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**PLUTONIUM STORAGE  
AT THE  
DEPARTMENT OF ENERGY'S  
SAVANNAH RIVER SITE**

**1<sup>st</sup> ANNUAL REPORT  
TO CONGRESS**

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**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**



**JUNE 2004**

John T. Conway, Chairman  
A.J. Eggenberger, Vice Chairman  
John E. Mansfield  
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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 28, 2004

To the Congress of the United States:

Congress required the Defense Nuclear Facilities Safety Board (Board) and the Secretary of Energy to submit to Congress reports on the actions taken by the Secretary of Energy in response to the proposals made in the Board's study *Plutonium Storage at the Department of Energy's Savannah River Site*, dated December 1, 2003. The first report was to be provided not later than 6 months after submission of the study (Section 3183(d) of the Defense Authorization Act for Fiscal Year 2003) and every year thereafter.

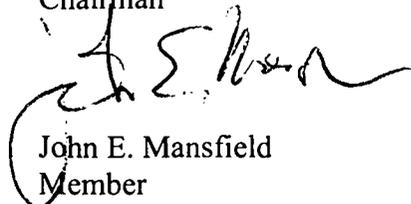
Herewith is the Board's first annual report on the Department of Energy's (DOE) actions on the Board's proposals as required. For the most part, the Board believes that DOE has initiated actions to begin to address the Board's proposals. Since these actions will not be complete until later this year, it is premature to evaluate whether DOE will agree with and implement the Board's proposals.

While DOE is addressing the specific proposals in the Board's study, in the Board's view the Secretary of Energy should take a more encompassing view of the current situation with regards to the disposition and storage options for the country's excess plutonium inventory. In its December 1, 2003 report to Congress, the Board proposed that DOE complete a study to evaluate options for plutonium storage at the Savannah River Site. This proposal was intended to achieve a broad perspective on plutonium disposition and storage.

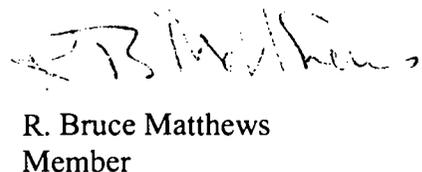
For extended storage, consolidation of excess plutonium into a single, robust facility specifically designed for storage is logical from a safety, security, and economic perspective. The Board believes that DOE should explore alternatives (including a new facility or processing options to reduce storage requirements) that limit the use of multiple old facilities.

Respectfully submitted,

  
John T. Conway  
Chairman

  
John E. Mansfield  
Member

  
A. J. Eggenberger  
Vice Chairman

  
R. Bruce Matthews  
Member

Enclosure

## PREFACE

### DEFENSE AUTHORIZATION ACT OF FISCAL YEAR 2003 PUBLIC LAW 107-314

#### SEC. 3183. STUDY OF FACILITIES FOR STORAGE OF PLUTONIUM AND PLUTONIUM MATERIALS AT SAVANNAH RIVER SITE.

(a) STUDY.—The Defense Nuclear Facilities Safety Board shall conduct a study of the adequacy of the K-Area Materials Storage facility (KAMS), and related support facilities such as Building 235-F, at the Savannah River Site, Aiken, South Carolina, for the storage of defense plutonium and defense plutonium materials in connection with the disposition program provided in section 3182 and in connection with the amended Record of Decision of the Department of Energy for fissile materials disposition.

(b) REPORT.—Not later than one year after the date of the enactment of this Act, the Defense Nuclear Facilities Safety Board shall submit to Congress and the Secretary of Energy a report on the study conducted under subsection (a).

(c) REPORT ELEMENTS.—The report under subsection (b) shall—

(1) address—

(A) the suitability of KAMS and related support facilities for monitoring and observing any defense plutonium or defense plutonium materials stored in KAMS;

(B) the adequacy of the provisions made by the Department for remote monitoring of such defense plutonium and defense plutonium materials by way of sensors and for handling of retrieval of such defense plutonium and defense plutonium materials; and

(C) the adequacy of KAMS should such defense plutonium and defense plutonium materials continue to be stored at KAMS after 2019; and

(2) include such proposals as the Defense Nuclear Facilities Safety Board considers appropriate to enhance the safety, reliability, and functionality of KAMS.

(d) REPORTS ON ACTIONS ON PROPOSALS.—Not later than 6 months after the date on which the report under subsection (b) is submitted to Congress, and every year thereafter, the Secretary and the Board shall each submit to Congress a report on the actions taken by the Secretary in response to the proposals, if any, included in the report.

