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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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98-0002157



June 10, 1998

The Honorable Federico Peña
Secretary of Energy
1000 Independence Ave, SW
Washington, DC 20585-1000

Dear Secretary Peña:

The staff of the Defense Nuclear Facilities Safety Board (Board) has been following the Department of Energy's (DOE) effort to develop a new uranium-233 packaging and storage standard in accordance with Recommendation 97-1, *Safe Storage of Uranium-233*. On April 30, 1998, DOE issued the draft storage standard as committed to in the DOE Implementation Plan for Recommendation 97-1. The issuance of this draft standard represents an important step forward in the implementation of the recommendation. However, in part because there is at present no technical rationale provided for many of the assumptions and parameters contained in the draft standard, substantial effort remains to make the standard technically defensible. For example, no data have been provided to substantiate the thermal stabilization temperature required to remove absorbed moisture within the uranium-233. The matter is further complicated by the lack of inspection and characterization data for uranium-233 material presently in storage.

The Board encourages the continued development of this U-233 packaging and storage standard. Towards such end, the Board is providing the enclosed set of Board staff comments for consideration by the standard developers, as they continue their work.

If further dialogue by the standard developers with the Board staff would be useful, the staff contact is Mr. Ron Barton.

If you have any comments or questions, please do not hesitate to call me.

Sincerely,

A handwritten signature in black ink, appearing to read "John T. Conway".

John T. Conway
Chairman

c: The Honorable Elizabeth A. Moler
The Honorable Victor H. Reis
Mr. James M. Owendoff
Mr. Mark B. Whitaker, Jr.

Enclosure

Enclosure**Comments on Draft DOE Standard*****Criteria for Packaging and Storing Uranium-233-Bearing Materials, April 22, 1998*****General Comments**

1. The U-233 standard specifies a less robust packaging system than the plutonium metal and oxide storage standard (DOE-STD-3013-96). Since U-233 may need to be stored for a long time, this is an apparent inconsistency between the two standards. If the reason for this inconsistency is the potential worker hazard due to radiation exposure during stabilization and packaging operations, DOE needs to provide a clearer technical rationale, including the hazard tradeoffs.
2. The standard as written does not incorporate consensus standards for pressure-containing vessels, such as the American Society of Mechanical Engineers (ASME) codes. DOE needs to provide the rationale for not using the structural requirements of ASME codes for containers that may become pressurized. This rationale also needs to address requirements for postulated accidents (e.g., handling accidents).
3. The question of whether more than one standard is required to address different forms of materials needs to be resolved (e.g., ceramic fuels versus metal and oxides).
4. A technical basis document, similar to that developed for DOE-STD-3013, *Criteria for Preparing and Packaging Plutonium Metal and Oxides*, is needed to properly review the standard.
5. The requirements for moisture content in U-233 forms (e.g., oxides, ceramic fuel pellets, oxide monoliths) and their measurement are not well defined. Additional research and development data may also be required to define the effect of thermal stabilization temperature and processing time on moisture content. These data, coupled with pressurization calculations, would allow DOE to specify thermal stabilization temperature processing time, and moisture content in the U-233 standard.
6. The standard should specify requirements that the facility or material form must meet in order to be credited as a barrier in the packaging system.

Specific Comments

1. Page 1, Section 1.1, first paragraph: The wording that the standard does not apply to ...“irradiated material” is misleading and ought to be changed to “U-233 in spent fuel.”

2. Page 2, Section 4.1 Material Quantities: The standard does not specify a maximum permissible quantity of U-233 (and other fissile materials) within an individual can based on single-point criticality criteria. Without this specification, failure of a package containing an excessive amount of material could result in an inadvertent criticality.
3. Page 2, Section 4.2.1, Metals and Alloys: Metal pieces with a specific surface greater than 50 cm²/g "shall" be thermally stabilized to oxides for storage.
4. Page 2, Section 4.2.2, Separated Oxide Powders: See general comment 4 above.
5. Page 2, Section 4.2.3, Oxide Monoliths: The statement that "no" residual moisture is contained in the material is technically incorrect. Moreover, the amount of moisture within the monolith needs to be quantified in some manner.
6. Page 2, Section 4.2.4, Ceramic Oxides: Additional technical rationale is needed to verify low moisture levels within ceramic fuel pellets.
7. Page 3, Section 4.3.1, General Requirements, item a: Requirements for organics (e.g., plastics, gaskets) in direct contact with U-233 are not specified.
8. Page 3, Section 4.3.1, item d: The requirement "shall be sealed" is ambiguous. The glossary definition of "sealed" mentions the ANSI N 4.5 - 1987 standard, but this is not explicitly required by the standard.
9. Page 3, Section 4.3.2, Inner Container: Requirements for removing contamination on the exterior of the inner containers are not specified.
10. Page 3, Section 4.3.4, Optional Containers: It is unclear whether the requirements of Section 4.3.1 apply to the optional containers.
11. Page 5, Section 4.3.5, Oxide Monoliths: The assumption that oxide monoliths provide robust containment for U-233 needs to be validated. Furthermore, as discussed in a meeting with DOE on May 13, 1998, if oxide monolith materials are stored in a single container as the first barrier, and the facility becomes the second barrier, the facility must incorporate other safety requirements, such as Technical Safety Requirements (TSRs), to control the hazards. For example, if the container leaked, the facility could become contaminated. A second container may still be required to provide adequate protection against U-233 dispersal.
12. Page 5, Section 4.3.6, Ceramic Fuel Materials: The standard relies on use of a screw-lid or bolted-lid container for ceramic fuel elements. For clad fuel elements, this approach may be adequate; for unclad fuel materials it may not, particularly since the standard allows this material to be stored within only one container barrier. Characterization of ceramic fuel

material is needed to verify that ceramic fuel materials will be stable for long-term storage. Also, additional information is needed to provide the technical rationale for allowing long-term storage of fuel pellets directly in plastic bags.

13. Page 7, Section 5.2.1, Facility Confinement: The title of DOE Order 425.1 is *Startup and Restart of Nuclear Facilities*.
14. Page 7, Section 5.1.1, item e: This item states that current U-233 storage facilities shall be evaluated for compliance with design criteria specified in DOE Order 420.1 for facility safety. The question of what happens if the facility does not fully meet the design requirements in the Order needs to be addressed.
15. A time limit should be specified after which packages of in-process materials or the small quantities involved in research and development studies will no longer be exempt from the requirements of the standard.