder-agriculture scenario is a chronic exposure scenario where an intruder is assumed to reside on a contaminated zone created during the excavation of a basement. The intruder is assumed to produce fruit, vegetables, meat, and milk within the contaminated zone. Twenty-five percent of the intruder's diet is assumed to be produced onsite within the contaminated zone.

The TEDE received by an intruder under the assumptions of the intruder-agriculture scenario at 100 years was estimated to be 84 mrem yr⁻¹. Inhalation and external irradiation are the most important pathways, contributing 81 percent of the dose. Ingestion doses from agricultural pathways were only a few percent of the total dose throughout the analysis interval. By 10,000 years, the estimated TEDE increases to 157 mrem yr⁻¹ as the activity concentration of progeny of ²³⁸U and ²³⁵U increases. The increasing dose is due largely to external irradiation from ²²⁶Ra and its short-lived progeny. Reasonable assurance of compliance with the performance objective can be obtained by increasing the thickness of the closure cap from 2.4 m to 4.0 m, thereby eliminating the possibility of a construction excavation reaching the buried waste.

The intruder post-drilling scenario assumes that an intruder builds a residence on an area contaminated with drill cuttings from the disposal site. As in the intruder-agriculture scenario, the intruder produces meat, milk, fruit, and vegetables within the contaminated zone.

The estimated TEDE at 100 years was 0.70 mrem yr⁻¹ for a post-drilling intruder penetrating a shallow land burial trench. At 10,000 years the dose increases to 0.71 mrem yr⁻¹, again due to external irradiation from ²²⁶Ra and its short-lived progeny.

A single pit (Pit 6) has been modified to accept a thorium waste stream. The pit has been excavated to a greater depth to allow burial of the thorium waste in a deeper or lower cell. The greater depth of burial was required to attenuate radon fluxes and reduce the potential for intrusion. However, since the depth of burial does not eliminate the potential for drilling intrusion, the estimated Pit 6 inventory was analyzed in the post-drilling scenario as a special case. The estimated TEDE at 100 years was 163 mrem yr⁻¹. The thorium waste in the lower cell contributes 99 percent of the dose. By 10,000 years, the TEDE is predicted to increase to 178 mrem yr⁻¹, due to external irradiation from ²²⁶Ra and its short-lived progeny produced by the radioactive decay of ²³⁰Th.

The inventory assumed for Pit 6 was found to exceed the performance objective when analyzed in the post-drilling scenario. The analysis did not meet the performance objective because of the concentration of ²³²Th assumed for the lower cell. This analysis used an estimated inventory based on the average concentration of wastes already received. A thorium inventory of 174 Ci for Pit 6 will assure compliance with the performance objective. Since only 18 Ci have been received to date, imposition of an inventory limit for Pit 6 can assure compliance. The results of intruder scenario analyses are presented in Table 2.

Table 2. Performance assessment results for intruder scenarios. Results are based on current waste management practices or assumed inventories.

Performance Objective	Performance Assessment Result	
	Shallow Land Burial	Pit 6 (PO6U)
Acute Scenario: 500 mrem Drilling	0.2 mrem	23 mrem
Chronic Scenario: 100 mrem yr ⁻¹ Agriculture Post-Drilling	157 mrem yr ⁻¹ 0.7 mrem yr ⁻¹	NA 178 mrem yr ⁻¹

NA - Scenario not applicable

The results in Table 2 indicate that there is currently reasonable assurance of compliance with the performance objectives for intruders, except for the intruder-agriculture scenario and for the post-drilling scenario analyzed for the inventory assumed for Pit 6. Reasonable assurance of compliance for the intruder-agricultural scenario can be obtained by requiring a final closure cap of at least 4 m. Compliance in the future can be assured by development of waste acceptance criteria based on performance assessment results. Implementation of an inventory for waste disposed in Pit 6 in the future can assure compliance with the post-drilling scenario for this waste disposal unit.

