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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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October 13, 1995

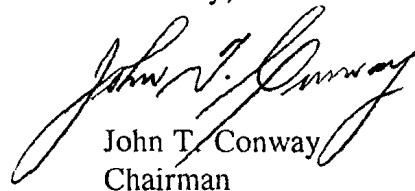
The Honorable Thomas P. Grumbly
Assistant Secretary of Environmental Management
Department of Energy
Washington, DC 20585

Dear Mr. Grumbly:

A Defense Nuclear Facilities Safety Board (Board) staff review team visited the New Waste Calcining Facility (NWCF) at the Idaho Chemical Processing Plant on August 29-31, 1995, to review the NWCF Turnaround Project and the safety basis for the facility. The staff noted progress in preparing the NWCF and the High-Level Liquid Waste Evaporator for operation. However, the Board's staff also noted that operator controls, including temperature monitoring and audio monitoring of kerosene ignition, are not proceduralized or raised to the level of Technical Specifications. These controls are relied upon, as backup measures, to preclude a severe kerosene explosion in the NWCF.

The enclosed report is a synopsis of the observations made during the review and is forwarded for your consideration.

Sincerely,



John T. Conway
Chairman

c: The Honorable Tara O'Toole
Mr. Mark Whitaker

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

September 19, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Daniel G. Ogg

SUBJECT: Chemical Processing and Safety Basis at the New Waste Calcining Facility, Idaho National Engineering Laboratory, Idaho Chemical Processing Plant, Report of Site Visit, August 29-31, 1995

1. **Purpose:** This memorandum documents the results of the Defense Nuclear Facilities Safety Board's (Board) staff visit to the Idaho National Engineering Laboratory (INEL). The review focused on High-Level Waste (HLW) processing and the safety basis at the New Waste Calcining Facility (NWCF) at the Idaho Chemical Processing Plant (ICPP). The review team included staff members Daniel Ogg, Joseph Roarty and Randall Robinson.
2. **Summary:** The Department of Energy, Idaho Operations Office (DOE-ID) and Lockheed Martin Idaho Technologies (LMIT) appear to have an aggressive program to manage the preparations for start-up of the new High-Level Liquid Waste Evaporator (HLLWE) and restart of the NWCF. Additionally, LMIT personnel have an adequate research program in place to identify processing alternatives for all the waste in the ICPP tank farm.

A review of the NWCF Plant Safety Document (PSD) indicated that there are two unlikely, but credible accidents associated with operation of the NWCF that could potentially be fatal to facility workers. These accidents involve kerosene explosions in the NWCF processing cell and in the calciner vessel. In fact, an event involving a small kerosene fire in the calciner cell occurred in December 1992. The contractor completed corrective action for the fire that included upgrades to maintenance procedures and equipment. Technical specifications that might serve to mitigate kerosene explosions have changed little in many years and remain essentially the same in the new draft revision to the PSD and in a new draft Safety Analysis Report intended to meet the requirements of DOE Order 5480.23, *Nuclear Safety Analysis Reports*. Certain procedural controls could be elevated to Technical Safety Requirement status to further reduce the risk posed by kerosene explosions.

Another potential accident involves an organic-nitrate explosion. This accident is precluded if organics are not present in the HLW tanks in sufficient quantities to form a separate organic phase. LMIT personnel stated that organic levels in the HLW tanks are below the saturation level, but HLW tank sample analysis reports were not readily available to confirm this. The Board's staff requested organic sample analysis results and will review them when they become available.

3. **Background:** The NWCF, which processes liquid HLW, completed its last operational campaign in November 1993. Several upgrades and repairs are being made to the facility, and a NWCF Turnaround Program has been established to ensure that the HLLWE and the NWCF will start up within the time frame mandated by the state of Idaho. LMIT plans to restart the NWCF by January 1997 and finish processing the remaining HLW partially blended with sodium bearing waste (SBW) from the HLW tank farm. A larger volume of unblended SBW will also be treated at the NWCF after a suitable processing method has been developed. If a new method is not identified in time, the contractor intends to continue operation of the NWCF and to process SBW by making a larger addition of aluminum nitrate nonahydrate (ANN) to the waste. The addition of more ANN serves to lessen (by dilution) the adverse effects of sodium on the calcine product quality.

