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## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004  
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September 27, 1995

Mr. Mark Whitaker  
Department of Energy  
1000 Independence Avenue  
Washington, DC 20585

Dear Mr. Whitaker:

Enclosed for your information and distribution are eight Defense Nuclear Facilities Safety Board staff reports. The reports have been placed in our Public Reading room.

Sincerely,

A handwritten signature in black ink, appearing to read "George W. Cunningham".

George W. Cunningham  
Technical Director

Enclosures (8)

April 26, 1995

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

**MEMORANDUM FOR:** G.W. Cunningham Technical Director

**COPIES:** Board Members

**FROM:** Donald J. Wille

**SUBJECT:** Hanford Site - Review of Waste Tank Farms - Trip Report  
(February 28, 1995 to March 2, 1995)

1. **Purpose:** This report documents a review of electrical, instrumentation and control systems, and configuration management activities in 200 East and West Waste Tank Farms at the Hanford Site by Defense Nuclear Facilities Safety Board (Board) technical staff, Donald J. Wille and Ajit K. Gwal on February 28, 1995 to March 2, 1995.
2. **Summary:**
  - a. Electrical and Instrumentation Systems:
    1. Direct burial cables at the Waste Tank Farms are over forty years old, have exceeded their design life, and do not comply with installation requirements of the National Electric Code (NFPA-70). The staff believes that an aggressive cable replacement program, based on the results of cable condition monitoring and testing, would enhance the reliability and availability of the electrical system, and greatly reduce shock hazards to workers.
    2. An integrated lightning protection plan for the Waste Tank Farms may not exist. Westinghouse Hanford Company (WHC) could not identify any actions being taken to install lightning protection or investigate whether a problem exists.
    3. The electrical distribution system at the Waste Tank Farms uses ungrounded Delta connected transformers. The staff believes that conversion to a grounded system would result in enhanced electrical safety, increased reliability, and reduced equipment failures due to reduced transient overvoltages.
    4. WHC management has not utilized the Department of Energy's (DOE) recommendations on electrical safety programs.

b. Configuration Management:

1. There is a recognized need to improve the Configuration Management (CM) activities at the Waste Tank Farms.
2. The design basis for most of the Waste Tank Farm systems is not readily available and a program for design basis reconstitution was started in August 1994. The staff believes that design basis and system description documents should be prepared for major systems and components as part of the engineering process for a significant modification or upgrade. This is being done for the new ventilation system design and procurement for the high heat tanks, but is not a universal requirement for the Waste Tank Farms.

3. **Background:**

The East and West Waste Tank Farms contain 177 Waste Tanks and the 242-A Evaporator. Construction of the 242-A Evaporator was completed in 1976 and startup was initiated in 1977. Since that time, several design upgrades were implemented to extend the useful life of the evaporator complex. It is an operational facility at the present time.

4. **Discussion:**

a. Electrical and Instrumentation Systems:

1. Direct Burial Cables (DBC): DBC were used at East and West Tank Farms to distribute electrical power and interconnect electrical equipment and devices. They serve as a link to transmit power, connect protective and control devices, and transmit information signals. These cables are over forty years old and have exceeded their design life. Existing design drawings for cable routing are diagrammatic only and do not provide the exact location of the DBC routing. Type and construction of these cables, in most instances, are unknown, and raceways were not utilized in the installation of DBC. Furthermore, the installation of DBC at the Waste Tank Farms does not comply with the requirements of the National Electric Code (NFPA-70); for example, code requires a minimum earth cover of 24 inches for DBC compared to the existing 6-24 inches. These cables, especially the ones with 6 inches of earth cover, may have suffered severe mechanical stresses due to trucks and cars traveling over them. Presently cables at the Waste Tank Farms are only replaced after they fail.

Maintenance testing of these cables, e.g. continuity and ground test, and insulation resistance test commonly referred to as Megger test, are not being performed. There are no plans to evaluate the cable condition by periodic testing and monitoring in

accordance with available industry practices. Electric Power Research Institute has sponsored various cable condition monitoring projects and has a list of references for industry usage.

The staff believes that severe cable degradation (age-related and damage) exists at the Waste Tank Farms and the criteria for replacing the cables only when they fail needs to be re-evaluated. The staff believes that an aggressive replacement program, based on the results of cable condition monitoring and testing, will enhance the reliability and availability of electrical system, and greatly reduce the shock hazards to workers.

2. Lightning Protection: An integrated lightning protection plan for the Waste Tank Farms was not available for the staff to review and may not exist. WHC, however, briefed the staff on lightning protection for SY-Tank Farm. They also submitted documents that recommend the removal of the lightning tower from SY-Tank Farm (Tank 101-SY) on the basis of a risk analysis. Removing lightning protection from the SY-Tank Farm violates the requirement of NFPA-780 "Lightning Protection Code". During pump or ventilation system failure, flammable concentration of vapor or gas will accumulate and if concurrently, lightning strikes a riser, an explosion or deflagration may result.

