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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 13, 2002

General John A. Gordon  
Under Secretary for Nuclear Security and Administrator  
of the National Nuclear Security Administration  
U. S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0701

Dear General Gordon:

Enclosed for your consideration and action, as appropriate, are observations developed by the staff of the Defense Nuclear Facilities Safety Board (Board) concerning fire protection in the wet chemistry area of Building 9212 (B-1 Wing) at the Y-12 National Security Complex (Y-12). Equipment in this area is currently undergoing testing in preparation to restart the chemical processing of highly enriched uranium.

For at least 15 years, the Department of Energy and its contractors have been aware of fire protection program deficiencies in this area. Upgrades to the fire protection program proposed to support resumption of operations in this area will consist of a combination of minor plant improvements and a significant number of administrative controls. Although the operating contractors and independent fire protection engineers have recommended a suppression system for this area for years, and the necessary funds are currently allocated under the Fire Protection Program Comprehensive Correction Action Plan, it appears that the current path forward is to continue to operate in this area without a fixed fire suppression system.

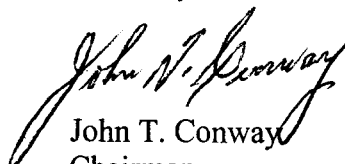
Historically, the Board has noted problems with maintaining administrative controls at Y-12. The enclosed report describes several examples of inadequate execution of existing administrative controls observed by the Board's staff, and notes the difficulty of maintaining effective administrative controls during the remaining life of the facility. The report also identifies possible non-conservative inconsistencies in the safety basis that supports this operation. Given the unique nature of this chemical processing activity and its role in the nuclear weapons complex, together with the risk of fire in the area and the potential consequences of such an event, the Board believes that the National Nuclear Security Administration (NNSA) should consider installation of a fixed fire suppression system to protect the structure and its workers.

General John A. Gordon

Page 2

Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board requests a report within 60 days of receipt of this letter that addresses the issues identified in the enclosed report, including whether to provide fixed fire suppression in B-1 Wing of Building 9212.

Sincerely,



John T. Conway  
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

April 15, 2002

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

**COPIES:** Board Members

**FROM:** C. Coones

**SUBJECT:** Fire Protection for Building 9212, B-1 Wing

This memorandum documents a review performed by the staff of the Defense Nuclear Facilities Safety Board (Board) at the Y-12 National Security Complex (Y-12). Staff members C. Coones, M. Feldman, and M. Helfrich and outside expert R. West, assisted by the Board's Y-12 site representative, M. Forsbacka, met with representatives of BWXT and the Department of Energy Y-12 Area Office (DOE-YAO) to review the adequacy of the safety basis to support the restart of wet chemical operations in Building 9212, located in B-1 Wing. This review encompassed the fire protection features of B-1 Wing. The current approach to fire protection in this area relies almost exclusively on administrative controls, and no change in this approach is anticipated for full operation. The staff's review of this approach indicated several deficiencies.

**Background.** Uranium extraction operations are performed in B-1 Wing of Building 9212, which contains large quantities of combustible organics to support these operations. B-1 Wing was constructed in the 1950s, and the original construction was not provided with sprinkler protection. Partial sprinkler systems were added in the 1960s. However, the area housing the extraction processes was not provided with sprinkler protection because of criticality safety concerns. Since 1987, both Factory Mutual and the operating contractor have identified the need to add sprinkler protection to this area. In an effort to mitigate the deficiencies in building protection and life safety features, a series of compensatory measures was implemented in 1999 to improve control of combustibles and assist in any necessary evacuation of employees and visitors from the area.

**Discussion.** The *B-1 Wing Fire Protection Program*, Y/MA-7754, Revision 0, identifies 33 minor building modifications and administrative controls needed to protect the facility during testing and process restart. Of these 33 controls, 21 are administrative in nature. The minor modifications include such items as repair of electrical deficiencies, placement of liquid-tight lighting, and removal of open shelving. The administrative controls include operational considerations in use of the organic solvents, a transient combustible program, control of ignition sources, and designated laydown areas for combustible materials. None of these modifications or controls include sprinkler protection of the areas containing combustible solvents, although the remaining active life of the facility is estimated to be 10 to 15 years. Both the Basis for Interim Operation (BIO) and the B-1 Wing Addendum to the *Building 9212 Fire Hazards Analysis* (FHA), Y/FPE-037, Revision 0, note the possibility that postulated fires could cause the facility to collapse in less than 10 minutes. This effect is most pronounced for the first floor, where leaks and spills are most likely to occur. Although one of the proposed building modifications would

provide fire-resistant coatings to structural columns in the area, a fire would still have the potential to result in significant on-site and off-site dose consequences, as well as pose a significant hazard to employees in the area. A fire in B-1 Wing could also render the wet chemistry process unavailable for some time, which would have national security ramifications. There is no similar capability elsewhere in the DOE complex.

