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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 15, 2000

LeRoy Moore, Ph.D.  
Rocky Mountain Peace  
and Justice Center  
P.O. Box 1156  
Boulder, Colorado 80306

Dear Dr. Moore:

The Defense Nuclear Facilities Safety Board (Board) has received your letter of April 24, 2000, which addresses plutonium-bearing material being prepared for shipment from the Rocky Flats Environmental Technology Site (RFETS) to the Savannah River Site (SRS) and to the Waste Isolation Pilot Plant (WIPP). To summarize briefly, your letter:

- Identifies that, according to recent research published in *Science*, plutonium dioxide is less stable than formerly believed, and advances to a higher oxidation state under certain conditions with a higher-than-expected level of hydrogen gas generation.
- Asks the Board to determine whether operations at RFETS guarantee nongeneration of hydrogen gas; to evaluate the implications of hydrogen gas generation for transportation, storage, and ultimate disposal of the material at WIPP; and to assess whether any corrective actions should be recommended.
- Notes that a report from the Board's site representative at SRS suggests certain residues be shipped to WIPP.

The Board has been aware for some time of the research concerning the possible generation of plutonium oxide in a high oxidation state ( $\text{PuO}_{2+x}$ ) in the presence of moisture. In fact, the Board's April 1994 report DNFSB/TECH-1, *Plutonium Storage Safety at Major Department of Energy Facilities* (page 45), addresses plutonium oxide with this higher oxidation state. The Department of Energy's (DOE) long-term plutonium storage standard, DOE-STD-3013-96, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage*, and subsequent revisions also recognize the higher oxidation state. Because knowledge about the kinetics and equilibrium state of the reaction between plutonium dioxide and water is incomplete, DOE-STD-3013 requires that storage systems for plutonium oxides be designed using the conservative assumption that all water in each container decomposes to generate hydrogen. Likewise, the Board has taken action to ensure that residue and waste drums stored at RFETS are vented to prevent hydrogen gas build-up.

It is virtually impossible to preclude plutonium oxides and other plutonium-bearing waste materials from generating hydrogen gas because of the inevitable presence of small quantities of water and other hydrogenous materials. Consequently, the goal of the transportation, storage, and disposal requirements for these materials is to guarantee that the hazard posed by hydrogen

gas generation is effectively controlled. This can be accomplished by providing filtered vents to prevent hydrogen gas build-up (as is done with residue and waste containers), or by ensuring that the gas generation rates can be safely accommodated by the container (as is the case with the DOE-STD-3013 containers, the Transuranic Packaging Transporter [TRUPACT], and the 9975 shipping containers).

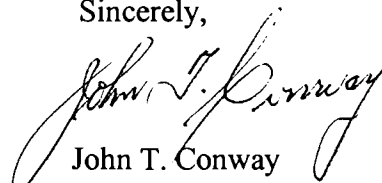
The shipment of plutonium-bearing residues from RFETS to SRS for stabilization was halted when confirmatory testing by DOE revealed that hydrogen generation rates were greater than predicted by models used in the safety evaluation of the 9975 shipping container. Instead of continuing with further gas generation testing in an attempt to qualify the 9975 container for this material, DOE concluded that the material could be safely disposed of at WIPP in lieu of processing at SRS. The decision to send this material to WIPP was not a suggestion of the Board or the Board's site representative.

While the Board encouraged early disposition of these residues at SRS, the Board believes this material can be safely disposed of at WIPP. Materials shipped to WIPP must meet the WIPP Waste Acceptance Criteria, the Nuclear Regulatory Commission's TRUPACT gas generation limits, and Department of Transportation's shipping requirements. These requirements allow shipment of wastes only if hydrogen generation rates are within bounds proven to be safe in the TRUPACT and at WIPP. The large TRUPACT vessel can safely accommodate hydrogen generation rates that would challenge the smaller 9975 container. Additionally, each drum shipped to WIPP is required to have a filtered vent to prevent hydrogen gas build-up during staging, storage, and disposal.

The Board has taken action at RFETS to ensure that effective controls are in place to mitigate risks associated with hydrogen gas generation (e.g., venting of plutonium tanks and drums). The Board will continue to evaluate activities at RFETS to ensure that hazards are effectively controlled. For RFETS residues, the Board, through its recommendations, has required that the materials be demonstrated to represent a low risk, and that the more dispersible materials be put into robust pipe overpack containers. Although the requirements for transportation containers are not within the Board's statutory purview, the Board will continue to evaluate DOE's residue and waste disposal activities to ensure that materials have been suitably characterized and are appropriately stable to ensure safety.

I and the other Board members and staff were pleased to meet with you and your associates on May 10th and hope you found the meeting informative.

Sincerely,



John T. Conway  
Chairman

c: Mr. Mark B. Whitaker, Jr.