During a staff review at Hanford by R. Tontodonato, D. Lowe and R. Robinson on March 15, 1995, WHC presented additional risk analyses regarding lightning-initiated accidents in the tank farms. WHC stated that lightning-initiated accidents were credible for the flammable gas watch list tanks as a group, and only marginally incredible ( $2.7 \times 10^{-7}$  per year) for Tank 101-SY alone. Furthermore, WHC stated that lightning strikes onto the risers of individual ferrocyanide and organic watch list tanks were also credible. Such events could ignite fuel/nitrate reactions with severe consequences, and could supply sufficient energy to ignite pool fires in tanks containing free organic liquids (such as Tank 103-C). DOE Order 5480.23, Nuclear Safety Analysis Reports, requires evaluation of the consequences of a design basis accident or beyond design basis accident if there is a potential for significant hazard to the public, worker, or the environment. WHC does not appear to have evaluated the consequences of such events in the absence of lightning protection.

WHC could not identify any actions being taken to either remedy the problem (e.g., install lightning protection in the tank farms) or rapidly investigate whether or not a problem truly exists (e.g., quickly assess whether existing grounding of tank risers and equipment provides protection). Further, WHC personnel stated they did not intend to conduct a Unreviewed Safety Question Determination (USQD) per DOE Order 5480.21, even though this type of accident is not addressed in the tank farms safety

basis (WHC-SD-WM-ISB-001, *Hanford Site Tank Farm Facilities Interim Safety Basis*). The staff believes that the USQD needs to be performed.

3. System Grounding: The Electrical distribution system at the Waste Tank Farms utilizes mostly Delta connected transformers (approximately 46 transformers). One of the disadvantages of using this type of transformer is that no neutral point is available for grounding unless additional auxiliary apparatus is provided. The staff noted that distribution systems do not have grounding transformers and are ungrounded.

The decision to convert an existing ungrounded system to grounded operations is usually made for the purpose of limiting transient overvoltages. The electrical system at the Waste Tank Farms is vulnerable to transient overvoltages resulting from arcing ground faults, particularly because of the degraded insulation of direct burial cables, and aged windings in motors and transformers. The staff believes that the conversion of the existing system to a grounded system would result in enhanced electrical safety, increased reliability, and reduced equipment failures due to transient overvoltages.

4. Electrical Safety Program (ESP): The staff reviewed the ESP awareness at the Waste Tank Farms using the DOE Electrical Safety Guidelines, "DOE/ID-10600," and DOE Report of the Task Group on Electrical Safety of Department of Energy Facilities, "DOE/EH-0298." Cognizant personnel were not aware of these documents and the recommendations contained in DOE/EH-0298 for the Hanford Site. However, WHC stated that they train the site workers to a Westinghouse electrical safety manual, but could not produce records/documentation to verify their assertion. The staff also could not verify that procedures exist to mandate the training of site workers to WHC electrical safety manuals.
5. Leak Detection and Radiation Monitoring System: Pole mounted, area radiation monitors were installed in 1974, to detect process line leaks at both Tank Farms in East and West areas. These monitors were sensitive to water and gave a moderate number of false alarms, which tended to increase as the system aged. Failures of the direct buried cables strung between the instrument houses and the individual poles resulted in long-term outages of some systems. Based on a safety evaluation that concluded the monitors were not required for accident detection, WHC is removing them. Presently, WHC does not plan to replace them with a system to provide indication of process line leaks.

b. Configuration Management :

1. The East Waste Tank Farm, West Waste Tank Farm and the 242-A Evaporator each has a Plant Engineering group with a staff of cognizant engineers that is the Design Authority for control of the respective facility design. Detailed engineering and design activities are often performed by other groups within WHC or ICF-Kaiser Hanford, subject to the approval of the facility Plant Engineering group.
  2. Currently, a site-wide Configuration Management Plan is undergoing WHC review. The Plant Engineering group for each facility is responsible for CM at that facility. These managers report to the Waste Tank Plant Engineering (WTPE) Manager, who is responsible for overall configuration management at the Tank Farms. Recently, a "Configuration Management Improvement and Control" group reporting to the WTPE Manager, was established. This group will consolidate various CM related activities (e.g., as-built drawing program) in order to provide improved coordination with other groups and guidance to Plant Engineering Managers. This change will need the overview of DOE-Richland Field Office (DOE-RL) to ensure that the responsibilities of the Plant Engineering Manager for CM are not diluted.
  3. The system cognizant engineers report to the facility Plant Engineering Manager. They exercise the design review and approval authority and are critical to overall design control and maintenance of the safety basis. Each cognizant engineer is trained in the Unreviewed Safety Question screening process. In order to be effective in evaluating design changes, a well understood design basis is necessary. The present Facility Description Manual was prepared in the mid-1980's and WHC stated that updated system descriptions will be included in the updated FSAR, which will be submitted to DOE-RL at the end of September 1995. A program plan was defined in mid-1994 for design reconstitution activities. The staff believes that appropriate design basis information and design descriptions could be of value for major modifications related to safety requirements. This approach was taken for the new ventilation system for the high heat tanks at the West Tank Farms when a design basis document was prepared as a part of the engineering activity.
5. **Future Staff Actions:** The Board staff will review the electrical calculations (i.e, voltage profile, short circuit studies and protective device coordination studies) and modifications to the lighting design, and also perform follow-up reviews as required to pursue the issues raised in this trip report.