DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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October 21, 1994

Mr. Mark Whitaker, EH-6
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Mr. Whitaker:

Enclosed for your information and distribution are 24 Defense Nuclear Facilities Safety Board (DNFSB) staff reports. The reports have been placed in the DNFSB Public Reading Room.

Sincerely,

George W. Cunningham
Technical Director

Enclosures (24)

94-0005831

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

March 25, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Steven Stokes

SUBJECT: Storage of Spent Ion Exchange Columns from the Hanford Site K-East and K-West Basins

1. **Purpose:** This memorandum describes concerns with potential hydrogen accumulation resulting from the storage of spent ion exchange columns generated at the Hanford Site K-East and K-West Basins.

2. **Summary:** The current storage configuration of spent ion exchange resin columns from the K-Basins recirculation system has not been adequately assessed to determine if the build-up of explosive mixtures of hydrogen gas is possible. An unreviewed safety question determination was performed to assess the storage of these columns in a chlorine vault in the K-West area but it failed to address the potential for buildup of hydrogen within this structure.

3. **Background:** The K-basins water recirculation systems utilize replaceable filtration and ion exchange columns to remove particulate matter to 5 μm and soluble radioactive species, i.e., Cs-137 and Sr-90. The lack of an approved disposal container has resulted in the interim storage of 39 spent ion exchange columns in a chlorine vault in the K-West area. This interim storage configuration was initiated 3 years ago with the storage of 27 spent ion exchange columns. Periodically, additional spent columns have been generated raising the total to the current level of 39. Spent ion exchange resins generate hydrogen gas as a result of radiolytic decomposition of water and spent resin. The long-term storage of these resins in the chlorine vault was questioned to ascertain if the appropriate safety considerations, i.e., the potential build-up of hydrogen gas, had been considered.

4. **Discussion/Observations:** The need for interim storage of spent ion exchange columns is a direct result of the failure to develop a waste management strategy for this waste stream. About three years ago, the method used for determining if spent ion exchange columns were transuranic (TRU) waste was found to be incorrect. The TRU waste determination had been based on the activity of TRU radionuclides per total weight of the waste package rather than just the activity of TRU radionuclides per weight of waste matrix. This necessitated an interim storage requirement until an adequate waste package could be developed and approved.

The current storage configuration includes placement of the spent columns in a burial box; these columns are vented via an activated carbon filter. The burial box is then placed inside the chlorine vault. The chlorine vault is a cement structure, which had been used to store a chlorine filled rail car (the chlorine was used for disinfection of potable water used in the K-West area).

The generation of hydrogen gas from spent ion exchange resins is a fairly well understood phenomenon and is based upon the radiolytic decomposition of water and ion exchange resin by alpha, beta, and gamma radiation. This decomposition results in the formation of hydrogen gas, hydrogen peroxide, and other decomposition products.

The potential, therefore, exists for the buildup of hydrogen gas to explosive levels within the chlorine vault if the facility is not properly ventilated. Based on interviews with Westinghouse Hanford Company (WHC) representatives of the K-Basin Waste Management Group and the review of the unreviewed safety question determination, the staff determined that no assessment has been done of the potential for hydrogen buildup within the chlorine vault. The staff believes that this is a significant safety issue that should have been addressed given the prolonged storage period in the chlorine vault.

Other issues that result from decomposition of the ion exchange resin include:

- release of bound water, radionuclides, and chemically active soluble decomposition products due to excessive lifetime radiation doses to the resin (the Nuclear Regulatory Commission has established a 10^8 rad lifetime dose limit to reduce the impact of radiolytic decomposition of the resin); and

- a reduction in pH within the resin bed, which can increase corrosion concerns.

These issues are not as immediate as the generation of hydrogen, but are important considerations for the disposal of these wastes.

5. **Future Staff Actions.** The assessment of the safe-storage of the ion exchange columns in the chlorine vault will be followed closely. Additionally, the disposition of these wastes will be monitored to ascertain if adequate precautions are taken to minimize potential impacts to public health and safety.