## EXECUTIVE SUMMARY

### DEPARTMENT OF ENERGY'S PLUTONIUM DISPOSITION PROGRAM

In its study *Plutonium Storage at the Department of Energy's Savannah River Site*, dated December 1, 2003, the Defense Nuclear Facilities Safety Board (Board) proposed that the Department of Energy (DOE) expedite the development of a complete, well-considered plan for the disposition of all excess plutonium to preclude unnecessary extended storage of plutonium at that site. The Board also proposed that DOE conduct a new study of available options for the storage of plutonium at the Savannah River Site (SRS).

***Status of DOE Actions.*** DOE has been developing a disposition plan to vitrify excess plutonium using a modified facility at SRS. DOE advises that this disposition plan is still in the early conceptual design stage and not yet ready to be evaluated.

DOE recently directed its Savannah River Operations Office (DOE-SR) to update the study of available options for the storage of plutonium at SRS. DOE-SR believes this updated study will reach the same conclusions as the plutonium storage study completed in 2000 since similar assumptions would be made with regard to near-term disposition of excess plutonium. In updating the study, DOE-SR expects to evaluate a 5 year delay in startup of disposition paths. The Board believes sensitivity to even longer delays should be considered. The study should be completed as soon as possible to avoid expending resources on evaluations and upgrades to facilities that may not be used.

### SUITABILITY OF FACILITIES

As currently identified by DOE, two facilities would be used for extended storage of plutonium at SRS, the K-Area Materials Storage facility and Building 235-F. Both facilities are 50-year-old facilities that currently do not meet modern safety standards.

***Status of DOE Actions.*** DOE-SR has directed the contractor to start evaluations needed to address the Board's proposals. Since most of the evaluations will not be completed until later this year, it is too early to determine whether DOE will implement actions proposed by the Board.

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## **1. INTRODUCTION**

### **1.1 CONGRESSIONAL MANDATE TO THE DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

In Section 3183 of the National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314),<sup>1</sup> Congress directed the Defense Nuclear Facilities Safety Board (Board) to conduct a study of the adequacy of the K-Area Materials Storage facility (KAMS) and related support facilities at the Savannah River Site (SRS) in South Carolina, in which the Department of Energy (DOE) proposes to store defense plutonium and defense plutonium materials. The Board was required to address suitability of KAMS and related support facilities for monitoring and observing plutonium materials stored in KAMS, the adequacy of provisions made for remote monitoring and for retrieval of material, and the adequacy of KAMS for plutonium storage beyond the year 2019. Congress also required that the Board include in its report proposals the Board considered appropriate to enhance the safety, reliability, and functionality of KAMS.

### **1.2 BACKGROUND**

A lack of consistent planning has forced SRS to focus on what can be done with existing facilities, foreclosing consideration of other options that might have been more cost-effective and safety-conscious. Past DOE decisions concerning plutonium storage at SRS were based on a study<sup>2</sup> that is no longer consistent with present circumstances. The DOE storage plans were based on the assumption that planned immobilization and mixed-oxide fuel (MOX) facilities would provide a then near-term disposition path for all the excess plutonium metal and oxide. Accordingly, in 2001 site plans changed from having one new, state-of-the-art facility for stabilization, packaging, and storage of materials to using multiple 50-year-old facilities.

The current DOE plutonium disposition plan depends on successful licensing, construction, and operation of the MOX Fuel Fabrication Facility for disposal of the bulk of excess plutonium. However, the planned immobilization plant has been canceled. Disposition plans for approximately 5 metric tons of excess plutonium have yet to be identified by DOE.

Although KAMS is a 50-year-old facility, the Board considers it to be a robust structure that can be made suitable for extended storage of plutonium. Fires are the most significant accidents of concern in the facility, yet it lacks fire protection systems. Building 235-F (235-F), also a 50-year-old facility, does not meet current safety standards and will require substantial upgrades before it is suitable for extended storage of plutonium. The Board believes that DOE should continue to remove plutonium currently stored in 235-F and should not plan to use this facility for extended storage of plutonium until proposals in the Board's study have been implemented.

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<sup>1</sup> See the appendix for the statutory text of Sections 3181, 3182, and 3183.

<sup>2</sup> Reference 1.

