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## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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January 8, 2001

The Honorable Carolyn L. Huntoon  
Assistant Secretary for  
Environmental Management  
Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0113

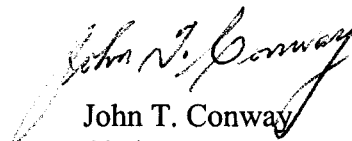
Dear Dr. Huntoon:

The Defense Nuclear Facilities Safety Board (Board) wishes to bring to your attention a fire safety issue at the Fernald Environmental Management Project. Members of the Board's staff recently visited Fernald to evaluate the Tension Support Structures (TSSs) used to store radioactive waste and special nuclear materials. The staff met with representatives of Fluor Fernald and the Department of Energy (DOE) Fernald Office to review the Fernald fire protection program as a whole and to discuss the fire hazards and safety analysis approach for the TSSs.

The staff's onsite review and analysis of Fernald documents led to two concerns detailed in the enclosed report. First, the Fire Hazards Analysis (FHA) for the TSSs is inadequate to support Fernald's Basis for Interim Operation and deficient when measured against DOE expectations for a nuclear facility FHA. Second, additional, cost-effective measures should be considered to further reduce the probability of fire in the TSSs and to ensure that a fire would be detected and extinguished as soon as possible.

The Board has been informed that the staff's findings are already being acted upon by the Fernald Office and the contractor. The Board's staff will conduct a follow-up review at a later date to confirm that the steps taken are adequate.

Sincerely,

  
John T. Conway  
Chairman

Enclosure

cc: Mark B. Whitaker, Jr.

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

November 9, 2000

**MEMORANDUM FOR:** K. Fortenberry, Technical Director

**COPIES:** Board Members

**FROM:** W. M. Shields

**SUBJECT:** Fire Protection Program, Fernald Environmental Management Project

This report documents a review performed by the staff of the Defense Nuclear Facilities Safety Board (Board). Staff members W. Shields and F. Bamdad met with personnel from the Department of Energy (DOE) and the site contractor, Fluor Fernald, on November 2, 2000, to assess the fire protection program at the Fernald Environmental Management Project (FEMP). The specific purpose of the review was to examine fire safety for three Tension Support Structures (TSSs) used to store mixed waste and special nuclear materials.

**Background.** The TSSs are essentially large tents, consisting of a non flammable fabric stretched over a metal frame that is anchored to a concrete slab. Beginning in 1990, FEMP planned to use the TSSs to store Resource Conservation and Recovery Act (RCRA) waste consisting of contaminated soil and debris collected during cleanup efforts. The tents would prevent runoff until these materials could be packaged and shipped to a disposal site. While this project was under way, DOE issued Order 5480.7A, *Fire Protection*, which would have required the installation of automatic suppression systems for the TSSs because their property value exceeded \$1 million. The FEMP contractor at the time, FERMCO, requested and received from DOE an exemption from this requirement. Thereafter, all the TSSs were built without automatic suppression or detection systems.

In 1995, FEMP personnel decided to begin storing drums containing nuclear materials, including some enriched uranium, in the TSSs. They concluded that storage of these materials was within the scope of the original DOE exemption from automatic suppression requirements. In 1999, the DOE Ohio Field Office raised the property value requirement for automatic fire suppression from \$1 million to \$10 million. As a result, the Fernald Area Office concluded that an exemption from the relevant DOE Order (now Order 420.1, *Facility Safety*) is not needed in any event. The continued validity of the exemption despite the change in mission has not been questioned by either the Ohio Field Office or the Fernald Area Office.

The staff's interest in this matter began with the review of an update to the fire hazard analysis (FHA) dated July 10, 2000. This update did not appear to adequately address the new hazards posed by storing special nuclear materials (e.g., the generation of hydrogen gas and the

presence of pyrophoric metals), or the significance of the lack of automatic fire detection and suppression capability given these hazards.

## Issues

*Fire Hazards Analysis.* Fernald Plant 1 Area, which includes the TSSs, is a Hazard Category 2 nuclear facility. The Basis for Interim Operation (BIO) for Plant 1 Area includes the authorization basis for TSS facilities and several other buildings and activities in the area. Most of the radioactive hazardous material (more than 6 million pounds of enriched uranium) is contained in these three TSSs. The hazard and accident analyses are based on some bounding scenarios, and controls are identified to reduce the probability of events leading to significant consequences to the public and workers. In addition to the safety management programs, administrative controls are identified to limit the facility inventory and physical storage of the material. The radiation detection alarms (criticality alarms) and fire suppression equipment (portable fire extinguishers) are identified as equipment vital to safety. Hazardous activities are controlled through implementation of procedures that require inspection and special handling of drums because of their potential for generation and accumulation of hydrogen. The fire hazards external or internal to the drums were to be analyzed in the FHA.

The staff reviewed the FHA and found it inadequate to support BIO assumptions and deficient when measured against DOE expectations for an FHA for a nuclear facility. Guidance on the contents of an FHA is provided in Section 4 of the Implementation Guide to Order 420.1, and a model is given in the DOE Fire Protection Handbook, *Combined Fire Hazards Analysis and Fire Protection Facility Assessment for Building 9116 at Y-12*. Specific deficiencies include the following:

- The FHA improperly relies on the DOE exemption issued in 1993. When this exemption was issued, the TSSs were not nuclear facilities and were not intended to store special nuclear materials in substantial quantities. The need for automatic suppression or alternative fire safety measures should have been reconsidered, and a new exemption requested if appropriate when the storage mission of the TSSs was changed.
- The FHA states, "As defense-in-depth, Fluor Fernald is taking a conservative approach to further identify and analyze hazards associated with the handling, inspection, venting, moving, and storage of hydrogen-generating materials." The FHA identifies but does not analyze these hazards, though procedures have been implemented to protect workers handling and inspecting the drums. Reliance on a Hanford study to support a position that drum fires will not spread to adjacent drums needs to be explained and justified.
- There is no detailed consideration of ignition sources, combustible loading, limits on transient combustibles, and other administrative controls, other than a reference to the conditions of the 1993 DOE exemption. As noted, this exemption was premised on

storage of only non-nuclear materials in the TSSs and did not consider the hazards presented by storing drums of hydrogen-generating and pyrophoric metals.

- There is no discussion of the risk of fire during long periods when the TSSs are unoccupied. Consideration of this risk is important because of the lack of any automatic detection/alarm devices.
- The recommendations of the FHA lack specificity.

*Detection of Fires When TSSs are Unoccupied.* Because the TSSs lack automatic suppression and detection, any fire starting inside while the structure is unoccupied will remain undetected for some time. Ignition sources are few and combustible loading is low, so the probability of a significant fire involving multiple drums (eventually extinguished by fire department action) is low. This scenario is nonetheless credible and needs to be analyzed as such in the FHA. A multiple-drum fire would generate personnel exposures during and after the fire, require a significant cleanup/decontamination effort, delay site closure, and lead to a major concern that safety measures at the site during cleanup are not adequate.

For these reasons, the staff believes additional, cost-effective measures should be considered to further reduce the probability of fire and ensure that a fire in the TSSs when unoccupied is detected as soon as possible. Measures that merit consideration include the following:

- Having backshift security patrols walk through the buildings rather than around them.
- Checking the buildings after an electrical storm.
- Adding an end-of-workshift check to ensure that propane-powered vehicles have been moved out, all transient combustibles have been properly stored or removed, and all electrical appliances have been unplugged or shut off at the breaker.
- Installing remote-alarm smoke detectors at the roof level to detect smoldering fires during unoccupied periods.