

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 16, 1993

MEMORANDUM FOR: G. W. Cunningham, Technical Director**COPIES:** Board Members**FROM:** A. K. Gwal**SUBJECT:** DWPF Electrical Distribution System Site Visit
April 21-23, 1993

1. **Purpose:** This memorandum provides a record of the DNFSB staff visit to the Defense Waste Processing Facility (DWPF) to review the facility's electrical distribution system.
2. **Summary:** The DNFSB staff review of the DWPF electrical system revealed several situations which could be considered questionable, they are listed below:
 1. DOE and WSRC do not consider any part of the DWPF electrical system to be a safety class system. This lack of safety class designation by DOE and WSRC will be reviewed when the station blackout analysis is completed in July 1993.
 2. During a tour of DWPF the staff raised several questions regarding ventilation in the battery room of the main processing building. There is a concern that hydrogen generated by the batteries may accumulate and create a potential for an explosion. In addition, there is no local or remote indicator or alarm to alert plant operators to a failure of room exhaust. Moreover, no calculations are available to support an assessment of the adequacy of the room ventilation. Also, it was noted that the ventilation duct for the battery room was at least two feet below the ceiling.
 3. The staff toured the Glass Waste Storage Building where the radioactive glass product will be stored in stainless steel canisters. A top level review of the building systems indicated that temperature monitoring may be inadequate, allowing undetected 'hot spots' in the building. Temperature rises in the storage building may degrade the concrete and cause allowable stress limits to be exceeded. A review of the documentation to be supplied by DOE/WSRC will be necessary before any conclusions can be made on the safety implications of any electrical system failures or inadequacies.

On the other hand, the staff is able to report several encouraging findings. The electrical system calculations done by Bechtel National were documented well. For

example, in its preliminary review of the contractor's protective device coordination study, the staff determined that the contractor's sample calculations appeared to be adequate. Further review of other supporting calculations will be necessary before any final determination of their overall adequacy can be made.

In addition, the staff was impressed with the demonstration of the Electrical Characteristics and Diagnostics (ECAD) System 1000 data acquisition system. This automated system is an informative and useful technology program which covers electrical system inspection, trouble shooting, condition monitoring, and preventive maintenance.

4. Recent improvements to the grounding system at DWPF have effectively eliminated the control computer failures that were occurring frequently due to lightning.
3. **Background:** DWPF is a vitrification facility built to process the high-level waste at the Savannah River Site into a form suitable for long-term storage. This facility is scheduled to begin operations with radioactive material in 1994. During April 21-23, 1993, DNFSB staff members Ajit Gwal and William White visited the facility to begin the review of the facility's electrical systems. The agenda for the trip [1] and meeting attendance lists [2] have been logged into the DNFSB library. A list of 22 requested documents [3] was presented to DOE on April 23, 1993.
4. **Discussion:** It is important to note that no part of the DWPF electrical system is considered a nuclear safety (NS) system by DOE/WSRC. The validity of this assumption will be determined following a review of DWPF design documents and of a station blackout analysis scheduled to be completed in July 1993. Other findings are as follows:
 - a. The staff received presentations which included brief descriptions of the facility normal and emergency power systems, ventilation systems, fire protection power supply systems, and power supplies to the process systems. The design and installation of the systems appeared adequate, but a more comprehensive review must still be done when the documents requested from DWPF become available.
 - b. During its tour, the staff noted several potential problems with the facility's electrical system. Design of the ventilation system in the battery room of the main processing building may not be adequate for the removal of hydrogen as required in IEEE 484 [4]. There is a concern that hydrogen generated by the batteries may accumulate and create a potential for an explosion. In addition, there is no local or remote indicator or alarm to alert plant operators to a failure of room exhaust. Moreover, no calculations are available to support an assessment of the adequacy of the room ventilation.

Also, it was noted that the ventilation duct for the battery room was at least two feet below the ceiling. These conditions could potentially allow hydrogen accumulations along the ceiling of above 2%, in violation of IEEE 484, and could create a potential for an explosion.

In the main processing facility, the staff noted a fire/ventilation seal (M05F016) whose sealing material was flaking away from the electrical cables. This represented a possible breach of the seal. DWPF electrical personnel are reviewing that condition and will notify the Board's staff of their findings. Other facility electrical anomalies included the lack of a fire suppression system in building 951 (facility electrical substation) and the lack of seismic qualification for the emergency lighting. In the event of an earthquake, the emergency lighting is needed for personnel egress from the facility.

- c. The staff also toured the Glass Waste Storage Building where the radioactive glass product will be stored in stainless steel canisters below grade in a steel support structure. A top level review of the building systems indicated that temperature monitoring may be inadequate, allowing undetected 'hot spots' in the building.

An analysis of a station blackout is to be included in the next DWPF SAR revision. As part of this analysis, DOE/WSRC will document their conclusions related to the structural adequacy of the storage building during loss of ventilation. Temperature rises in the storage building may degrade the concrete and reduce allowable stresses. A review of the station blackout analysis by the staff will be necessary before any conclusions can be made on the overall safety implications of electrical system failures in DWPF.

- d. Several encouraging findings were noted by the staff during the tour. The staff was impressed with the demonstration of the Electrical Characteristics and Diagnostics (ECAD) System 1000 data acquisition system. This automated system is an informative and useful technology program which covers electrical system inspection, trouble shooting, condition monitoring, and preventive maintenance. This system can also analyze installed power and control circuits, including cables, components, and connecting hardware. Also, a new grounding system installed almost a year ago has effectively eliminated electrical failures caused by lightning.
- e. The staff reviewed the testing, maintenance, and qualification programs for electrical equipment, as well as the size and design of selected facility electrical systems. These selected systems seemed adequate to meet the facility process needs. The only problem noted was that cable pull-bys were allowed during design modifications, a practice discouraged in industry because of the potential for damaging the cable. In addition, there was no

local or remote indicator or alarm to alert the plant operators to failed fuses. The only indication of fuse failure for the facility was failure of the equipment.

- f. In its review of selected electrical system calculations done by Bechtel National, the staff determined that these calculations were documented well and supported an adequate facility electrical design. Review of a larger sample of calculations will be necessary before any final determination of their overall adequacy can be made. Sample calculations requested for review include the voltage profile, the short circuit study, the cable ampacity and sizing study, and the plant load study.
 - g. DWPF compliance review of DOE Order 6430.1A, "General Design Criteria," indicated deviations from the Order, but it included justifications for those deviations. The staff will review the adequacy of this order compliance assessment when requested documents become available.
 - h. A brief overview of the distributed control system (DCS) which controls the process at DWPF was provided. The DCS consists of a main processor and several remote processor units. Both hardware and software had been extensively tested by WSRC and the vendor (Texas Instruments). Several improvements to the DCS had been made since the system was installed. Long cable runs were switched to fiber optic to prevent excess noise and signal attenuation, and grounding improvements were made to prevent spurious electrical noise. A system was also put in place to track the root causes of DCS failures.
5. **Future Plans:** The staff will review the additional documents requested. This review will, in part, determine the scope and necessity for future reviews. This site visit did not address DWPF's fire protection system. This system will be covered during a future visit to the facility planned for July 1993.