

January 14, 2000

Brigadier General Thomas F. Gioconda  
Acting Assistant Secretary  
for Defense Programs  
Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0104

Dear General Gioconda:

The staff of the Defense Nuclear Facilities Safety Board (Board) visited Oak Ridge National Laboratory (ORNL) on October 28–29, 1999, to review equipment checkout and development of procedures during preparations for the Uranium-233 Inspection Program. That program is part of the Department of Energy's (DOE) response to the Board's Recommendation 97-1, *Safe Storage of Uranium-233*. In early October 1999, the DOE Oak Ridge Operations Office (DOE-ORO) reported that three test containers were dropped from a significant height during checkout of the equipment in Building 3019. DOE-ORO appropriately implemented a 30-day pause in the preparations for the program to conduct a DOE Peer Review.

The DOE Peer Review concluded that the ORNL contractor is inexperienced in nuclear operations with regards to conduct of operations and with startup of nuclear facilities. A review by the Board's staff made additional observations that should be helpful in your preparations for the Uranium-233 inspection activities. The Board's staff observed that improvements are needed in the formality of test controls and that an integrated program for checking out equipment, validating procedures, and completing training of operators is needed prior to the contractor's Operational Readiness Review. The staff also identified the need for DOE to review the assumptions behind the analysis of potential worker hazards associated with a dropped storage cask. These staff observations are included in the enclosed report.

If you have comments or questions on this matter, please do not hesitate to contact me.

Sincerely,

John T. Conway  
Chairman

c: The Honorable Carolyn L. Huntoon  
Dr. James F. Decker  
Ms. Gertrude Leah Dever  
Mr. Mark B. Whitaker, Jr.

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

November 23, 1999

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director  
J. K. Fortenberry, Deputy Technical Director

**COPIES:** Board Members

**FROM:** H. W. Massie  
L. M. Zull

**SUBJECT:** Review of Uranium-233 Inspection Program at Oak Ridge National Laboratory

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the Phase I Uranium-233 (U-233) Inspection Program in Building 3019 at the Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL). This review was conducted during a visit made to the facility on October 28–29, 1999, by staff members H. Massie, L. Zull, P. Gubanc, and D. Moyle and outside expert R. Lewis.

**Background.** In early October 1999, the DOE Oak Ridge Operations Office (DOE-ORO) reported that three test containers had inadvertently been dropped and damaged during checkout of new equipment in Building 3019. On October 12, 1999, partly as a result of these incidents, DOE-ORO sent a letter to the ORNL Director implementing a 30-day pause in the preparations and scheduled a DOE Peer Review to be held on November 30, 1999.

Because of the occurrence of the container drops, the staff was concerned that the project was not sufficiently controlling equipment testing and ensuring formal conduct of operations for the prestart activities. Therefore, the staff reviewed the scope of the DOE Peer Review, as well as responses to a number of staff questions concerning the reliability and safety of the equipment, the formality of test controls, operating procedures, and hazards associated with dropped U-233 containers. This report documents issues noted by the staff, and describes some recent improvements made by ORNL to equipment reliability and operating procedures.

**Scope of DOE Peer Review.** A DOE Peer Review was held on November 30– December 2, 1999, to advise the DOE Site Office Manager on the completeness of project planning and management integration. The team addressed (1) the general validity of the project approach, including perceived drivers, constraints, and criteria; (2) the adequacy of equipment and associated procedures and training; (3) the assurance that significant safety issues have been recognized and are being addressed; and (4) potential areas for improvement in the project. The scope of the DOE review included both Phase I and Phase II inspections and repackaging to a new U-233 storage standard. The team members were experienced individuals representing the DOE Offices of Environmental Management and Defense Programs. Initially, the scope of the review did not include safety issues; following the staff's discussions with DOE, safety issues

were added to the scope. The conclusions of the DOE Peer Review Team are complementary to those presented in this paper, and are not discussed in this report.

