

Peter S. Winokur, Chairman  
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**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



April 20, 2011

The Honorable Thomas P. D'Agostino  
Administrator  
National Nuclear Security Administration  
1000 Independence Avenue, SW  
Washington, DC 20585-0701

Dear Mr. D'Agostino:

The Defense Nuclear Facilities Safety Board (Board) is concerned that the Y-12 Site Office (YSO) has initiated an effort that may inappropriately degrade the safety posture of the Highly Enriched Uranium Materials Facility (HEUMF) in a manner that is inconsistent with current Department of Energy (DOE) regulations. More specifically, the Safety Evaluation Report (SER) that approves the first annual update to the Documented Safety Analysis (DSA) for HEUMF seeks to significantly change the safety strategy for HEUMF initially communicated to the Board in 2003 and implemented during startup of the facility in 2010.

In its SER, YSO concludes that several safety-significant controls should be evaluated for downgrading since the radiological dose consequences involved are low. YSO is now excluding toxicological and chemical hazards resulting from a fire from consideration in the determination of the safety classification of controls. The Board notes that toxicological and chemical hazards associated with a defense nuclear facility must be analyzed according to the requirements of Title 10 Code of Federal Regulations (CFR) Part 830, *Nuclear Safety Management* (10 CFR Part 830). Safety-significant controls must be identified if certain criteria are met, consistent with the methodology provided in the safe harbor of the rule, DOE Standard 3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. The Board also has concerns about downgrading the safety classification of the Active Secondary Confinement System and the Fire Protection System.

The Board believes the new direction YSO provided to the contractor regarding the potential for downgrading some of the existing safety-significant controls for HEUMF is not conservative. The Board found the set of safety-related controls currently documented in the original DSA to be complete, providing adequate protection for the public and workers and implementing the principles of defense-in-depth. Over the past several years, the Board thoroughly reviewed the design, construction, and startup activities of HEUMF, which were appropriately integrated with its safety basis. The safety-related controls were designed, procured, and installed, and are now being operated in accordance with nuclear safety requirements. It is not clear to the Board why it would be appropriate to degrade the safety

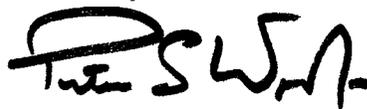
posture of this facility by downgrading safety-significant controls that are for defense-in-depth, or protect against non-radiological hazards. The enclosed report provides more detail in support of the Board's concern.

The Board notes that the Safety Design Strategy for the Uranium Processing Facility (UPF), issued by the contractor in November 2010, reflects an approach to the treatment of non-radiological hazards similar to that in the SER for HEUMF. Once again, application of this approach is inconsistent with the requirements of 10 CFR Part 830 and could result in significant deficiencies in the design and safety posture of UPF.

Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board requests a report and a briefing within 30 days of receipt of this letter providing the following:

- the technical basis for directing the Y-12 contractor to consider downgrading safety-related controls for HEUMF, and the safety benefits expected to be gained by this action;
- the technical basis for determining that toxicological and chemical hazards in a defense nuclear facility need not be considered in the designation of safety-significant structures, systems, or components during the development of safety basis documents; and
- the basis for deviating from the requirements of 10 CFR Part 830 and excluding some toxicological hazards from being analyzed during the safety basis development process for the UPF project.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter S. Winokur". The signature is stylized and cursive.

Peter S. Winokur, Ph.D.  
Chairman

Enclosure

c: Mr. Glenn S. Podonsky  
Mr. Theodore D. Sherry  
Mrs. Mari-Jo Campagnone

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

February 28, 2011

**MEMORANDUM FOR:** T. J. Dwyer, Technical Director

**COPIES:** Board Members

**FROM:** F. Bamdad

**SUBJECT:** Safety Posture of the Y-12 National Security Complex

This report documents a recent review of the safety posture of the Highly Enriched Uranium Materials Facility (HEUMF) and the Uranium Processing Facility (UPF) at the Y-12 Nuclear Security Complex (Y-12). This review was performed by staff members of the Defense Nuclear Facilities Safety Board (Board) F. Bamdad, W Andrews, D. Campbell, D. Grover, and C. March.