Comparison of Selected DOE and Non-DOE Requirements, Standards, and Practices for Low-Level Radioactive Waste Disposal

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ABSTRACT

This document results from the Secretary of Energy's response to Defense Nuclear Facilities Safety Board Recommendation 94-2. The Secretary stated that the U.S. Department of Energy (DOE) would "address such issues as...the need for additional requirements, standards, and guidance on low-level radioactive waste management." The authors gathered information and compared DOE requirements and standards for the safety aspects of low-level radioactive waste disposal with similar requirements and standards of non-DOE entities.

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Comparison of Selected DOE and Non-DOE Requirements, Standards, and Practices for Low-Level Radioactive Waste Disposal

1. INTRODUCTION

In 1988, the U.S. Congress established the Defense Nuclear Facilities Safety Board (DNFSB) to provide independent oversight relative to the design, construction, operation, and decommissioning of certain defense nuclear facilities of the U.S. Department of Energy (DOE). On September 8, 1994, the DNFSB issued Recommendation 94-2, "Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites." In response, by letter dated October 28, 1994, the Secretary of Energy accepted Recommendation 94-2 and stated that the DOE would "address such issues as ... the need for additional requirements, standards and guidance on low-level radioactive waste management."

On March 31, 1995, the Secretary of Energy issued the DNFSB Recommendation 94-2 Implementation Plan, which outlines the actions DOE will take to respond to the recommendations. Section VI of the Implementation Plan commits DOE to perform several tasks, one of which is Task B.6, "Review Commercial and International Standards and Requirements and Compare to DOE Standards and Requirements."

This report was prepared to fulfill task VI.B.6. To accomplish this, contributors gathered information and compared DOE requirements and standards for the safety aspects of the disposal of low-level radioactive waste (LLW) with similar non-DOE requirements and standards, and highlighted the differences. The non-DOE requirements are those applicable to licensees of the Nuclear Regulatory Commission (NRC) or Agreement States. These facilities are generally located on government-owned land and operated by commercial entities. This report is not intended to offer a judgment about whether one method is better than another.

In comparing regulatory systems the term "standards" cannot easily be distinguished from the term "requirements." Therefore, to avoid confusion, the term "standards" is not normally used in this document. For purposes of this document, "requirements" include both mandated actions and standards imposed by DOE-Headquarters (DOE-HQ), the NRC, or Agreement States. The term "practices" refers to the approaches taken by individual DOE field offices or by state licensees to meet technical requirements. An example of a practice is the use of a specific computer code (in lieu of others that are available) for performance assessment work to calculate dose to the most exposed individual.

The scope of the review includes the comparison of safety-related topics found in the following types of documents:

- NRC regulations and guidance
- Agreement State requirements

- DOE orders and guidance
- Non-DOE license conditions and requirements
- Disposal facility waste acceptance criteria
- International programs such as the International Atomic Energy Agency (IAEA) Radioactive Waste Safety Standards (RADWASS)
- Site-specific performance assessment (PA) documents.

Section 2 of this report provides background information and a brief history of NRC and DOE LLW disposal activities. Section 3 describes the method used for selecting the topics for comparison and the criteria for identifying differences. Section 4 summarizes the differences that were found by comparing the requirements, guidance, or practices for the different topics. The appendices contain more detailed comparisons from which many of the differences were derived. Some of the differences were observed while reviewing documents such as disposal facility licenses and publications discussing disposal practices at facilities outside the United States.

Information on IAEA requirements, guidance, and practices was obtained by review of a list of IAEA documents from an IAEA Order Form for Radioactive Waste Management Publications, dated January 1995. Twelve older IAEA documents (dated 1965 to 1989) were obtained locally and reviewed. These consisted of eight Safety Series, two Technical Report Series, and proceedings from two symposia. The authors decided that appropriate documents for use in this report would come from the RADWASS series of international consensus documents, which are designed to make more evident the agreements by member countries regarding approaches to establishing safety. Of 24 planned RADWASS documents that might have been appropriate for this comparison, only two were available, *Classification of Radioactive Waste, A Safety Guide*, Safety Series No. 111-G-1.1, dated 1994,¹ and *Siting of Near Surface Disposal Facilities*, Safety Series No. 111-G-3.1, dated 1994.² Some information from these two documents was used in this report. Other RADWASS documents are currently pending approval or scheduled for later publication.