4. **Discussion:**

- a. Accident Analysis and Mitigation: The Safety Analysis Report (SAR) for the NWCF identifies two unlikely, but credible accidents that could result in fatalities to site workers. These accidents are associated with explosions of kerosene in either the calciner cell that houses the equipment or the calciner vessel in which the HLW solution is calcined to ceramic particles. An explosion in the calciner cell is possible if the kerosene spray is not ignited when introduced into the vessel and allowed to accumulate. If ignited, the accumulated kerosene could cause a large and potentially fatal explosion. The primary means of preventing this accident is a temperature interlock. Kerosene flow cannot be initiated prior to the vessel temperature reaching 340°C, which is approximately 10 percent above the auto-ignition temperature of kerosene.

A similar event, involving a small kerosene fire, occurred at the NWCF in December 1992 when kerosene leaked from a spray nozzle on the calciner vessel and ignited inside the calciner cell. The cause of that incident was a faulty nozzle and improper installation. The contractor corrected these problems by making upgrades to the equipment and revising maintenance procedures.

Operator knowledge and experience are also relied upon to recognize whether kerosene ignition has occurred. This is noted by a temperature fluctuation in the calciner vessel and by hearing a popping noise that is transmitted to the operating corridor through a speaker. Contractor personnel, who have been members of the operating staff, explained that the kerosene gas flashes in small repetitive bursts as it is sprayed into the chamber and ignited. This phenomenon causes a popping noise that can be heard through audio monitoring. However, the operational practices of monitoring temperature fluctuations and popping noises have not been proceduralized.

If one assumes a single fault, common mode failure such as a faulty thermocouple calibration or an erroneous temperature readout, then the accident may not be prevented by current technical specification requirements. The additional intelligence involving the

the temperature response following initiation of kerosene flow, or the audio response used as verification of kerosene ignition, could be proceduralized or elevated to technical specifications to provide a greater reduction in risk posed by this accident.

A similar situation exists for an organic-nitrate explosion that could potentially result in the fatality of facility workers. This accident is possible if organics are present in the HLW tanks in sufficient quantity to create a separate organic phase. The Board's staff inquired about sampling of storage tanks and was told by LMIT personnel that organic concentrations in the HLW tanks were below the saturation value. Additional evidence that a separate organic phase does not exist was provided by limited video surveys of the HLW tanks. The surveys showed no organic layer on the surface of the waste. The Board's staff requested a copy of the tank sample analysis report that indicates the organic concentration.

- b. SAR Update: The current safety analysis for the NWCF is contained in the ICPP PSD Section 8.2, dated October 1990. LMIT updated the PSD through 1994 and 1995 to reflect changes made to the NWCF and to include the HLLWE. LMIT then submitted the updated PSD to DOE for approval and, as of August 1995, the PSD was still under review. Additionally, the LMIT safety analysis group has started work on a new Safety Analysis Report that meets the requirements of DOE Order 5480.23, *Nuclear Safety Analysis Reports*.

The Board's staff reviewed the current PSD and the new update to the PSD. Also, the staff discussed the format and content of the new SAR with LMIT safety analysis personnel. The Board's staff observed that technical specifications (TSRs in the new SAR) are essentially identical in all three versions of the SAR and there appears to be simply a continuation of past successful operational practices into the future. For example, there were no noted changes to the technical specifications following the kerosene fire at the NWCF in 1992. It is the opinion of the Board's staff that the safety of these operational practices could be augmented by a dedicated reassessment of each significant hazard and the establishment of safety systems, TSRs, or other mitigative systems to establish defense-in-depth.

5. **Future Staff Reviews**: The staff will continue to review the efforts to start up the HLLWE and to restart the NWCF. As further information becomes available on the chemical processing methods proposed for treating sodium bearing waste, the staff will evaluate that information.