## 2. DEPARTMENT OF ENERGY'S ACTIONS ON THE BOARD'S PROPOSALS

This section presents the status of and the Board's observations on actions being taken by DOE to address the Board's proposals for enhancing the safety, reliability, and functionality of plutonium storage facilities at SRS. Information on the status of DOE's actions is based on discussions between the Board's staff and representatives of DOE-Headquarters, on-site discussions with personnel at DOE's Savannah River Operations Office (DOE-SR), and the site contractor. While conducting its study, the Board identified safety issues it believed should be brought to DOE's attention before completion of the study. The Board notified DOE of those issues in advance of issuing the study report.<sup>4</sup> DOE's responses to the Board's comments were also considered in compiling the information that follows.<sup>5</sup>

### 2.1 PLUTONIUM DISPOSITION PROGRAM

**Proposal 1. Expedite the development of a complete, well-considered plan for the disposition of all excess plutonium to preclude unnecessary extended storage at SRS.**

It is important for DOE to establish a firm, technically feasible disposition path for excess plutonium not planned for use in MOX fuel. Without a clearly defined disposition path, plutonium storage in SRS facilities could be unnecessarily prolonged.

**Status.** DOE has been developing a disposition plan for its excess plutonium. The preliminary DOE disposition plan entails vitrifying plutonium in lanthanide borosilicate glass. As envisioned, DOE-SR would modify an existing facility at SRS by 2011 and operate it for about 6 years. The vitrified plutonium canisters would subsequently be encased in high-level waste containers in the Defense Waste Processing Facility and stored on site for eventual shipment to Yucca Mountain. An initial conceptual design for the modified facility is being prepared and is expected to be provided to DOE for approval in August 2004.

**Board's Observations.** DOE's preliminary disposition path appears to be a viable alternative; however, it is highly preliminary and years away from being realized. Major facility modifications would be needed and the processing and vitrification gloveboxes may not fit into some of the facilities being considered. An evaluation is needed to confirm that impure plutonium materials can be vitrified or adequately treated prior to vitrification. Safe storage of the excess plutonium for an extended period will still be needed.

Given the preliminary nature of the disposition path, DOE should explore alternatives including processing and disposal of plutonium materials utilizing existing facilities. For example, using HB-Line to process lower purity plutonium materials may be desirable.

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<sup>4</sup> References 3 and 4.

<sup>5</sup> References 5 and 6.

study should include a sensitivity analysis with regard to longer delays in the assumed disposition path. It may be prudent for DOE to assume that its excess plutonium will remain at the site indefinitely, instead of assuming it will be processed in the next 15 years. A longer-term approach would allow DOE to decide on the safest, most economical plan for storage of its excess plutonium while providing ample time to develop and implement a disposition path for these materials.

## **2.2 SUITABILITY OF FACILITIES**

### **K-Area Materials Storage Facility**

#### **Proposal 1. Install fire protection systems.**

Fires are the most prevalent accident scenarios of concern in KAMS, yet, the facility does not have a fire protection system. The Board believes DOE should establish an appropriate fire protection system—fire alarm and suppression or, alternatively, fire detection and alarm system with an enhanced firefighting capability.

**Status.** DOE is evaluating the fire protection needs for the KAMS facility. A new fire hazards analysis and documented safety analysis are being prepared to evaluate the planned extended plutonium storage in the facility. Although details have not been finalized, DOE intends to sponsor an independent review of these analyses to assess the fire protection situation and recommend any changes needed to provide adequate fire protection.

**Board's Observations.** The Board considers DOE's actions to be appropriate. The Board notes that any cost-safety benefit analysis performed to assist in determining appropriate actions must be based on well-founded cost estimates.

#### **Proposal 2. Eliminate unnecessary combustibles in KAMS.**

Abandoned cables in the actuator tower present a large combustible loading and fire risk. Rather than accommodate this fire risk as approved by DOE for the short-term storage mission, the Board believes it would be better to remove the abandoned cables, thereby eliminating the corresponding fire risk for the extended mission.

**Status.** DOE will evaluate the need to remove the abandoned cables in conjunction with preparation of the new fire hazards analysis discussed above.

**Board's Observations.** The Board considers DOE's action to evaluate this proposal appropriate. When evaluating the cost-safety benefit of removing these cables now, DOE should consider that these cables will most likely have to be removed when the facility is decommissioned.

**Board's Observations.** The Board considers DOE's action on this proposal to be appropriate.

**Proposal 4. Decontaminate unused process cells.**

One of the most significant hazards in 235-F results from the presence of extensive plutonium-238 contamination in process cells no longer in use. Since there is no future use for the process cells containing this holdup, the Board believes the hazard should be eliminated to enhance the safety of the facility.

**Status.** DOE has started evaluating options for removing plutonium-238 holdup, as well as for fixing the plutonium in place (e.g., by grouting or applying a fixative). A proposal for addressing this hazard will be finalized in conjunction with the new safety analysis at the end of 2004.