*Administrative Controls*—The Board's technical report DNFSB/TECH-27, *Fire Protection at Defense Nuclear Facilities*, sets forth the overall principle that active systems are preferred to administrative controls. One reason for this preference is the difficulty of maintaining administrative controls for an extended period of time.

In addition to the 21 administrative controls identified in the *B-1 Wing Fire Protection Program*, additional administrative controls and compensatory measures are required in the Building 9212 Compensatory Measures Summary Sheet and the FHA. An example is an additional operational restriction in the FHA that all flammable and combustible liquids in Building 9212 be stored and handled in accordance with National Fire Protection Association (NFPA) 30, and that the lack of continuity between combustibles be maintained. Not included among any of the administrative controls are ongoing fire patrols for use during current system testing. Moreover, the various administrative controls are not always updated or modified as plans or equipment change, and there are significant deficiencies in the contractor's compliance with these controls. Examples noted in the staff's review include the following:

- Both the *B-1 Wing Fire Protection Program* and the BIO refer to a B-1 Wing combustible control program. However, during discussions with fire protection personnel, the staff was informed that a formal program did not exist. While there are compensatory measures and administrative controls which address aspects of combustible control, these have not been incorporated into a formal program.
- Compensatory measure 9212-98-048 requires that combustible trash not in metal containers be removed from the B-1 Wing corridor. At the time of the staff's visit, combustible boxes, papers, and plastics were found in this corridor in violation of the established compensatory measure.
- Compensatory Measure 9212-98-020 requires that the double doors between the B-1 Wing and Headhouse corridors be kept closed except during entry because of a potential inadequacy in the fire alarm/door closer system. The system has since been tested and found to be functional, and the doors are now latched open. However, the compensatory measure had not been updated to reflect the completion of testing and establishment of new operating practices. The open doors are a violation of the out-of-date requirement. This example highlights the site's poor record for accurately maintaining administrative controls.

Most importantly, there is no current program providing for a periodic review to verify that the combination of administrative controls associated with B-1 Wing is fully operational.

*Sprinkler Protection*—While B-1 Wing is not a new facility, there is guidance contained in DOE orders and industry standards applicable to new facilities that is relevant to this existing facility. DOE Order 420.1, *Facility Safety*, states that automatic fire protection systems shall be installed throughout all significant facilities and in all areas subject to loss of safety-class systems, significant life-safety hazards, and unacceptable program interruption due to fire. NFPA 801, *Standard for Fire Protection for Facilities Handling Nuclear Materials*, states that fire suppression systems should be provided in processing areas unless the FHA and the authority having jurisdiction agree that an alternative approach is acceptable. Fire protection reviews of B-1 Wing conducted during the last 15 years have concluded that sprinklers should be installed in the area. The original argument against water-based fire suppression in the area was based on criticality concerns. Although some areas are sensitive to the introduction of water, improvements in criticality analysis have decreased these areas in both size and number and would allow for the installation of fixed protection. In addition, criticality safety personnel have indicated that a sprinkler system would be acceptable for the concept of operations planned for wet chemistry under the restart program.

The primary argument against the proposed sprinkler system appears to be monetary. The estimated cost of such a system is \$16 million, versus \$3 million to implement the combination of minor modifications and administrative controls proposed in the *B-1 Wing Fire Protection Program*. Neither estimate includes the life-cycle cost of maintaining and implementing the controls during the life of the building, but one must expect the administrative controls to require a significant operating cost. However, the staff notes that the projected cost for the B-1 Wing sprinkler system is included in the \$150 million Fire Protection Program Comprehensive Correction Action Plan for Y-12, previously endorsed by DOE. The schedule for sprinkler system installation shows approximately 6 years to completion. However, major risk reduction is achieved by providing the first and/or third floors with sprinkler protection. Providing sprinkler protection also improves the opportunity for workers to evacuate the area safely.

*Safety Analysis*—The current BIO shows that the postulated B-1 Wing fires could result in doses of approximately 55 rem to collocated workers and 3 rem to off-site populations. However, the staff's review of the BIO indicates that the airborne release fraction (ARF) used, 3E-3, may be inappropriate. Section 3.3.1 of DOE Handbook 3010-94 recommends using the 3E-3 ARF as the upper bound for a solvent fire involving no aqueous solutions. Section 3.3.3 of the handbook, however, recommends using an ARF of 1E-1 for fires involving combustible solvents over pools of acid solutions, a situation similar to some of the fire scenarios described in the BIO. Use of this larger ARF greatly increases the dose consequences.

The FHA also mentions that the aqueous solution and other chemicals in use in the area are considered to be Class I oxidizers under NFPA 430, *Code for Storage of Solid and Liquid Oxidizers*. The impact of these oxidizers on the postulated fires is not considered in the FHA or the BIO. Oxidizers would tend to increase the burning rate and overall severity of a fire.

**Conclusions.** Considering the complex set of proposed administrative controls, questions about the reliability of the administrative controls, the remaining useful life of the building, and the potential effects of a fire, the staff believes installation of a fire suppression system is warranted.