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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
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June 17, 1996

The Honorable Thomas P. Grumbly
Under Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Mr. Grumbly:

Members of the Defense Nuclear Facilities Safety Board's (Board) staff visited the Hanford Site on February 21-22, 1996, and reviewed safety issues involving the high-level waste tanks and several inactive tank farm facilities. Westinghouse Hanford Company (WHC) personnel presented local weather data that showed lightning strikes the 200-East and 200-West areas (including the tank farms) twice per year. Subsequent to our staff's review, WHC completed an analysis of the lightning hazard and recommended specific actions to provide lightning protection in the Hanford tank farms. Division 16 of DOE Order 6430.1A, *General Design Criteria*, states that lightning protection must be considered for buildings storing explosives and radioactive material. Because the high-level waste tanks contain radioactive and flammable material, the Board believes it would be beneficial to implement the WHC recommendations as quickly as possible.

During the February review, our staff also discussed the status of several inactive tank farm facilities that contain significant quantities of radioactive materials and waste. The discussion revealed that the current condition of these facilities is not well known and hazards such as flammable gas generation and spread of contamination have not been analyzed. Subsequent discussions indicate that WHC and the Department of Energy-Richland are reluctant to further investigate or clean out these facilities apparently due to a lack of funding and the upcoming change of the primary Hanford contractor. The enclosed report is a synopsis of the observations made during the February 21-22, 1996, Board's staff review and it accurately reflects the problems that continue to exist. It is forwarded for your consideration.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

March 28, 1996

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Cliff Moore

SUBJECT: Trip Report - Review of Hanford Tank Safety Issues February 21-22, 1996

1. **Purpose:** This trip report documents a visit by the Defense Nuclear Facilities Safety Board's (Board) staff members (Ralph Arcaro, Cliff Moore, Lani Miyoshi, and Richard Tontodonato) to the Hanford Site on February 21-22, 1996, to review safety issues for the high-level waste tanks.

2. **Summary:** Review of the tank farms safety issues focused on specific Board staff concerns resulting from recent authorization basis discussions. Because inactive facilities containing radioactive material pose similar safety issues, they were included in the review. The staff review team made the following significant observations:

   a. Lightning continues to be a credible tank deflagration initiator and requires a comprehensive assessment to determine adequate mitigation.

   b. Westinghouse Hanford Company (WHC) intends to write a topical paper on flammable gases to address inconsistencies among hazards analyses, references, and associated technical reports. While WHC states that this report will provide support for the development of the tank farms Final Safety Analysis Report (FSAR), its September 1996 release date makes this seem unlikely.

   c. WHC has recommended adding nine tanks to the Flammable Gas Watch List (FGWL) based on atmospheric pressure correlations that involve unquantified uncertainties and have not been validated through controlled tests with actual waste. Although recommending the addition of these tanks is conservative, the staff believes WHC should further investigate the technical bases for current gas screening models to develop a definitive method for identifying tanks for addition to the FGWL.

   d. WHC is reevaluating plans to saltwell pump the liquid phase from tank 241-C-103 without first removing the organic liquid layer. WHC's principal concern is that saturating the sludge with organics during saltwell pumping would affect future sludge processing.

e. Hanford has several long-inactive facilities that still contain radioactive material and waste. In most cases, the current condition of these facilities is not well known. The configuration and contents of these facilities need to be determined to adequately address safety issues such as flammable gases and spread of contamination.

3. **Background:** Storage of high-level waste in tanks at Hanford poses many safety issues, including lightning control, flammable gases, and combustible organic materials. WHC has several parallel path efforts aimed at characterizing the tank wastes and clearly bounding the risks so that they can define the systems and controls required to mitigate these hazards. These studies are maturing to the point where WHC feels they can support the development of a compliant FSAR. However, the Board's staff review of many of these reports has revealed inconsistencies in data, inadequate recommended controls, or failure of WHC to implement justified controls on a timely basis.

4. **Discussion/Observations:**

a. Lightning: Weather data from a five-year period ending January 1, 1996, showed ten strikes within the 200-East and 200-West tank farms collectively. In order to develop a formal position on the lightning control issue, WHC has committed to issuing a comprehensive report in August 1996 on lightning and its associated safety issues. Preliminary discussions with WHC personnel indicate that the report will be probabilistic in nature and show that although lightning may strike the 200 areas at a frequency of twice per year, the probability of striking a tank is in the incredible range ($<10^{-6}$ per year). Given the unpredictable nature of lightning, the simplistic nature of a probabilistic analysis, and the availability of mitigative measures, a deterministic analysis of tank lightning strikes would be prudent.

b. Flammable gases: The staff discussed inconsistencies between the Accelerated Safety Analysis (ASA) and other technical reports on the Hanford waste tanks--some of which were used as references for the ASA. Inconsistencies included ignition source probabilities used to calculate accident frequencies and flammable gas compositions used to determine deflagration consequences. WHC stated that they will issue a topical report in September 1996 on flammable gases in order to eliminate these inconsistencies. However, because the release date of the report coincides with the release date of the tank farms FSAR, the staff is concerned that it will not be able to provide timely input for the hazards analysis, which is the core of the FSAR. Discussions with WHC also revealed the following issues:

(1) Additional FGWL Tanks: WHC recently completed an analytical study of all 177 tanks to determine if additional tanks should be added to the FGWL.