**Board's Observations.** The Board considers DOE's action on this proposal to be appropriate. Should DOE decide to fix the plutonium in place, agreements need to be obtained that such action provides an acceptable end state for decommissioning the facility. Fixing the plutonium-238 in place could increase the difficulty and risk of removal if it is decided the holdup must be removed.

**2.3 REMOTE MONITORING AND RETRIEVAL OF MATERIAL**

**Proposal 1. Develop and implement validated procedures for the handling and intrasite shipment of plutonium containers, including damaged containers.**

Transfer of a plutonium material container from KAMS to the planned receiving facility to correct a damaged container can not be accomplished using existing procedures. To preclude unnecessary delays in removing a damaged container from KAMS, the needed procedures should be developed and validated now to facilitate the transfer.

**Status.** DOE has developed and validated new procedures to allow for timely transfer of containers between KAMS and FB-Line. Similar procedures are to be provided for transfers between KAMS and 235-F before 235-F is designated as the receiving facility.

**Board's Observations.** The Board considers DOE's action on this proposal to be appropriate. The Board considers that DOE has completed all necessary actions concerning this proposal.

## APPENDIX

### PUBLIC LAW 107-314, SUBTITLE E—DISPOSITION OF WEAPONS-USABLE PLUTONIUM AT SAVANNAH RIVER, SOUTH CAROLINA, SECTIONS 3181, 3182, AND 3183

#### SEC. 3181. FINDINGS.

Congress makes the following findings:

(1) In September 2000, the United States and the Russian Federation signed a Plutonium Management and Disposition Agreement by which each agreed to dispose of 34 metric tons of weapons-grade plutonium.

(2) The agreement with Russia is a significant step toward safeguarding nuclear materials and preventing their diversion to rogue states and terrorists.

(3) The Department of Energy plans to dispose of 34 metric tons of weapons-grade plutonium in the United States before the end of 2019 by converting the plutonium to a mixed-oxide fuel to be used in commercial nuclear power reactors.

(4) The Department has formulated a plan for implementing the agreement with Russia through construction of a mixed-oxide fuel fabrication facility, the so-called MOX facility, and a pit disassembly and conversion facility at the Savannah River Site, Aiken, South Carolina.

(5) The United States and the State of South Carolina have a compelling interest in the safe, proper, and efficient operation of the plutonium disposition facilities at the Savannah River Site. The MOX facility will also be economically beneficial to the State of South Carolina, and that economic benefit will not be fully realized unless the MOX facility is built.

(6) The State of South Carolina desires to ensure that all plutonium transferred to the State of South Carolina is stored safely; that the full benefits of the MOX facility are realized as soon as possible; and, specifically, that all defense plutonium or defense plutonium materials transferred to the Savannah River Site either be processed or be removed expeditiously.

#### SEC. 3182. DISPOSITION OF WEAPONS-USABLE PLUTONIUM AT SAVANNAH RIVER SITE.

(a) PLAN FOR CONSTRUCTION AND OPERATION OF MOX FACILITY.—(1) Not later than February 1, 2003, the Secretary of Energy shall submit to Congress a plan for the construction and operation of the MOX facility at the Savannah River Site, Aiken, South Carolina.

(2) The plan under paragraph (1) shall include—

(A) a schedule for construction and operations so as to achieve, as of January 1, 2009, and thereafter, the MOX production objective, and to produce 1 metric ton of mixed-oxide fuel by December 31, 2009; and

amount of defense plutonium or defense plutonium materials equal to the amount of defense plutonium or defense plutonium materials transferred to the State of South Carolina after April 15, 2002.

(B) Each report under subparagraph (A) shall include an analysis of each option set forth in the report, including the cost and schedule for implementation of such option, and any requirements under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) relating to consideration or selection of such option.

(C) Upon submittal of a report under paragraph (A), the Secretary shall commence any analysis that may be required under the National Environmental Policy Act of 1969 in order to select among the options set forth in the report.

(c) CONTINGENT REQUIREMENT FOR REMOVAL OF PLUTONIUM AND MATERIALS FROM SAVANNAH RIVER SITE.—If the MOX production objective is not achieved as of January 1, 2009, the Secretary shall, consistent with the National Environmental Policy Act of 1969 and other applicable laws, remove from the State of South Carolina, for storage or disposal elsewhere—

(1) not later than January 1, 2011, not less than 1 metric ton of defense plutonium or defense plutonium materials; and

(2) not later than January 1, 2017, an amount of defense plutonium or defense plutonium materials equal to the amount of defense plutonium or defense plutonium materials transferred to the Savannah River Site between April 15, 2002 and January 1, 2017, but not processed by the MOX facility.

