TRANSMITTED TO M. WHITAKER 02/08/96

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

October 2, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Cliff Moore

SUBJECT: Process Hazards Review of the Hanford Site Plutonium Finishing Plant

1. Purpose: This trip report is a summary of the Defense Nuclear Facilities Safety Board (Board) staff review of the vertical denitration calciner under development at the Plutonium Finishing Plant (PFP) located on the Hanford Site. The review covered the process hazards resulting from the operation of the calciner and their associated consequences and mitigating factors. Calciner testing using plutonium-bearing materials was to begin at the time of the Board staff visit. The review took place September 18-20, 1995.

2. Summary: It appears that the Westinghouse Hanford Corporation (WHC) personnel performed appropriate engineering design reviews, criticality safety analyses, process hazard reviews, and an unreviewed safety question determination (USQD) to support pilot vertical calciner operations on plutonium solutions. However, some of these reviews were not formally documented and assessed as part of the startup and approval process. Nevertheless, based on the discussion provided by WHC, the staff believes that a sufficient level of effort was focused on providing the engineering and administrative controls necessary for safe radioactive testing of the vertical calciner. This conclusion is predicated on the testing being conducted only by senior experienced researchers. Transition to production use by PFP operators will require significant procedure development and operator training as a prerequisite.

3. Background: The vertical denitration calciner is a unit operation developed by the WHC Plutonium Processing Support Laboratory (PPSL) to convert residual plutonium solutions to plutonium oxide for interim storage in accordance with the implementation plan for Board Recommendation 94-1. The calciner is one of the options considered in the draft PFP Cleanout Environmental Impact Statement (EIS) and it has been successfully operated using simulated feeds. The PPSL is now set to process plutonium solutions obtained from the Argonne National Laboratory. Results from the radioactive testing will be used in selecting the final process option for the EIS Record of Decision.

4. Discussion/Observations: According to WHC Engineering Procedures, PPSL personnel must perform a Job Safety Analysis and Criticality Safety Analysis (CSA) prior to implementing laboratory-scale process testing. Additionally, an Unreviewed Safety Question Screening must be performed to ensure the testing is within the safety envelope defined in the PFP Final Safety Analysis Report (FSAR). Board staff review of these documents as well as the radioactive test plan (including the test procedure) for the calciner did not indicate a sufficient level of detail concerning potential process hazards and their mitigating factors. Specifically, no formal discussion of "what if" scenarios involving the operating parameters of the calciner was evident. This is contrary to industry practices used at some other Department of Energy (DOE) sites. For example, Westinghouse Savannah River Company (WSRC) requires the use of Process Hazard Reviews (PHR) as part of the design and preoperation process.

The Board staff discussed 21 different "what if" scenarios with WHC PPSL and PFP Engineering personnel. The scenarios included loss of power, loss of process ventilation, calciner overheating, offgas scrubber failure, and offgas filter failure. Each scenario was evaluated for its cause(s), consequences, safety significance, existing protection, and recommended actions. Through the course of this discussion, it was apparent that PPSL and PFP Engineering personnel had considered and adequately addressed these issues using primarily engineered safety features with some administrative controls. Existing alarm setpoints had a technical basis, and calculations for potential energetic releases and their consequences on the processing equipment and glovebox had been performed. PPSL personnel had not taken credit for their engineering design and safety review documentation because it was not a requirement for laboratory processing operations. WHC imposes limited requirements and provides only general guidance for safety reviews of laboratory processing operations. By taking this approach, WHC relies on the judgement and objectivity of its personnel to insure the safety of laboratory processing. In contrast, WSRC requires a formal PHR for laboratory experiments and provides extensive safety review criteria in its Process Safety Management Manual (U).

The two residual plutonium solution processing options being considered are calcination and magnesium oxide precipitation. Precipitation, although effective, results in a considerable volume increase because of the bulk chemical addition, liquid waste streams, and impure product. Precipitation also requires further drying to meet storage requirements and is currently considered a less desirable treatment method than calcining. According to the DOE implementation schedule for Board Recommendation 94-1, testing of the processing methodologies will be complete by March 1996 and startup of the selected treatment method by August 1996. The schedule for implementation of the calciner system as a full-scale PFP operation by August 1996 is ambitious. According to the PFP lead engineer, procurement and installation of a full-scale calciner system is expected to take six months if the calciner involved in the current testing proves effective. A longer period of time may be required should design modifications be identified during testing. In addition, procedural development, safety basis documentation, personnel training, and an evaluation of operational readiness will be required prior to startup.

To date, a total of 15 liters of solution have been processed by the calciner during testing. However, on September 25 the calciner impeller seized up and operation of the calciner was suspended. Currently, calciner testing is indefinitely delayed while the mechanical difficulties with the impeller are examined and corrective actions implemented. The delay is expected to be lengthy as the calciner must be disassembled, examined, and repaired in the glovebox.