

**Department of Energy**

Washington, DC 20585

February 17, 1999

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DNF SAFETY BOARD

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, DC 20004

John
Dear Mr. Chairman:

Enclosed is the Department of Energy's Annual Report of activities related to the implementation of Recommendation 97-1, *Safe Storage of Uranium-233*. This report, covering the period January 1–December 31, 1998, presents the status of actions and milestones associated with the 97-1 Implementation Plan and describes activities underway to address issues associated with uranium-233 storage.

If I can be of further assistance concerning matters relating to Recommendation 97-1, please contact me or have your staff contact Mr. John C. Tseng, Director, Nuclear Materials Stewardship Program Office at 301/903-4482.

Sincerely,

A handwritten signature in cursive script, reading "David G. Huizenga".

David G. Huizenga
Acting Deputy Assistant Secretary for
Nuclear Material and Facility Stabilization
Office of Environmental Management

Enclosure



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**Implementation of
Defense Nuclear Facilities Safety Board
Recommendation 97-1**

Annual Report 1998

Prepared by the
Nuclear Materials Stewardship Program Office
Office of Environmental Management
U. S. Department of Energy

RECOMMENDATION 97-1: EXECUTIVE SUMMARY

Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 97-1, *Safe Storage of Uranium-233*, issued on March 3, 1997, addressed the need for the Department of Energy to safely and systematically stabilize and store its inventory of Uranium-233 (U-233).¹ This is the second annual update of the status of actions committed to in the Implementation Plan in response to Recommendation 97-1.

The Department has an inventory of approximately two metric tons of U-233 in many different forms stored in a variety of packages throughout the complex. Due to inherent radiation from the U-233 and trace amounts of U-232, many of these packages have not been inspected for years, and their condition is unconfirmed. The majority of the U-233 material is located at the Oak Ridge National Laboratory and the Idaho National Engineering and Environmental Laboratory, with significantly lesser quantities at Los Alamos National Laboratory. Even smaller quantities of material exist as oxides, metal, solutions and fluorides at numerous other sites.

The primary safety issue addressed in the 97-1 Implementation Plan is the lack of material characterization and uncertainty of maintaining safe storage conditions for U-233. There are a total of 18 commitments in the Plan that will ensure characterization and stabilization of U-233 materials and development of a strategy for extending the safe storage of U-233 until final disposition. Fourteen of the 18 commitments have been submitted to the DNFSB as of December 1998, and one is overdue. Table ES-1 summarizes the status of the plan commitments.

In October 1998, the Department proposed a formal change to the 97-1 Implementation Plan. The System Design Document, (Commitment 16) will be included as part of the Program Execution Plan (Commitment 17) instead of being developed as a separate deliverable. The Program Execution Plan will be updated periodically to reflect changes to the U-233 system design resulting from future program activities and decisions.

¹The Secretary accepted Recommendation 97-1 on April 25, 1997, and an Implementation Plan was sent to the Board on September 29, 1997. The Board accepted the Plan on October 21, 1997.

Table ES-1: Status of Commitments in the 97-1 Implementation Plan
(Continued on next page)

97-1 Implementation Plan Commitment	Commitment Description	Due Date	Status
6.3.1 Commitment 1: Develop U-233 waste threshold criteria	Specific threshold criteria to differentiate between U-233 material which can be accepted into the waste streams from U-233 material which is subject to this IP will be developed.	May 1998	Submitted
6.3.2 Commitment 2: Develop the draft U-233 Safe Storage Standard	A Department Standard for interim and long-term packaging and storage of U-233 will be developed to guide actions for assessing adequacy of current packages and for stabilization and repackaging.	April 1998	Submitted
6.3.3 Commitment 3: Develop the final U-233 Safe Storage Standard	A Department Standard for interim and long-term packaging and storage of U-233 will be finalized.	September 1998	Submitted
6.3.4 Commitment 4: Prepare LANL initial Site Assessment Report	Los Alamos National Laboratory will conduct the near-term assessments described in Sections 6.2.3 and 6.2.4. A technical status report will be prepared summarizing information developed from its assessments and initial inspections.	December 1997	Submitted
6.3.5 Commitment 5: Prepare ORNL initial Site Assessment Report	Oak Ridge National Laboratory will conduct the near-term assessments described in Sections 6.2.3 and 6.2.4. A technical status report will be prepared summarizing information developed from its assessments and initial inspections.	March 1998	Submitted
6.3.6 Commitment 6: Prepare INEEL initial Site Assessment Report	Idaho National Engineering and Environmental Laboratory will conduct the near-term assessments described in Sections 6.2.3 and 6.2.4. A technical status report will be prepared summarizing information developed from its assessments and initial inspections.	March 1998	Submitted
6.3.7 Commitment 7: Prepare LANL final Site Assessment Report	Los Alamos National Laboratory will finalize its initial site assessment as described in Sections 6.2.5 and will identify if any remedies to observed shortfalls are needed in addition to those as listed in Section 6.2.6.	December 1998	Submitted
6.3.8 Commitment 8: Prepare ORNL final Site Assessment Report	Oak Ridge National Laboratory will finalize its initial site assessment as described in Sections 6.2.5 and will identify if any remedies to observed shortfalls are needed in addition to those as listed in Section 6.2.6.	June 1999	On schedule
6.3.9 Commitment 9: Prepare INEEL final Site Assessment Report	Idaho National Engineering and Environmental Laboratory will finalize its initial site assessment as described in Sections 6.2.5 and will identify if any remedies to observed shortfalls are needed in addition to those as listed in Section 6.2.6.	December 1998	Submitted

