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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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December 7, 2004

The Honorable Spencer Abraham
Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

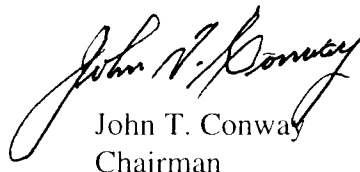
Dear Secretary Abraham:

On December 7, 2004, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286a(a)(5), unanimously approved Recommendation 2004-2, *Active Confinement Systems*, which is enclosed for your consideration. This recommendation addresses the confinement of hazardous materials at defense nuclear facilities in the Department of Energy (DOE) complex.

In order to assist you in developing a response to this recommendation, the Board has enclosed a technical report, DNFSB/TECH-34, *Confinement of Radioactive Materials at Defense Nuclear Facilities*. This study compares the benefits of employing a safety-related active confinement ventilation system to a policy of relying only on a passive confinement system.

After your receipt of this recommendation and as required by 42 U.S.C. § 2286d(a), the Board will promptly make it available to the public. The Board believes that the recommendation contains no information that is classified or otherwise restricted. To the extent this recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2161-68, as amended, please arrange to have it promptly placed on file in your regional public reading rooms. The Board will also publish this recommendation in the *Federal Register*. The Board will evaluate the Department of Energy response to this recommendation in accordance with Board Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Sincerely,



John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

RECOMMENDATION 2004-2 TO THE SECRETARY OF ENERGY
Pursuant to 42 U.S.C. § 2286a(a)(5),
Atomic Energy Act of 1954, As Amended

Dated: December 7, 2004

There is a long-standing safety practice in the design, construction, and operation of nuclear facilities to build-in and maintain structures, systems, and components that contain or confine radioactive materials. The Department of Energy (DOE) establishes requirements to ensure such containment or confinement. In the hierarchy of safety controls, passive design features are preferred over active systems; however, controls must be capable of performing their intended function. Passive confinement systems are not necessarily capable of containing hazardous materials with confidence because they allow a quantity of unfiltered air contaminated with radioactive material to be released from an operating nuclear facility following certain accident scenarios. Safety related active confinement ventilation systems will continue to function during an accident, thereby ensuring that radioactive material is captured by filters before it can be released into the environment.

The enclosed technical report, DNFSB/TECH-34, *Confinement of Radioactive Materials at Defense Nuclear Facilities*, compares the benefits of including a safety-related active confinement ventilation system to those of relying only on a passive confinement system. This technical report illustrates that using only a passive confinement system for an existing or new defense nuclear processing facility would not account for many safety considerations such as post-accident monitoring and response, and may result in the release of an undeterminable amount of radioactive materials, the consequences of which could approach that of the unmitigated scenarios.

The Defense Nuclear Facilities Safety Board (Board) has advised DOE in various ways during the past decade regarding the need to pay increased attention to the design and operational reliability of the confinement ventilation systems at defense nuclear facilities. These Board efforts include transmittal of a technical report on May 31, 1995, *Overview of Ventilation Systems at Selected DOE Plutonium Processing and Handling Facilities*, a letter to the Deputy Secretary of Energy dated July 8, 1999, and Recommendation 2000-2, *Configuration Management, Vital Safety Systems*, on March 8, 2000. This advice has helped DOE improve the reliability of its confinement ventilation systems. However, DOE requirements have become less prescriptive during the last decade as DOE Order 6430.1A, *General Design Criteria Manual*, was replaced with DOE Order 420.1, *Facility Safety*, and its subsequent revisions. Furthermore, it has become apparent that the Board's advice on confinement systems is not being rigorously pursued as evidenced by the following:

- On December 27, 2002, the Board sent a letter to the National Nuclear Security Administration (NNSA) regarding the confinement concept used for the Highly Enriched Uranium Materials Facility at the Y-12 National Security Complex. The proposed confinement concept was based on isolating the radioactive material in the building using a passive confinement system under certain abnormal events. The Board

communicated safety concerns associated with this concept in the letter; subsequently, the confinement concept for HEUMF was modified to adopt a safety-related active ventilation system.

- On April 12, 2004, the Board sent a letter to the Administrator of NNSA regarding similar safety issues related to the confinement systems for the plutonium facility at the Lawrence Livermore National Laboratory. The proposed approach utilized passive confinement of radioactive material from the facility during certain accident scenarios. Further, because the offsite dose consequences of such an unfiltered release were calculated to be below DOE's evaluation guideline (25 rem), the proposal included downgrading the existing safety-class active confinement ventilation system to a safety-significant system. The Board believed that the new approach was inconsistent with a defense-in-depth philosophy. Subsequently, the Livermore Site Office commissioned an independent calculation of the amount of the unfiltered release. These calculations yielded results that were an order of magnitude greater than the original building leakage estimates—clearly indicating that significant uncertainties existed in the analytical techniques. As a result, NNSA decided to maintain the existing safety-class active confinement ventilation system.
- On August 27, 2004, the Board sent a letter to the Under Secretary of Energy regarding the confinement approach proposed for the Salt Waste Processing Facility at the Savannah River Site. The confinement concept for this new facility is based on isolation of the process building using passive confinement during accident scenarios. The Board suggested that the salt waste facility should be designed with a safety-related active ventilation system.