**Introduction.** The Board's staff performed an in-depth review of the safety posture of HEUMF during its design, construction, and subsequent startup in 2010. During this period, the Board communicated its concern to the National Nuclear Security Administration (NNSA) regarding several weaknesses related to the development of the safety basis and the incorporation of safety into the design. These weaknesses were resolved satisfactorily.

In 2010, the Y-12 contractor submitted an annual update to the Documented Safety Analysis (DSA) for HEUMF to the Y-12 Site Office (YSO) for review and approval. YSO approved this annual update to the DSA in September 2010 through a Safety Evaluation Report (SER), consistent with Department of Energy (DOE) requirements. According to the SER, however, "Fire-initiated releases of potentially toxic materials are regulated by national consensus codes and 10 CFR [Part] 851 [*Worker Safety and Health Program*] that also requires code-compliant fire suppression; thus, these hazards meet the definition of standard industrial hazards within DOE-STD-3009 [*Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*] and additional analysis is not necessary." Consequently, the controls identified in the DSA for protection against toxicological hazards of a fire may be eliminated in the next revision of the DSA.

Additionally, YSO recommended in the SER that the contractor investigate downgrading several safety-significant controls that are fundamental to providing and maintaining an adequate safety posture for HEUMF. The SER states that "the need for some of the safety-significant controls is not justified" and that the contractor "should consider downgrading controls for the design-basis fire, such as the secondary confinement system." The SER states further that the contractor "should investigate the possibility of downgrading some or all of the controls for the

design-basis fire.” Two of the safety-significant controls identified in the SER for potential downgrading are the Active Secondary Confinement System and the Fire Protection System, which serve to prevent or mitigate the consequences of a fire.

Similar to YSO’s recommendation on treatment of the toxicological hazards at HEUMF, the Safety Design Strategy document for the UPF project, issued in November 2010, excludes full consideration of the toxicological hazards from a fire event.

**Treatment of Toxicological and Chemical Hazards.** The Nuclear Safety Management rule, Title 10 Code of Federal Regulations (CFR) Part 830, paragraph 830.204(b)(3), requires that a DSA “Evaluate normal, abnormal, and accident conditions...that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials...” In addition, paragraph E.4 in Appendix A to the rule states, “A documented safety analysis must address all hazards (that is, both radiological and *nonradiological* hazards) and the controls necessary to provide adequate protection to the public, the workers, and the environment from the hazards [emphasis added].”

The rule also defines “safety-significant” controls as “the structures, systems, and components which are not safety class...but whose preventive or mitigative function is a major contributor to defense in depth and/or worker safety as determined from safety analyses.” The safe harbor to the rule, DOE Standard 3009-94, elaborates on this definition: “As a general rule of thumb, safety-significant SSC designations based on worker safety are limited to those systems, structures, or components whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or *chemical* exposure to workers [emphasis added].”

Appendix B (“Chemical Hazard Evaluation”) to DOE Standard 1189-2008, *Integration of Safety into the Design Process*, provides “a sense of scale as to what is meant by a ‘significant exposure’ in the criterion for classifying SSC’s as safety significant...by evaluating the severity of potential exposure against advisory classification criteria for collocated workers and the public.” The appendix contains a detailed methodology for estimating consequences and provides criteria for exposure limits for use in identifying safety-significant controls to protect against toxicological and chemical hazards.

Thus, DOE regulations and directives establish a framework that requires identification, analysis, and control of toxicological and chemical hazards in a nuclear facility and classification of those controls as safety-significant if certain criteria are met. The contractor appropriately applied these DOE requirements to the design of HEUMF to ensure safe operation of the facility. Consequently, the original DSA identified several safety-significant controls, such as the fire protection system, to limit the size of fires and protect workers from adverse consequences due to exposure to several toxicological and chemical hazards.

The DSA for HEUMF (Y/DSA-82, Rev. 0) that was the basis for the facility’s startup and safe operation met all applicable DOE requirements and NNSA’s commitments to the Board, and provided adequate protection of the public and workers. A significant portion of the safety-

significant controls identified in the DSA are for protection against toxicological and chemical hazards. The radiological consequences to the public at the site boundary and to collocated workers at 100 meters are in the range of rem and tens of rem total effective dose equivalent, respectively. While these consequences do not drive the need for safety-related controls, the toxicological and chemical consequences to workers have the potential to be adverse and require safety-significant controls.

