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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 1, 2006

Mr. C. Russell H. Shearer
Acting Assistant Secretary for Environment, Safety and Health
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Mr. Shearer:

The Defense Nuclear Facilities Safety Board (Board) received the Department of Energy's (DOE) letter dated March 30, 2006, transmitting the draft DOE manual *Nuclear Material Packaging Manual*. This manual is a deliverable under the Implementation Plan for the Board's Recommendation 2005-1, *Nuclear Material Packaging*. As was the case with comments from DOE's technical review board on the draft repackaging prioritization methodology, DOE's internal process for comment resolution failed to adequately resolve all substantive comments. Detailed comments developed by the Board's staff on the draft packaging manual are provided in the enclosure to this letter. These comments were also provided to DOE's Responsible Manager for Recommendation 2005-1 on April 21, 2006. Pursuant to 42 U.S.C. § 2286b(d), the Board requests that, within 30 days of receipt of this letter, DOE provide a response to the enclosed comments. This response should provide a specific resolution for each comment that either accepts the comment, with proposed changes to the draft manual, or rejects the comment, with justification based on technical merit and impact on safety.

In the Implementation Plan, DOE committed to developing a nuclear material packaging manual in response to two sub-recommendations: (1) "Issue a requirement that nuclear material packaging meet technically justified criteria for safe storage and handling"; and (2) "Identify which nuclear materials should be included in the scope of the above requirement and then determine the technically justified packaging criteria needed to ensure the safe storage and handling of those materials." The Implementation Plan lists baseline assumptions that are consistent with these sub-recommendations: "This plan deals with materials that are stored outside of an approved engineered contamination confinement barrier, such as a glovebox or packages meeting DOE-STD-3013 and/or DOE-STD-3028"; and "This plan deals with solid and liquid nuclear materials in interim storage." The draft manual appropriately defines interim storage as follows: "Interim Storage is on-site storage of materials outside of an approved engineered contamination barrier. Interim storage excludes materials that are stored in accordance with DOE-STD-3013, DOE-STD-3028, or DOE-HDBK-1129." Defining the scope of the nuclear material packaging manual using these assumptions and the associated definition would have met the intent of Recommendation 2005-1.

The Board has reviewed the draft packaging manual. In general, the manual sets forth a sound approach to nuclear material packaging. However, it contains an exclusion for packages

in a “specifically analyzed and controlled radiological production or processing activity.” This exclusion significantly departs from the intent of the Recommendation and the Implementation Plan, and could exclude from the scope of the manual nuclear materials in any facility operating under the requirements of either 10 Code of Federal Regulations (CFR) 835, *Occupational Radiation Protection*, or 10 CFR 830, *Nuclear Safety Management*. Retaining this exclusion could greatly reduce the safety benefits of the manual’s entire content.

DOE’s technical review board for Recommendation 2005-1 commented on this serious deficiency before the draft manual was sent to the Board. However, DOE failed to adequately resolve this substantive comment. In its acceptance of the Implementation Plan for Recommendation 2005-1, the Board noted that it was encouraged by DOE’s establishment of a technical review board to comment on the packaging requirements document and the repackaging prioritization methodology. In failing to correct deficiencies identified by the technical review board, however, DOE is undermining the benefits of having an independent peer review process.

Sincerely,

A handwritten signature in black ink, appearing to read "A. J. Eggenberger". The signature is fluid and cursive, with a large initial "A" and "E".

A. J. Eggenberger
Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. Richard M. Stark

Enclosure

Enclosure

Comments of the Board's Staff on Draft DOE Manual M441.1, *Nuclear Material Packaging Manual*

- 1. The scope exclusion for nuclear materials in a “specifically analyzed and controlled radiological production or processing activity” is inconsistent with DOE’s Implementation Plan (IP).** Under this broad definition, activities involving nuclear materials in any facility operating under the requirements of either 10 CFR 835, *Occupational Radiation Protection*, or 10 CFR 830, *Nuclear Safety Management*, could potentially be excluded from the manual requirements. The Board’s staff understands the intent is not to overly constrain “in-process” activities. However, this exclusion appears to be inconsistent with a baseline assumption in the IP, which states, “This plan deals with materials that are stored outside of an approved engineered contamination confinement barrier, such as a glovebox or packages meeting DOE-STD-3013 and/or DOE-STD-3028.” This exclusion also appears to be inconsistent with the manual’s definition of interim storage, which states, “Interim Storage is on-site storage of materials outside of an approved engineered contamination barrier. Interim storage excludes materials that are stored in accordance with DOE-STD-3013, DOE-STD-3028, or DOE-HDBK-1129.” A more defensible approach, consistent with the intent of Recommendation 2005-1, would be to rely on a reasonable time limit to allow for certain processes between removal of nuclear materials from an engineered contamination barrier and placement in packaging that meets the requirements of the manual.
- 2. The options for calculating material thresholds have significantly different technical and regulatory origins and result in substantially different values.** No justification is provided for allowing field activities to choose between the two methodologies, which in some cases may result in differences in threshold quantity of several orders of magnitude for identical materials. This inconsistency could result in excluding packages with sufficient quantities of material to be within the scope of the manual, or in categorizing materials as low risk that would otherwise be high risk, depending on which methodology is used. The manual ought to provide consistent protection of workers from equivalent quantities of nuclear material.

