

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

December 21, 1995

MEMORANDUM: 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 Owens
 - 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 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% ²³⁵U), 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.