The statement made in the SER for HEUMF regarding the treatment of toxicological hazards as “standard industrial hazards” is inconsistent with DOE requirements. Toxicological hazards during a fire are considered in the DSA for identification of safety-significant controls. Implementation of YSO’s recommendation could inappropriately lead to the downgrading of several safety-significant controls that the DSA relies upon for protection of workers. Such action would erode the safety posture of HEUMF and lead to a DSA that would be inconsistent with the Nuclear Safety Management rule and its safe harbor methodology.

**Active Secondary Confinement System.** The original design of HEUMF relied on passive confinement (isolation holdup) of the hazardous materials that would be released during a potential fire. The Board found this design strategy to be unreliable and communicated identified weaknesses to NNSA through various correspondence between 1999 and 2002. In a response to the Board dated April 1, 2003, NNSA concurred with the Board’s view and stated that the “isolation holdup approach... is no longer being considered.” NNSA also indicated that the safety analysis would provide adequate protection for workers and the public through a “Safety-Class building and storage racks and Safety-Significant fire sprinkler system.... The secondary confinement system will be identified in the draft HEUMF PDSA [Preliminary DSA] as a Safety Significant system providing significant defense in depth.” The Board found this safety approach to be sound and adequate. The DSA for HEUMF identifies the Active Secondary Confinement System (Active SCS) as safety-significant and defense-in-depth. It is not relied upon to directly prevent or mitigate a hazard, but if the credited controls were to fail, the Active SCS would filter the releases and mitigate the event.

YSO’s direction for the contractor to “consider down grading controls for the design-basis fire, such as the secondary confinement system” could negate the expectations in DOE Standard 3009-94 that systems can be identified as safety significant for defense-in-depth purposes, as well as reverse the approach to providing adequate protection of health and safety communicated in NNSA’s April 1, 2003, letter to the Board.

**Fire Protection System.** NNSA recognized the importance of the fire protection system early in the life of the HEUMF project and identified that system as safety-significant to reduce the potential for small fires to expand into large fires or to cause an energetic release of material or a criticality event. The DSA that formed the safety basis of the facility prior to its startup in 2010 continues to rely on this vital safety-significant control.

The DSA identifies the Fire Water Distribution System and the Fire Protection System as safety-significant to ensure that small fires will be mitigated by a reliable fire suppression system. The DSA credits this fundamental safety approach to prevent small fires involving

radiological and non-radiological hazards from growing into large fires that could have adverse consequences to the workers on site.

Referring to the radiological consequences, YSO states in the SER, “Given the low doses resulting from the design basis fire accidents in various locations within HEUMF, the need for some of the safety-significant controls is not justified. Babcock & Wilcox should investigate the possibility of downgrading some or all of the controls for the design-basis fire.” The SER does not consider the toxicological hazards and their significant consequences that would result in the need for safety-significant controls. Furthermore, considering that the Fire Protection System and its Water Distribution System have been designed, procured, and installed, and are required to be maintained, it is not clear what benefits YSO expects will be gained from downgrading them.

**Safety Design Strategy for the Uranium Processing Facility.** The Board’s staff has observed that the Safety Design Strategy for the UPF project, prepared by the contractor in November 2010 (RP-FS-801768-A003, Rev. 3), employs the same philosophy and interpretation for evaluating toxicological hazards as that presented by YSO in its SER for HEUMF. The Safety Design Strategy states, “Toxicological materials that could be released during a fire will be controlled by the implementation of the International Fire Code (IFC)/International Building Code 2006 (IBC-06) in compliance with 10 CFR [Part] 851. These materials are not specifically evaluated for toxic effects on receptors during fire scenarios other than their potential for exacerbating a radiological material release.” Relying on 10 CFR Part 851, however, would not lead to the identification and classification of controls as safety-significant, as required by the Nuclear Safety Management rule and its safe harbor. Such misinterpretation of the requirements would have a significant safety impact on the design adequacy of this project and could lead to deficiencies in the safety posture and final design of the facility if not corrected in the current preliminary design stage.