# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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September 25, 2001

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

Dear General Gordon:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the progress toward startup of the Hydrogen Fluoride Supply System at the Y-12 National Security Complex. The Board notes the recent progress that has been made in preparing the safety basis for the associated activities using the guidance provided in applicable Department of Energy directives. The Board is aware of the continuing work in this area and believes further improvements can be made by integrating the findings of the safety analyses with emergency management and response activities. The enclosed issue report summarizes observations of the Board's staff on this matter, and is provided for your consideration and use as appropriate.

Sincerely,

John T. Conway
John T. Conway
Chairman

c: Ms. Gertrude L. Dever
Mr. Mark B. Whitaker, Jr.

Enclosure

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

# Staff Issue Report

August 24, 2001

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

**COPIES:** Board Members

**FROM:** M. Duncan

**SUBJECT:** Review of Hydrogen Fluoride Supply System, Y-12 National Security Complex

This report documents the results of a review performed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) at the Y-12 National Security Complex in Oak Ridge, Tennessee. Staff members W. Andrews, F. Bamdad, M. Duncan, P. Gubanc, L. Haubelt, and M. Helfrich and outside expert R. West participated in discussions with representatives of the U.S. Department of Energy, National Nuclear Security Administration (NNSA) and BWXT Y-12 regarding the Y-12 Hydrogen Fluoride Supply System (HFSS). The staff also reviewed related draft safety basis documentation.

**Background.** The hydrogen fluoride (HF) process reduces uranium trioxide to uranium dioxide in a fluidized bed reactor using hydrogen gas, and converts the uranium dioxide to uranium tetrafluoride in another fluidized bed reactor using HF vapor. The fluidized beds are located in the B-1 wing of Building 9212, while the HFSS is located on a nearby loading dock. The supply system consists of an HF cylinder, a vaporizer, a superheater, and transfer piping that connects the system to the hydrofluorination fluidized bed. The resulting uranium tetrafluoride is then processed in a reduction furnace to produce uranium metal. The scope of the planned HFSS startup includes the supply system and the fluidized beds, as well as all associated equipment.

**Status.** The contractor is completing the safety basis documentation for the HFSS. The authorization basis was recently redone, beginning with the hazard analysis, and has been substantially improved. A process hazard analysis has been performed in response to the Board's previous concerns. As a result, more than 500 potential events have been identified that may require preventive or mitigative controls. New plume modeling was done to model releases of HF more realistically for the accident analysis section. Work continues on finalizing the safety basis documentation. The contractor hopes to obtain approval from the Y-12 Area Office by August 30, 2001. System testing is scheduled to occur later this calendar year. Initial use of the system is expected in May 2002.

**Risk.** A review of the current draft of the safety basis documentation revealed that there are many postulated accident scenarios whose unmitigated consequences are considered Scenario Class I, or high-risk. Specifically, a high-risk event is either qualitatively "anticipated" or "unlikely" to happen and has a high consequence. Because of the high hazard associated with HF, a high consequence means that airborne concentrations could potentially be great enough to cause serious injury or fatality to those exposed. For most of these scenarios, safety systems, structures, and components (SSCs) have been identified to mitigate the risk. These controls can reduce both the frequency and the consequences of these accidents. In several cases, however, engineered controls could not be selected because of the nature of the accident scenario. To prevent some of these accidents, the current draft safety basis credits only administrative controls, such as operating procedures, the maintenance program, and independent verification of certain important procedures. As a result, these accident scenarios remain Class I even though their frequency has been reduced from "anticipated" to "unlikely."

While it is not always feasible to install SSCs to prevent or mitigate every accident scenario, as much as possible should be done to reduce known risks to a level that would be considered acceptable. An emphasis on effective training of operators and strict adherence to procedures during hazardous activities has already been identified as reducing risk. Since operational and human errors can still be expected, it would be prudent to assume that such an accident could occur, and to focus on formulating a preplanned emergency response to mitigate its potential effects.

According to the analysis, there are discrete times of heightened risk of an accidental release of HF. An example is any maintenance activity that temporarily removes primary or secondary confinement systems (e.g., leaves the cylinder enclosure open) while HF that could be released as the result of an operator error or a mishap is still in the system. Additional mitigative controls could be devised to reduce the consequences should a release occur during such hazardous activities. For example, if emergency responders were notified and physically present during the few most potentially hazardous activities, they could respond immediately to an incident.

It should be noted that the contractor intends to apply the new analyses and revise the emergency management hazard analysis to benefit from the recent progress. It would be prudent to consider improving the emergency response procedures by preplanning activities, and ensuring the presence of emergency responders during some of the more hazardous activities.