The methodology derived from DOE-HDBK-3010, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, employs a dilution factor in the calculation, and does not appear to have been reviewed previously or approved for use in safety basis calculations for determination of controls to protect facility workers. Such a calculation is inconsistent with the requirements in DOE-STD-3009 CN2, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, which emphasize the difficulty of developing conservative quantitative consequences to facility workers. The methodology derived from DOE-HDBK-3010 requires significant knowledge of the nuclear material’s physical characteristics (e.g., particle size distribution), which are not commonly determined under current practices. Assuming adequate

information is available, the methodology then requires difficult technical judgments to ascertain appropriate values for respirable release fractions from DOE-HDBK-3010. The values listed in DOE-HDBK-3010 were developed experimentally for estimating macro source terms resulting from significant facility accidents (e.g., facility fires); those source terms were to be included in airborne plume models used to determine consequences for receptors located at relatively large distances from the facility. The use of these values in conjunction with a dilution factor for calculating consequences impacting safety to workers in the immediate vicinity of a radioactive material release from a package is highly questionable. The drawbacks of using this methodology to calculate threshold material quantities for the packaging manual are exacerbated by the lack of an explicit mechanism for review and approval by subject matter experts to provide a level of consistency across sites.

The methodology derived from DOE-HDBK-3010 contrasts with the technical simplicity and regulatory precedence associated with the more conservative methodology based on net intake factor used to calculate the A2 values specified in 49 CFR 173.435, *Shippers—General Requirements for Shipments and Packagings*. The A2 values have long been accepted as adequately conservative by numerous regulatory bodies, including the U.S. Department of Transportation, the U.S. Nuclear Regulatory Commission, and the International Atomic Energy Agency. The A2 methodology, as applied in the manual, offers a simple, defensible way to determine material thresholds for facility workers by adjusting dose consequences to account for the receptor differences between a nuclear facility worker and a member of the public (e.g., shipping courier or first responder). The methodology derived from DOE-HDBK-3010 ought to be dropped in favor of the A2 methodology.

3. **The manual lacks technical bases for key parameters specified for several significant requirements.** While many of the values appear to lead to reasonable results, providing technical bases for key parameters that are specified as requirements would strengthen the overall credibility of the document. Examples of key parameters that ought to be supported with a technical basis include the following:
 - Dose values used for the in-scope and low to high thresholds
 - Acceptable time limits for leaving materials unpackaged after removal from an engineered contamination barrier
 - Packaging performance requirements (e.g., qualification leak rates, drop heights, and post-drop leak rates)

4. **The list of radionuclides covered by the manual appears to be incomplete.** A significant number of radionuclides that may fall under the definition of “by-product material” and whose dominant dose contributions are through the inhalation pathway are not included in Table 1.1, and therefore would be excluded from the manual requirements. It is unclear whether some of these isotopes are currently present in the complex or may be separated in the future. Given this possibility and the hazardous nature of these radionuclides, it would be more appropriate to specify an overall methodology for identification of in-scope radionuclides, and present the Table 1.1 as a listing of radionuclides commonly found in the complex.

5. **The definition of a “sealed source” requires further clarification to qualify for exclusion from the scope of the manual.** Exclusion of sealed sources is consistent with Recommendation 2005-1; however, the Board’s expectation was that all excluded nuclear materials would be packaged or protected in a manner that would afford protection to workers substantially equivalent to that provided by packaging meeting the requirements in the manual. Indeed, this is why materials packaged to meet DOE-STD-3013 or DOE-STD-3028 are excluded from the scope of the manual. The definition referenced in 10 CFR 835.2 does not provide adequate criteria to ensure this protection; thus there is a need for greater specificity in the definition (e.g., minimum classification levels under American National Standards Institute [ANSI] N43.6, *Sealed Radioactive Sources—Classification*, or similar basis).
6. **The surveillance techniques required to be considered may result in inconsistent or inadequate detection of vulnerable packages.** The overall objective of providing early indications of container degradation is appropriate. However, implementation of the surveillance techniques listed for consideration does not appear to be required. The result could be significantly different levels of rigor applied in determining the state of the packaging depending on which techniques the sites implement. Greater specificity in either the performance of the objective or the required use of techniques may be necessary to ensure that sites perform adequate surveillance.
7. **Information on the technical basis for packaging and surveillance is not explicitly required in Section I.4, *Documentation*.** Although this information is generally specified as a requirement under the *Packaging Criteria* sections, it is unclear where this information would be documented for review. Stipulating a complete list of documentation requirements for a centralized technical basis document for packaging and surveillance would assist the field element managers in their review and approval process.
8. **DOE’s review process for Recommendation 2005-1 deliverables requires improvement.** As was the case with the draft repackaging prioritization methodology, many of the substantive technical issues concerning the manual that were identified by the Board’s staff were also identified by DOE’s technical review board (TRB). Some of the TRB’s comments do not appear to have received the appropriate level of consideration and technical resolution. For example, significant comments generated by several TRB members pertaining to the problems outlined in the staff’s comments 1–3 above resulted in only trivial changes in the wording of the manual. In its acceptance of the IP, the Board noted it was encouraged by DOE’s decision to use a TRB to review and comment on the principal activities related to the resolution of safety issues. Unfortunately, DOE has failed to incorporate substantive changes to both the draft manual and the draft repackaging prioritization methodology required to adequately resolve significant comments made by the TRB. A mechanism for consistently developing balanced, technically valid responses to the TRB’s comments is needed.