**Equipment Reliability.** The recent inadvertent dropping of three dummy containers during equipment testing led to increased staff concern regarding equipment reliability. In particular, the staff was concerned that the project was not using sufficient visual indicators and physical interlocks to control the lifting process. Project personnel agreed to add markings to the container lifting cable at regular intervals to assist the operator. In addition, another camera has been placed in the inspection chamber so a container that is being raised into a transfer cask can be viewed. The operators also now have a 27-inch TV screen that can display views from six different cameras simultaneously. With regard to physical interlocks, a commercial hand-operated industrial winch, with a friction clutch to prevent the dropping of a container when the hand crank is released, has been installed on both the inspection chamber tower handwheel and the transfer cask tower handwheel. Additionally, the hose that provides vacuum to disengage the container lifting device (grapple) will now be physically disconnected after a container has been engaged to prevent inadvertent release of the container. These additional visual indicators and physical interlocks will reduce the possibility of dropping and damaging containers during inspection operations.

**Test Control.** A major lesson learned by the U-233 Inspection Program is the need to complete equipment development and shakedown testing prior to formal preparations for startup. Moreover, in its October 12, 1999, letter, DOE-ORO states that “. . .it is apparent from our interaction that schedule pressures have been intense.” The staff concurs with this assessment. Project personnel discussed a test control program they are developing for equipment checkout. However, the project personnel have little experience in conducting such a program. The staff suggested that an integrated preoperational testing program is needed. Such a program would be used to check out the equipment, validate the procedures, and provide training to the operators. The program would also support preparations for line management’s readiness self-assessment and the contractor’s Operational Readiness Review, which must be conducted before the inspection program can begin. Assistance from personnel knowledgeable in organizing and coordinating preoperational testing would help the program prepare for operations.

**Procedures.** The staff reviewed current versions of the five major operating procedures to be used in the inspection program. This review revealed that most of the staff’s comments made on an earlier version of the procedures in late July 1999 have been resolved. The amount of explanation and level of detail in the procedures have improved significantly. The first procedure to complete the review and verification process was recently approved. However, the procedures must still be validated during equipment checkout and operator training, and additional revisions are expected.

**Hazards of Dropped U-233 Containers.** The staff requested that ORNL discuss in detail the consequences, particularly to workers, of a dropped container (1) in the tube vault, (2) in the inspection chamber, and (3) outside the inspection chamber (i.e., in a dropped transfer cask). A single U-233 container drop would not result in significant radiation doses to the public, but could

pose a hazard to nearby workers/operators.

The dropping of a transfer cask is the worst postulated drop accident. In this scenario, a transfer cask containing a pressurized U-233 container is dropped, resulting in a 1 rem worker dose. The radiation doses are 50-year cumulative effective dose equivalent doses.

It is not clear that the assumptions used in the Unreviewed Safety Question Determination analysis are conservative. The pressure in the U-233 can is assumed to be only 25 psig, which results in a very small release of respirable material. ORNL assumes that the probability of having a can with a higher pressure is remote. The staff notes that increasing the can pressure from 25 to 100 psig increases the dose by a factor of 21 (i.e., to 21 rem). Hence, the analysis is very sensitive to the internal can pressure. Additionally, ORNL stated that the operator will have to rely on seeing a U-233 dust cloud caused by the release in deciding to immediately leave the dropped cask. Otherwise, the stay times for the operator/worker are increased, which results in significantly higher doses. The staff believes this issue requires further review by DOE to identify possible controls or compensatory measures, such as emergency response procedures, prior to startup.

The potential for the ventilation system to spread contamination during an accident is also of concern. As discussed in a letter of November 2, 1999, from the Board to the Assistant Secretary for Environmental Management, modifications may be needed to prevent contamination of the Building 3019 vessel off-gas systems should a container of U-233 be breached during handling in the storage vaults. The project has developed a dropped container worksheet, but no emergency response plan has been formulated. Project personnel agreed to identify response equipment that may be needed and to develop a document describing actions to be taken to address a container breach. It is not yet clear what will be done to confine potential contamination releases near the point of release.

**Authorization Agreement.** The Authorization Agreement for Building 3019 was approved on October 20, 1999, for existing operations within Building 3019.