DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
(202) 208-6400

August 11, 1995

Mr. William F. Hensley, Director
Office of Engineering, Operations, Security,
and Transition Support
Department of Energy
Germantown, MD 20874

Dear Mr. Hensley:

Enclosed are the comments by the Defense Nuclear Facilities Safety Board's (Board) staff on the draft standard, *Criteria for Safe Storage of Plutonium-Bearing Materials (Excluding Metals and Oxides Containing Greater Than 50 Weight Percent Plutonium)*. As agreed upon at our meeting on August 1, 1995, interim storage criteria need to be developed to satisfy Recommendation 94-1. In addition, the technical justification provided for the long-term storage criteria needs to be strengthened.

In Recommendation 94-1, the Board recommended that preparations be expedited to process the containers of possibly unstable residues at the Rocky Flats Plant and to convert constituent plutonium to a form suitable for safe interim storage. In the 94-1 Implementation Plan, the Department of Energy (DOE) identified the residues that were possibly unstable, but did not define the end states of the treated residues. According to the implementation plan, a standard would be developed to define end states and packaging requirements for the residues that would be acceptable for interim storage. However, the draft residue standard under development does not address interim storage; it addresses long-term storage (i.e., 50 years or more). In addition, the draft residue standard specifically excludes plutonium-bearing materials destined for the Waste Isolation Pilot Plant (WIPP). This would exclude most of the plutonium residues at Rocky Flats, which were the primary focus of Recommendation 94-1.

Expanding upon the commitments in the Recommendation 94-1 Implementation Plan, a plan needs to be developed that clearly identifies the processing, end states, packaging, and other criteria required for the treatment and safe interim storage of possibly unstable residues. The plan should also describe any mitigating actions or pretreatment needed while the material is awaiting processing or if treatment is delayed. The criteria would apply to the plutonium-bearing material being addressed by 94-1 that will be stored on site until shipment to WIPP is possible.

The draft residue standard is, in any case, not a technically sound long-term storage standard. The criteria in DOE-STD-3013-94, *Criteria for Safe Storage of Plutonium Metals and Oxides*, are based on decades of experience in handling these two forms of plutonium. The draft residue

standard, however, attempts to provide long-term storage criteria for dozens of plutonium residues, alloys, intermetallics, and compounds. Some of these materials may be similar in their properties to plutonium metal or oxide, but many are not. Many are heterogeneous and difficult to characterize. Most have never been stored for long periods and their longer-term storage behavior is poorly understood. If plutonium residues and compounds cannot be stored to approximately the same degree of safety and certainty as plutonium oxide or metal, they should be limited to interim storage and eventually be processed to plutonium oxide or metal. The technical bases need to provide more justification for why the forms are acceptable for long-term storage, and why the criteria are appropriate.

We believe that it would be helpful for the Board's staff to continue to meet with DOE personnel to discuss both the interim and long-term storage criteria. Mr. Mark Sautman and Mr. Davis Hurt will be available to arrange future meetings and to provide any additional information you may require.

Sincerely,

George W. Cunningham
Technical Director

Enclosure

c: Mr. Mark B. Whitaker, EH-9
Mr. Henry F. Dalton, EM-60

U.S. DEPARTMENT OF ENERGY

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OMB Burden Disclosure Statement on Reverse

COMMENT AND RESOLUTION SHEET

1. Document Title: Criteria for Safe Storage of Plutonium-Bearing Materials (Excluding Metals and Oxides Containing Greater Than 50 Weight Percent Plutonium)	2. Document Number: DOE-STD-DRAFT-SAFT-0045	3.Document Data	4. Date Comments Sent
5. Commenting Individual (Office/Name/Signature) Defense Nuclear Facilities Safety Board Mark Sautman	6. Phone 202-208-6407	7. Resolution by Office/Name)	8. Phone

Index			12. Type	13. Comments, Suggested Solution	14. Resolution of Comment
9. Number	10. Page	11. Section/Paragraph			
1	All	General	E	The Plutonium Metal and Oxide standard established a baseline for storage safety to which other plutonium storage standards should be evaluated against. If the plutonium-bearing material cannot be stored to approximately the same degree of safety and certainty as plutonium oxide metal, they should be limited to only interim storage or converted to metal or oxide.	
2	All	General	E	The draft standard addresses long-term storage (i.e., 50 years). According to the 94-1 Implementation Plan, the standard was to define acceptable interim states. In other words, it was supposed to define the end state for processing residues to satisfy 94-1.	
3	4	2.0 Loss-On-Ignition (LOI) Definition	E	LOI tests are only applicable to thermally stabilized plutonium-bearing oxide; it is not applicable for other compounds, other residues, or unstabilized material. The definition from DOE-STD-3013-94 should be used because it provides temperature, heating time, and atmosphere requirements.	

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4	14	4.0 Oxide-Like Materials and Compounds	E	Plutonium chlorides, fluorides, sulfates, and phosphates are all salts and should be put under category C, Salts. Placing plutonium salts under this group would ensure that they meet the specific salt storage criteria of not reacting with their container material. (See comments on 5.1.C.)	
5	16	5.0.1/5.0.3 Safe Storage Criteria	E	There is no definition for "dry solid" or criteria provided for "free of plastics, organic compounds, and other material that can undergo radiolysis." Add, "the combined amount of moisture and other hydrogenous material shall be limited to 0.5 percent by weight."	
6	16/17	5.0.5/5.1.C Safe Storage Criteria/Salts	E	Both citations require that the material not react with their container material or contents. This requirement needs to be defined to ensure consistent interpretation. "React" could be defined by limiting the container corrosion rate or gas generation rate due to chemical reactions. In addition, industrial standards which define material incompatibilities could be referenced.	