(d) ECONOMIC AND IMPACT ASSISTANCE.—(1) If the MOX production objective is not achieved as of January 1, 2011, the Secretary shall, from funds available to the Secretary, pay to the State of South Carolina each year beginning on or after that date through 2016 for economic and impact assistance an amount equal to \$1,000,000 per day, not to exceed \$100,000,000 per year, until the later of—

(A) the date on which the MOX production objective is achieved in such year; or

(B) the date on which the Secretary has removed from the State of South Carolina in such year at least 1 metric ton of defense plutonium or defense plutonium materials.

(2)(A) If, as of January 1, 2017, the MOX facility has not processed mixed-oxide fuel from defense plutonium and defense plutonium materials in the amount of not less than—

(I) one metric ton, in each of any two consecutive calendar years; and

(ii) three metric tons total, the Secretary shall, from funds available to the Secretary, pay to the State of South Carolina for economic and impact assistance an amount equal to \$1,000,000 per day, not to exceed \$100,000,000 per year, until the removal by the Secretary from the State of South Carolina of an amount of defense plutonium or defense plutonium materials equal to the amount of defense plutonium or defense plutonium materials transferred to the Savannah River Site between April 15, 2002, and January 1, 2017, but not processed by the MOX facility.

(B) Nothing in this paragraph may be construed to terminate, supersede, or otherwise affect any other requirements of this section.

(3) If the State of South Carolina obtains an injunction that prohibits the Department from taking any action necessary for the Department to meet any deadline specified by this subsection, that deadline shall be extended for a period of time equal to the period of time during which the injunction is in effect.

(A) the suitability of KAMS and related support facilities for monitoring and observing any defense plutonium or defense plutonium materials stored in KAMS;

(B) the adequacy of the provisions made by the Department for remote monitoring of such defense plutonium and defense plutonium materials by way of sensors and for handling of retrieval of such defense plutonium and defense plutonium materials; and

(C) the adequacy of KAMS should such defense plutonium and defense plutonium materials continue to be stored at KAMS after 2019; and

(2) include such proposals as the Defense Nuclear Facilities Safety Board considers appropriate to enhance the safety, reliability, and functionality of KAMS.

(d) REPORTS ON ACTIONS ON PROPOSALS.—Not later than 6 months after the date on which the report under subsection (b) is submitted to Congress, and every year thereafter, the Secretary and the Board shall each submit to Congress a report on the actions taken by the Secretary in response to the proposals, if any, included in the report.

## ACRONYMS

Board	Defense Nuclear Facilities Safety Board
CFR	Code of Federal Regulations
DOE	Department of Energy
DOE-SR	DOE Savannah River Site
KAMS	K-Area Materials Storage facility
MOX	mixed-oxide fuel
SRS	Savannah River Site
235-F	Building 235-F

## REFERENCES

1. Sena, R. F., Director, Nuclear Materials Stewardship Project Office, U.S. Department of Energy Memorandum, *Savannah River Plutonium Storage Study Final Report*, November 30, 2000.
2. Conway, J. T., Chairman, Defense Nuclear Facilities Safety Board, Report to Congress, *Plutonium Storage at the Department of Energy's Savannah River Site*, Washington, D.C., December 1, 2003.
3. Conway, J. T., Chairman, Defense Nuclear Facilities Safety Board, Letter to S. Abraham, Secretary, U.S. Department of Energy, Washington, D.C., June 12, 2003.
4. Conway, J. T., Chairman, Defense Nuclear Facilities Safety Board, Letter to J. H. Roberson, Assistant Secretary for Environmental Management, U.S. Department of Energy, Washington, D.C., July 10, 2003.
5. Abraham, S., Secretary, U.S. Department of Energy, Letter to J. T. Conway, Chairman, Defense Nuclear Facilities Safety Board, Washington, D.C., November 10, 2003.
6. Golan, P. M., Chief Operating Officer, Office of Environmental Management, U.S. Department of Energy, Letter to J. T. Conway, Chairman, Defense Nuclear Facilities Safety Board, Washington, D.C., January 5, 2004.
7. Roberson, J. H., Assistant Secretary for Environmental Management, Office of Environmental Management, U.S. Department of Energy, Letter to J. M. Allison, Manager, Savannah River Operations Office, Aiken, South Carolina, April 16, 2004.