Each tank was evaluated for the potential to exceed 25% of the lower flammability limit (LFL) under steady state or episodic gas release conditions. Criteria used for the evaluation were: (1) calculated steady state gas concentration, (2) surface level increase (slurry growth), and (3) correlation of surface level fluctuations with changes in atmospheric pressure (CLAP). Where possible, actual vapor space sample results were used in place of calculated steady-state gas concentrations. Preliminary results of the survey prompted Department of Energy-Richland (DOE-RL) to formally recommend the addition of 25 tanks to the FGWL.

Nine of the 25 formally-recommended tanks exceeded the LFL criteria based only on CLAP data. However, this methodology relies on level and pressure measurements made by low precision instruments. Uncertainties from these instruments can introduce large uncertainties in estimated trapped gas volumes because changes in waste level and atmospheric pressure used in the correlation are very small relative to the size of the tank. While adding suspect tanks to the FGWL is conservative, the addition of tanks without a sound technical basis makes removal of the tanks from the FGWL very difficult and has the potential to impede sampling and saltwell pumping of the single-shell tanks (SSTs). Further investigation and validation of the technical bases of current gas screening models would provide a definitive methodology for identifying tanks for addition to the FGWL.

(2) Single-shell tanks: A Los Alamos National Laboratory (LANL) report on SST bounding gas releases identified eight tanks on the FGWL that represented the most serious flammable gas deflagration risk. WHC plans to "interim stabilize" these tanks by pumping their liquid contents to double-shell tanks (DSTs) once the LANL safety assessment on saltwell pumping of FGWL SSTs is complete.

(3) Double contained receiver tanks: As reported in a January 12, 1996, Board staff trip report, the ASA concluded that the double contained receiver tanks (DCRTs) could develop a flammable atmosphere within several days of receiving waste. Although not all controls recommended in the ASA are practical, WHC still has not implemented acceptable controls to prevent a deflagration in the DCRTs. Instead, WHC has sought to determine the level of ventilation currently provided for the DCRTs. WHC stated that the DCRTs have diptube bubblers that they are now using to purge the tanks. However, for at least two DCRTs, the purge supplied by the bubblers does not meet the purge rate recommended in the ASA. Furthermore, WHC does not know the contents of some DCRTs so the ASA may not have used conservative waste types for hydrogen generation calculations.

c. C-103 Organics: SST 241-C-103 has a two-inch floating organic layer (~5000 gallons) composed primarily of tributyl phosphate and normal paraffin hydrocarbons. The original method proposed by WHC for removing leakable liquids from this tank was saltwell pumping the liquids to a double-shell tank without first removing the organic layer.

However, this method provides the undesirable potential for separable phase organics in later sludge wash and filtration/ion exchange operations. Thus, plans for skimming the organic before pumping the supernatant to a double-shell tank are being explored. Subsequent to this site visit, WHC completed a systems engineering study for the interim stabilization of tank 241-C-103; however, a preferred alternative was not identified. A topical paper will be prepared on solvent fires in tank 241-C-103 to assist in the development of the FSAR evaluation of this hazard.

d. Inactive facilities: Field inspections and inquiries by the Board's Hanford Site Representative revealed several inactive facilities that were abandoned without proper equipment cleanout and inventory removal. Hazards posed by this situation include hydrogen generation, spread of contamination, and loss of radioactive material containment. Specific observations are noted below.

(1) 244-AR Vault: The 244-AR vault was an interim holding station for waste transfers between PUREX and B-Plant. The facility contains four tanks in underground cells. One of these tanks contains 23,000 gallons of waste including 600 gallons of neutralized current acid waste (NCAW) from PUREX. The estimated source term for this tank is 120,000 curies. While the actual configuration of the tank is uncertain, WHC stated that it is isolated from the ventilation system. The staff expressed concern about hydrogen generation in the tank and WHC agreed to take a vapor space sample. WHC plans to upgrade mechanical systems and restore steam service to the building in the near term so that they can empty the tanks.

(2) 242-T Evaporator: The 242-T evaporator facility concentrated T-Plant waste until shutdown in 1976. The configuration of the facility at the time of shutdown is unknown; however, radiation levels of 1 R/hr at the condensate cell doors (one cell away from the evaporator pot) indicate the presence of radioactive material in the evaporator facility's vessels. At present, no tank level or floor sump monitoring capability exists and no records indicate if the evaporator pot was drained prior to shutdown. WHC plans to use robotics to obtain radiation level readings at the evaporator cell doors to help determine if the evaporator pot contains radioactive material. Because the evaporator vessels are carbon steel and thus susceptible to corrosion, long-term storage of material in them presents a potential for gross contamination should they fail.

(3) 209-E Critical Mass Laboratory: The Critical Mass Laboratory (CML) is an inactive part of the 209-E waste handling facility. The current condition of the CML is not known. However, a 1994 criticality assessment of the 209-E facility stated that the CML contains approximately 500 grams of plutonium.

WHC personnel stated that this plutonium was held up in the ventilation equipment, which is isolated, but they are not sure if any of the processing equipment in the CML contains residual plutonium. (As of March 27, 1996, WHC had not yet found the CML layup records provided to WHC by Pacific Northwest National Laboratory in 1992.)

5. Future Staff Actions:

a. The Board's staff will continue to review the flammable gas and organic safety issues as WHC develops the Tank Farms FSAR.

b. The Board's staff will follow up on the safety issues of the inactive facilities listed in this report.