A number of existing facilities (including the TA-55 Plutonium Facility, the Device Assembly Facility, and the Hanford Evaporator) rely on passive or non-safety related confinement systems. More importantly, designs for proposed facilities (including Chemistry and Metallurgy Research Replacement Facility and the Salt Waste Processing Facility) are based on the same passive confinement concept and use an assumed quantitative value for the building leak path factor as a design criterion.

These examples illustrate two primary concerns. First, a reliance on calculations that do not appropriately account for large uncertainties is not defensible. These analytically determined building leak path factors are based on a combination of several computer programs that were not specifically designed for this purpose. Furthermore, it is generally impossible for these programs to model the true conditions of a real accident because of the uncertain behavior of the workers and emergency crews responding to the event.

Second, these examples represent a fundamental change in DOE's approach to protection of the public near defense nuclear facilities. DOE appears to be using the evaluation guideline of 25 rem exposure at the site boundary as a design criterion and an allowable dose to the public. This is contrary to the Board's July 8, 1999 letter to the Deputy Secretary of Energy that states

“the 25 rem evaluation guideline is not to be treated as a design acceptance criterion nor as a justification for nullifying the general design criteria relative to defense-in-depth safety measures.” It is also contrary to DOE-STD-3009 that states that the 25 rem evaluation guideline “is not to be treated as a design acceptance criterion.” However, the Board continues to see 25 rem at the site boundary used as an acceptance criterion for the performance of confinement systems. The Board is concerned that in these examples DOE and its contractors are underestimating the significance of the performance requirements for a confinement ventilation system and are relying on questionable calculations of offsite doses to evaluate performance. **The Board reiterates that the 25 rem evaluation guideline is solely to be used for guidance for the classification of safety controls, and not as an acceptable dose to the public for the purpose of designing or operating defense nuclear facilities.**

Notwithstanding the concerns discussed above, DOE continues to pursue a passive confinement approach in the design of some new nuclear facilities that have the potential for a radiological release. The Board recognizes that DOE’s defense nuclear complex is comprised of a wide variety of nuclear facilities with an equally diverse range of materials, forms, activities, and proximities to the public. For this reason, it is difficult to prescribe a single, broadly-applicable design requirement. However, in light of the examples discussed above, the Board believes a more prescriptive design requirement is needed.

The Board further recognizes that certain Hazard Category 2 and 3 defense nuclear facilities may not benefit significantly from an active confinement ventilation system. An example would be a facility that stores radioactive material in protected, safety-class containers. Other examples may be certain tritium facilities, outside storage locations, burial grounds, or facilities with planned declining nuclear material inventories and scheduled for decommissioning in the near future. This recommendation is not meant to require an active confinement ventilation system in all such cases.

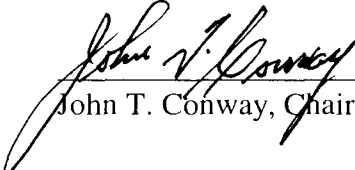
Therefore, the Board recommends that DOE:

1. Disallow reliance on passive confinement systems and require an active confinement ventilation system for all new and existing Hazard Category 2 defense nuclear facilities with the potential for a radiological release. These systems are expected to be classified as safety-class or safety-significant as required by a conservative application of DOE-approved methodology, and should be designed and maintained to function during abnormal and accident conditions. Exceptions to such classifications should be approved at a level in DOE that ensures a consistent, conservative approach throughout the complex.
2. Disallow reliance on passive confinement systems and require an active confinement ventilation system for all new and existing Hazard Category 3 defense nuclear facilities with the potential for a radiological release. These systems would not ordinarily be classified as safety-class or safety-significant unless such designation is required by the DOE-approved methodology.

3. Revise all applicable DOE directives pertaining to operation of existing facilities, design and construction of new facilities, and major modifications to existing facilities, in accordance with Items 1 and 2 above. These revisions should include guidance for determining when a facility would not benefit from an active confinement ventilation system.
4. Assess existing facilities, ongoing major modifications, and new design/construction projects, to ensure that
 - a) the confinement strategy described above is implemented, and
 - b) the 25 rem evaluation guideline is used solely for classification of safety controls.

Section 42 U.S.C. § 2286d(e) provides authority to the Secretary of Energy to "implement any such Recommendation (or part of any such Recommendation) before, on, or after the date on which the Secretary of Energy transmits the implementation plan to the Board under this subsection." The Board suggests that the Secretary of Energy consider taking action on Item 4 above in parallel with the development of an Implementation Plan for this Recommendation.

In addition, the Board's Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*, addresses the need for complex-wide consistency in the application of DOE requirements and expectations. The Board expects the mechanisms established in response to Recommendation 2004-1 would likewise ensure consistent, conservative implementation of the confinement requirement provided here.


John T. Conway, Chairman