97-1 Implementation Plan Commitment	Commitment Description	Due Date	Status
6.3.10 Commitment 10: Prepare Small Holdings Sites Assessment Report	The Department intends to consolidate U-233 material currently stored at a number of small holdings sites to the larger holdings site(s). If this consolidation is not complete prior to the end of 1998, then the Director of the NMSTG will prepare a technical report summarizing information developed from assessments and initial inspections at the small holdings sites.	December 1998	Submitted
6.3.11 Commitment 11: Document long-term disposition alternatives for U-233	An ongoing study of utilization and disposition options for excess U-233 will be issued as input for the SE analysis.	January 1998	Submitted
6.3.12 Commitment 12: Technical Competency	The ongoing Department actinide programs with technical expertise applicable to the U-233 Safe Storage Program will be documented.	January 1998	Submitted
6.3.13 Commitment 13: Technical Data Book	A technical data book will be assembled for future reference documenting the knowledge base gained through past U-233 operations.	April 1999	On schedule.
6.3.14 Commitment 14: Building 3019 Alternatives Trade Study	A trade study will be completed in order to evaluate Building 3019 at Oak Ridge and other possible storage facilities.	September 1998	Submitted
6.3.15 Commitment 15: Develop system requirements for U-233 Safe Storage System	The requirements for the U-233 Safe Storage System will be included in the SRD, a key product of the SE process.	March 1998	Submitted
6.3.16 Commitment 16: Develop a system design description for interim and long-term storage of U-233	During the interim, before a permanent system is designed and developed to utilize, store, and/or dispose of the Department's inventory of U-233, existing U-233 storage conditions will be assessed and upgraded as necessary. Some U-233 materials will be relocated and consolidated, as a desirable alternative to upgrading several different facilities.	October 1998	This commitment was changed to be included in the Program Execution Plan (October 22, 1998 letter from Under Secretary Moniz to Board Chairman Conway).
6.3.17 Commitment 17: Develop a multi-year program plan for implementation of the selected system design	As a key product of the SE process, the PEP will be produced, delineating in detail the organization, control system, work breakdown structure, task definitions, multi-year schedule, and resources required to safely conduct life-cycle management of the Department's U-233 inventories.	December 1998	Overdue
6.3.18 Commitment 18: Prepare annual reports	The Department will provide annual reports to the Board which will be submitted with the Board Recommendation 94-1 annual reports.	January 1998, then annually thereafter	First report transmitted to the Board in January 1998. This is the second report.

SECTION TWO: RECOMMENDATION 97-1

I. SECOND YEAR STATUS

Overall Progress

The 97-1 Implementation Plan describes a total of 18 commitments. Of these, eleven commitments were completed on time, three were completed late and one is overdue as of December 1998.

II. ACTIVITIES

A. Site-Specific Activities

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is storing the ceramic fuel materials from the Light Water Breeder Reactor program. This material includes irradiated spent fuel as well as an unirradiated fuel assembly, fuel rods, pellets, scrap from the fuel fabrication process and process wastes. The fuel assembly and the fuel rods are stored in below grade sealed vaults at the Idaho Nuclear Technology and Engineering Center (formerly the Idaho Chemical Processing Plant). Most of the pellets are stored in standard shipping containers that met the Department of Transportation (DOT-6M) specifications at the time the drums were shipped to the Radioactive Waste Management Complex (RWMC) at INEEL.

All near term actions described in the 97-1 Implementation Plan were completed in 1997. Ongoing inspections of storage conditions, including visual inspections and gas sampling of half of the underground storage vaults in which U-233 fuel materials are stored, were completed in July 1998. No contamination was found that would be indicative of leaking fuel. The visual inspection of the vault walls and the containers did not indicate that there had been any significant corrosion. These inspections have been an annual requirement since this material was placed in these vaults.

The material stored at the RWMC was consolidated into the storage building, in late 1997. Several of the drums were opened and the internal DOT-2R container examined. Minor corrosion was noted on some of the exterior surfaces of some of the drums. No contamination or degradation of the inside or outside surfaces of the DOT-2R container or on the inside surface of the DOT-6M drums was noted. In addition, twelve of the drums were examined by x-ray tomography. No unusual conditions were observed during this inspection.

Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is storing over 1,000 packages of separated U-233 and mixed U-233/U-235 primarily in the form of oxides. Metals and fluorides are also in storage. The packages are stored in vertical tube vaults contained within heavily shielded hot cells in Building 3019, a pilot reprocessing facility. The material is contained in a variety of storage packages derived from numerous research and development programs with U-233 over the past 40 years. The primary safety concern is that most of the packages have not been inspected for many years or decades. Hence the condition of the packages is uncertain. The ORNL Site Assessment activity determined from direct radiation and smear samples that off-gas lines in the storage vaults in Building 3019 are uncontaminated. This preliminary information indicates that packages, some of which have been stored for more than 30 years, have maintained their gross integrity. Gas sampling equipment has been installed in the off-gas system to further test storage vaults for hydrogen and mobile radionuclides, such as Rn-220, a decay product in the U-232 chain. These results also did not indicate failures in the stored packages. A natural phenomena hazard analysis has been completed to assess the acceptability of current ventilation and structural systems in Building 3019. Package handling equipment is being installed to enable sampling, inspection and repackaging of U-233 materials and packages. Consolidation of small holdings of U-233 from other sites at ORNL is being evaluated. A National Environmental Policy Act review of consolidation at ORNL determined that this action is part of an ongoing activity and mission of the U-233 National Repository at ORNL to ship, receive, and store U-233.

Los Alamos National Laboratory

With the exception of completing its Final Site Assessment report (submitted to the Safety Board in January 1999), there has been little activity related to Recommendation 97-1 at Los Alamos National Laboratory due to operational stand-downs at both the Chemical Metallurgy Research (CMR) and TA-18 buildings. CMR is currently fully functional, and TA-18 is approaching that point. Because of the changes in operating conditions and requirements, LANL has not been able to move the U-233 from TA-18 to CMR. Los Alamos is currently reevaluating this move based on the new CMR BIO. No impact on the CMR safety envelope is anticipated, and the move should be completed in two months.

In preparation for moving the material from TA-18, a radiography study of the material packaging was completed. The results of this study did not identify any critical safety concerns. However, it did provide information regarding the contents of each package. Many of the larger packages contain a variety of smaller containers. The smaller containers were identified as being glass, plastic, and metal containers. This information will be used when opening the containers for repackaging. It is now known that these contain packaging material not suitable for storage of U-233.

A neutron streaming study was also completed on the floor hole storage array in the CMR building. This was done to verify that the material to be stored in the floor holes will be adequately shielded to minimize radiation fields outside of the storage locations. It was also used to ensure that there would be no interaction of radiation fields between each storage location. The results of this study confirmed that these locations are suitable for storage of U-233. The radiation field measurements on top of the storage location were only background, indicating that there should be no transient personnel dose from storage of material in these locations. Hole to hole neutron measurements were taken at a variety of depths ranging from unshielded readings at the top of the hole to readings at the bottom of the hole. The readings observed were approximately 1 mr/hr at the top to 300 mr/hr at the bottom of the hole. Gamma radiation readings were only taken at floor level, and no readings above background were observed. This does not raise any concern for storage of U-233 in these locations.

Sites With Small U-233 Holdings

Initially it was believed that nearly 25 sites have small quantities of in-scope U-233 in their facilities. During 1998, an evaluation of these sites' inventories determined that 13 have in-scope quantities of U-233. The total amount at these sites is less than 5 kg and typically less than 50 g at each site. An inventory and assessment of the integrity of packaging of this material has begun. Material that is surplus to a site's requirements will be sent to either INEEL, ORNL or an applicable waste repository.

B. Other Activities

The Implementation Plan for Recommendation 97-1

The primary safety issue addressed in the Implementation Plan is the lack of material characterization and uncertainty of maintaining safe storage conditions for U-233.

The Department is using a systems engineering approach to establish a long-term solution to problems associated with safe U-233 storage throughout the complex. Driver requirements were defined in the System Requirements Document, provided to the Board in June 1998. A system design and program execution plan delineating in detail the organization, control system, work breakdown structure, task definitions, multi-year schedule and resources required to safely conduct life-cycle management of the U-233 material is being developed. This systems engineering process helps to ensure that the recommended approach is effective, can be accomplished in a reasonable time frame, incurs no unacceptable risk, and can be accomplished at a defensible cost.

Other implementation plan commitments completed in 1998 include:

- Technical Competency Report detailing the U-233 expertise available to the Department, provided to the Board in January 1998.

- U-233 Storage Standard, developed by the 97-1 Technical Team and provided to the Board in October 1998. A draft of this standard was provided to the Board in April 1998 as a separate deliverable.
- Report, "U-233 Waste Definition: Disposal Options, Safeguards, Criticality Control, and Arms Control" differentiating between U-233 material that can be accepted into the waste streams from U-233 material that is subject to the 97-1 Implementation Plan; provided to the Board in July 1998.
- Initial Site Assessments for Idaho and Oak Ridge; provided to the Board in March 1998.
- Building 3019 Alternatives Trade Study; final report provided to the Board in October 1998.
- Strategy for Future Use and Disposition of U-233; provided to the Board in January 1998.
- Final site assessment for INEEL; provided to the Board in December 1998.
- Final site assessment for LANL; submitted to the Board in early January 1999.
- Report on sites with small U-233 holdings; provided to the Board in early January 1999.