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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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SB022122

1996.0001122



SAC200181560000

March 18, 1996

Y-12  
NA-56

The Honorable Victor H. Reis  
Assistant Secretary for Defense Programs  
Department of Energy  
Washington, D.C. 20585

Dear Dr. Reis:

The Defense Nuclear Facilities Safety Board (Board) commends the Department of Energy (DOE) and its contractor Lockheed Martin Energy Systems for their activities in support of Project Sapphire. This was a significant effort in support of national security interests, which ultimately resulted in removing approximately 600 kilograms of fissile material from the former Soviet Union. Over the past year, the Board's staff made numerous reviews and observations of activities at the Y-12 Plant related to this initiative. The enclosed report provides information on the Board's staff assessment of those activities; this information may be useful in executing any future initiatives similar to Project Sapphire.

It appeared that the material brought to the United States was insufficiently characterized to conclude compliance with Y-12 Plant standards for storage of highly-enriched uranium. The Board notes that DOE did develop, but failed to execute, a technically rigorous sampling plan to characterize the material after it had been placed into storage at the Y-12 Plant. If national security priorities allow, such a plan should be executed for any similar future initiatives prior to the material arriving in the United States, with the Board being advised at the earliest opportunity, so that the necessary oversight efforts can be executed.

After careful consideration, the Board is of the opinion that the enclosed staff report should be shared with you and your associates.

Sincerely,

John T. Conway  
Chairman

c: The Honorable Tara O'Toole  
Mr. Mark Whitaker  
Mr. James Hall

Contains no unclassified sensitive program-specific vulnerability information.  
Reviewed by: *DA 8/14* 104120102

Enclosure

*w/enclosure*  
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DOE/OFFICE OF DECLASSIFICATION  
HERBERT SCHMIDT, A.D. DATE:

*HS Schmidt 4/1/02*

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**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

December 21, 1995

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director

**COPIES:** Board Members

**FROM:** W. Andrews

**SUBJECT:** Staff Observations of Department of Energy (DOE) and Lockheed Martin Energy Systems' (LMES) Support of Project Sapphire

1. **Purpose:** This memorandum is a summary of Defense Nuclear Facilities Safety Board (Board) staff observations at the Oak Ridge Y-12 Plant during the period November 1994 through October 1995. These observations were made to monitor DOE's and LMES's support of the characterizing, packaging, shipping, and storing of highly enriched uranium (HEU) from Kazakhstan. Most of the observations were accomplished in conjunction with other staff reviews at Y-12. The observations included:

- |                                   |                  |
|-----------------------------------|------------------|
| a. November 16 - 18, 1994         | McConnell, Krahn |
| b. November 22 - 23, 1994         | McConnell        |
| c. November 28 - December 2, 1994 | Andrews, Moury   |
| d. December 14 - 15, 1994         | Andrews          |
| e. January 31 - February 3, 1995  | McConnell, Krahn |
| f. June 26 - 29, 1995             | Andrews          |
| g. July 25 - 27, 1995             | Owen             |
| h. October 27 - 29, 1995          | Andrews          |

2. **Summary:** The Project Sapphire material from Kazakhstan was received, stored, and reshipped from Y-12 in a safe manner, but the Board's staff did identify areas for improvement, that should be considered for any similar future initiatives. Staff reviews prior to Y-12's receipt of material from Kazakhstan identified that the material was insufficiently characterized and thus the hazards analysis was inadequate. Although the DOE did eventually develop an adequate sampling plan, the necessary additional sampling and characterization were never accomplished. In addition, an adequate hazards analysis and unanswered safety question screening was not accomplished prior to receipt of the material to determine if the special operation was actually within the safety authorization basis for the facility.

3. **Background:** In November 1994 approximately 600 kilograms of highly enriched uranium was transported from a nuclear facility in Ulba, Kazakhstan, to the Y-12 Plant in Oak Ridge, Tennessee. Prior to this, a 31-person United States' team had spent six weeks characterizing and preparing the material for shipment. Upon arrival in the United States, the material was loaded aboard DOE vehicles and driven to the Y-12 Plant. It was received and placed into interim storage by the Y-12 personnel, at which time DOE began negotiations with private vendors for

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its sale and eventual blending down into commercial reactor fuel. The final shipment of Project Sapphire material was made from the Y-12 Plant in October 1995 to Babcock and Wilcox (B&W) in Lynchburg, Virginia.

#### 4. Discussion:

- a. In December 1994 LMES published a *Sapphire Sampling Plan* (Y/ES-039). As stated in the plan, "Since there is some uncertainty as to how long this storage at Y-12 will be required and because of its origination, additional measures are necessary to acquire more detailed characterization of the materials, so that potential hazards can be assessed . . . ." This was never accomplished. In a letter to DOE in March 1995, the Board identified the issue of incomplete characterization of the Project Sapphire material. Due to this deficiency, an adequate hazards analysis was never completed.
  - b. There were seven basic forms of uranium-bearing materials in the approximately 1,300 cans: 1) uranium metal, 2) uranium oxides, 3) uranium-beryllium alloy rods, 4) uranium oxide-beryllium oxide rods, 5) uranium-beryllium alloy, 6) uranium contaminated graphite, and 7) laboratory salvage. Over 93% of the total number of cans (1,220 of 1,300) contained beryllium.
  - c. The plan called for the testing of 130 cans (out of the 1300) comprising approximately 850 tests. The data from the characterization would be used to assess the potential hazards associated with the interim storage of the material. The potential hazards to be assessed were nuclear criticality (the material was declared by Kazakhstan to be HEU of approximately 89%  $^{235}\text{U}$ ), penetrating radiation (including the alpha-neutron reaction from the U-Be mixtures), release of toxic substances (uranium and beryllium), and fire and explosion (due to pyrophoric materials and chemically induced overpressurization). This sampling plan was never executed by the DOE or LMES prior to the material being shipped to B&W.
  - d. It would be appropriate in any similar future initiatives to maximize the amount of characterization and hazards analyses done *prior* to bringing the material to Y-12. In addition, if any repackaging is done on location, as it was with the Project Sapphire material, the planning could include contingencies for further characterization once it arrives at Y-12.
5. **Future Staff Actions:** The staff will closely monitor future shipments of foreign HEU to Y-12.