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7	17	5.1.B.1 Oxide-Like Materials and Compounds	E	The LOI test criterion is not appropriate for these non-oxide compounds and may not be appropriate for the oxide-like material. Rather than using inappropriate LOI criteria, the use of thermal stabilization (with specified temperatures and heating times) as well as limits on moisture and hydrogenous material (see 5.0.1 and 5.0.3 comments above) would be more appropriate for non-oxide compounds and oxide-like materials. The long-term storage of any oxide-like material or compounds that could withstand this thermal stabilization would still need to be justified.	
8	17	5.1.B.1 Oxide-Like Materials and Compounds	E	Some compounds (e.g., hydrides, nitrides) are not appropriate for long-term storage because of their instability. The use of screening criteria (e.g., stable to X°C) would eliminate several of these. These compounds should be explicitly prohibited. The technical bases would only have to address the remaining compounds.	

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9	17	5.1.C Salts	E	In the Recommendation 94-1 Implementation Plan (IP), Rocky Flats committed to using pyrochemical oxidation while Los Alamos committed to using carbonate oxidation followed by either: 1) dissolution and plutonium precipitation or 2) salt distillation. Since the stability of salts in long-term storage (i.e., this standard) should be equivalent or exceed the stability of salts in interim storage (i.e., 94-1 end state), oxidation of the salts is required.	
10	23	5.4.D.1 Data Base Documentation	E	The data base should also contain the current matrix/form (e.g., Item Description Code) of the plutonium-bearing material.	
11	24	5.5.D.1 Quality Assurance	E	QA and QC should not only apply to the material certification procedures, but also the material conditioning procedures.	
12	A5	Ap.5.1.A Metal Alloys and Intermetallic Compounds	E	The technical bases do not justify why criteria appropriate for pure plutonium metal will necessarily be acceptable for alloys and intermetallic compounds.	

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17	3	2.0 End State Definition	S	Add: "The end state for materials covered by this standard should meet the criteria contained in this standard or DOE-STD-3013-94."	
18	4	2.0 Interim Storage Definition	S	If this standard addresses long-term storage(i.e., at least fifty years), interim storage should be defined as less than fifty years rather than ten years.	
19	5	2.0 Low-Fired Oxide Definition	S	Add "in air" after "heated."	
20	6	2.0 SS&C Definition	S	Insert "from reduction of plutonium halides" after the word "materials."	
21	7	2.0 Thermal Stabilization Definition	S	Delete the words "a residence time of."	
22	9	3.1 Federal Regulations	S	Delete references to 10CFR60, Disposal of High Level Radioactive Wastes in Geologic Repositories and 10CFR61, Licensing Requirement for Land Disposal of Radioactive Waste. This is a storage standard, not a disposal one.	

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23	17	5.1.B.2 Oxide-Like Materials and Compounds	S	Replace first sentence with, "Oxide-like materials containing uranium shall be conditioned to have an LOI of less than 0.5 w/o."	
24	17	5.1.C Salts	S	The words, "be conditioned to," should be deleted.	
25	18	5.2 Packaging	S	The containers are to be designed to allow for inspection and surveillance, but no requirements are provided for specific inspection and surveillance tests. This needs to be clarified in section 2.0 or 5.3.	
26	19/21	5.2.2.C.2/5.2.3.D.5/ 5.2.3.D.6 Boundary and Primary Vessel Structural Requirements	S	The handling shock, vehicle crush, and puncture tests are not understandable without further explanations of the test conditions. The test conditions for the other tests need more detail. The basis for the specification of these tests should be provided and if it is based upon some reference, then that citation should be provided.	
27	20	5.2.2.D. Boundary Container Pressure Requirements	S	The requirements for a proof-test as it applies to boundary and material container integrity should be defined in the standard.	

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28	20/21/22	5.2.2.D/5.2.3.E/5.3 Container Pressure Requirements	S	To ensure a design life of fifty years without repackaging, the maximum theoretical operating pressure for a container (a function of Pu content, container free volume, and allowable LOI) should be less than or equal to the value of the surveillance acceptance criteria for pressurization.	
29	20	5.2.3.B Primary Container Dimensional Requirements	S	The boundary container dimensions are recommended, not required. Since new and larger transportation packages can be developed and the boundary container may have different dimensions, these dimensions should be only be recommendations.	
30	21	5.2.3.E/5.2.3.F Primary Containment Vessel Pressure Requirements	S	There is no justification provided for the use of 204°C as the temperature that could result from a major facility fire. Experience suggests that a major facility fire could generate a much higher temperature. For transportation accidents, NRC regulation 10CFR71.73 requires exposure of packages to a temperature of 800°C for at least thirty minutes.	

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31	21	5.2.3.F.3 Packaging Requirements	S	This requirement should be eliminated because 5.2.3.F.4 repeats the requirement word-for-word, but in addition specifies the mass of plutonium-bearing material and minimum free volume required.	
32	22	5.3 Inspection and Surveillance	S	Need to define "inspection and surveillance."	
33	A5	Ap.5.0.6 Specific Criteria for Material Classes	S	Change "sealed material container failure" to "single barrier failure."	
34	A6	Ap.5.1.B Oxide-Like Materials and Compounds	S	The UO_2 should be oxidized to U_3O_8 before performing the LOI test. Performing both actions simultaneously hides how much moisture and volatile material are being released.	

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