DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700 Washington, D.C. 20004-2901
(202) 694-7000

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Dr. Ines R. Triay
Acting Assistant Secretary for Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Dr. Triay:

A three-step strategy for resolving safety issues related to fire protection coating on structural steel used in the construction of the Hanford Waste Treatment and Immobilization Plant (WTP) was described in the June 6, 2008, letter from the Manager of the Department of Energy's (DOE) Office of River Protection (ORP) to the Defense Nuclear Facilities Safety Board (Board). While the Board has concluded that the plan for fire protection coating of the structural steel at WTP developed by the execution of this strategy is adequate, the rationale applied by ORP is faulty. Furthermore, the Board believes that it is necessary to validate that a design basis fire would not result in unacceptable toxicological consequences under ORP's current plan.

The ORP strategy for evaluating structural steel fire protection included: (1) demonstrating structural stability of the WTP facilities without taking credit for unprotected structural steel, (2) demonstrating that concrete slabs in the WTP facilities remain stable without the support of unprotected steel, and (3) determining the potential for thermal expansion of unprotected steel to affect protected structural steel in a fire. The ORP letter stated that the first two steps were complete for the Low Activity Waste (LAW) facility, and an acceptable approach for the third step at LAW was being developed. Analysis of the other WTP facilities (High Level Waste (HLW), Pretreatment (PT), and the Analytical Laboratory) would be held in abeyance until LAW analysis was completed.

On July 31, 2008, ORP wrote that fire protection issues for structural steel in all WTP facilities were resolved based upon the WTP contractor's report on the impacts of thermal expansion of unprotected steel in a representative section of the LAW facility. Subsequently, the Board's staff engaged in discussions with project personnel to develop a clear understanding of the contractor's analysis supporting ORP's conclusion.

The contractor's report attached to the July 31, 2008, ORP letter, asserts that primary confinement for a design basis fire scenario is provided by hot cells, black cells, and melter caves that do not rely on structural steel, and therefore uncoated structural steel does not present a direct nuclear safety concern. The report notes that WTP is provided with multiple levels of

defense-in-depth including fire barriers, administrative procedures for control of combustible materials, a trained work force, automatic sprinkler protection systems, fire alarm and detection systems, and automatic fire department notification and response, which together will limit the severity and extent of a facility fire. Furthermore, the report asserts that in the unlikely event of an uncontrolled fire, protected structural steel members will still maintain sufficient capacity to support the facility during and after a fire.

Based upon this analysis, ORP concluded that the structural performance of the LAW facility during a design basis fire is acceptable. ORP believes that the facility is stable when crediting only the fire-protected structural steel, that floor slabs are stable and capable of supporting prescribed loads without the support of uncoated structural steel, and that uncoated structural steel expansion and contraction as a result of a fire would not adversely impact the performance of coated structural steel.

ORP also concluded that the PT facility meets the 2000 International Building Code (IBC, the code of record) for Type IB construction (a 2-hour fire resistance rating) and that the other WTP facilities, while classified as Type IIB construction (zero-hour fire resistance rating), exceed Type IIB requirements and are equivalent to Type IB construction.

The Board agrees with the conclusion that the fire protection strategy for structural steel at WTP is acceptable from a nuclear safety perspective; however, the Board's rationale differs from ORP's in several important respects. The Board considered first the Hazard Category 2 facilities at WTP—the HLW and PT facilities—and then the lower hazard facilities.

In the case of the HLW and PT facilities, there is no significant radioactive material source term in the areas where structural steel is uncoated. Accordingly, the Board agrees with ORP that the lack of coatings on structural steel does not cause a direct concern for confinement of nuclear materials in these facilities. However, the Board believes that the redundancy of safety-class systems must be assured to minimize the potential for on-site or off-site radiological consequences for these facilities. Redundancy of safety-class systems is achieved by ensuring that fire area boundaries and structural steel will be designed or protected such that damage to the building from a fire in a given area will not allow the fire to spread to adjacent fire areas.

The contractor's analyses performed for the LAW facility are not directly transferable to other WTP facilities because the extent of structural steel fireproofing of LAW is not representative of the HLW and PT facilities. However, the Board believes that Type IB construction requirements—invoked for the PT facility—provide assurance that a fire will not spread to an adjacent fire area, protecting the redundancy of safety-class systems. Similarly, review by the Board's staff of the fire protection coating specified to date for the HLW facility determined that it is, for all practical purposes, consistent with Type IB construction requirements (i.e., structural frame is provided with fire protection coating consistent with 2000 IBC Table 601, footnote a) even though it is classified as Type IIB. Based on these observations, the Board concludes that the specified fire protection coating for structural steel in the HLW and

PT facilities is adequate. Consequently, ORP will need to ensure that as design and construction progress at both the PT facility and the HLW facility, they remain consistent with Type IB structural frame fire protection coating requirements.

In the case of the LAW facility and the Analytical Laboratory, a different rationale is required, because review by the Board's staff determined that the specified fire protection coating of structural steel in these facilities does not meet Type IB construction requirements. However, these facilities are Hazard Category 3 facilities, and the off-site radiological consequences of a design basis fire are below the evaluation guideline value and do not require any safety-class systems. The Board believes that the current plans protect sufficient structural steel in these two facilities to support fire area barriers as required by DOE Standard 1066-99, *Fire Protection Design Criteria*. Therefore, the Board concludes that the specified structural steel fire protection coating for the LAW facility and Analytical Laboratory is adequate.

ORP's letter of July 31, 2008, does not address chemical hazards that may be present in these facilities. The Board believes that it is necessary to validate that a design basis fire would not result in unacceptable toxicological consequences under ORP's current plan for fire protection coating of structural steel in WTP facilities. Once this validation work has been completed, the issue of fire protection coating for structural steel in WTP can be closed.

Sincerely,

A. J. Eggenberger
Chairman

c: Ms. Shirley J. Olinger
Mr. Mark B. Whitaker, Jr.