DEFENSE NUCLEAR FACILITIES SAFETY BOARD

July 19, 1993

MEMORANDUM FOR: Board Members
G. W. Cunningham, Technical Director

FROM: J. Kent Fortenberry

SUBJECT: Trip Report - Review of the Hanford Plutonium Finishing Plant

1. **Purpose:** This memorandum provides observations resulting from the DNFSB staff's ongoing reviews of the Hanford Plutonium Finishing Plant (PFP).

2. **Summary:** The DNFSB staff has performed reviews of the PFP during five facility visits: December 7 through 10, 1992; January 26 through 28, 1993; February 22 through 25, 1993; April 26 through 29, 1993; and on June 15, 1993. The DNFSB staff has compiled observations from its ongoing reviews in this trip report. These observations might be of use to DOE in improving the readiness of the PFP for restart and in preparing a PFP Operational Readiness Evaluation (ORE).

   The PFP is categorized by DOE as a High Hazard or Category 1 Non-reactor Nuclear Facility (per DOE Order 5481.1B, *Safety Analysis & Review System*, or the current DOE Order 5480.23, *Nuclear Safety Analysis Report*). Radiological events at the PFP that could affect the safety of the public, co-located workers, and facility personnel include earthquakes, fires, explosions, criticalities, spills/pressurization, and ventilation upsets. There are also many opportunities for worker contamination during operating and maintenance activities, as seen from recent occurrences. During visits to the facility, the staff has observed deficiencies that do not reflect the discipline needed to operate safely. These deficiencies, in summary, are:

   a. the absence of a complete and separate set of procedures to define the immediate and subsequent actions to be taken in the event of various emergencies, abnormal events, or operational upsets,

   b. the absence of emphasis during operator training on the process of responding to abnormal events,

   c. the absence of, or reluctance to use, an integrated operating procedure to control the status and configuration of the facility,

   d. difficulty in achieving procedural compliance,

e. DOE Facility Representative training and qualifications for general plant operations, power operations, environmental waste operations, and facility surveillance will not be required prior to re-start,

f. the absence of correction or compensation for electrical issues in the area of protective device coordination, age related degradation, preventative maintenance procedures, and Hydrogen accumulation in the battery rooms,

g. the reluctance to accept the applicability of industry standards such as the Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 3.16, *General Fire Protection Guide for Plutonium Processing and Fuel Fabrication Plants*,

h. an inadequate ventilation seismic shutdown design,

i. the absence of a baseline industrial hygiene survey quantifying chemical exposures during plant operation,

j. the absence of a change control process for the proposed Safety Analysis Report (SAR),

k. the absence of a systematic approach for addressing potential aging effects on plant equipment,

l. inadequate administrative controls for ensuring compliance with Operational Specification Requirements (OSRs),

m. weak processes for audits, independent assessments, commitment tracking, records management, and corrective action management, and

n. weaknesses in the Plutonium Finishing Plant Administration Manual, WHC-CM-5-8, which do not reflect some important elements of the organizational structure described in the proposed SAR.

The DNFSB staff will continue to follow the PFP restart activities and will look for improvements in the deficiencies noted. The staff also plans to monitor the DOE ORE for restart of the PFP.

3. **Background:** The DOE-Richland Operations Office (DOE-RL) desires to restart the PFP to process existing plutonium nitrate solutions and some of the plutonium bearing materials to improve the safety posture of the facility and to allow for an accurate inventory of special nuclear material. This proposed processing campaign would restart the Plutonium Reclamation Facility (PRF), the Remote Mechanical "C" (RMC) Line, and

miscellaneous handling and storage activities. The PRF would be used to concentrate existing plutonium nitrate solutions and to convert plutonium bearing materials to plutonium nitrate. The RMC Line would then be used to convert plutonium nitrate to plutonium oxide powder for storage at the PFP. The PRF processing would last about 40 weeks. The RMC Line operation would require an additional 40 weeks.

The PFP is classified as a High Hazard or Category 1 Non-Reactor Nuclear Facility. To ensure adequate protection of public health and safety while operating the PFP, the DNFSB staff began a review of the facility late in 1992. Westinghouse Hanford Company (WHC) planned to issue a statement of readiness on May 25, 1993 for the restart of the PFP. However, on March 22, 1993, following several occurrences and contaminations at the PFP during fairly routine operations and maintenance activities, the plant manager curtailed facility operations, training, and maintenance activities. Following the identification and disposition of corrective actions, WHC lifted the curtailment on May 7, 1993. A statement of readiness from WHC concerning restart of the PFP is now expected in November, 1993.

4. **Discussion:** On December 7 through 10, 1992, DNFSB staff members visited the PFP and conducted reviews in the areas of: Quality Assurance, Packaging and Transportation, Organization, Managerial Controls and Oversight, Non-radiological Safety, Waste Management, and Engineering Reviews.

On January 26 through 28, 1993, DNFSB staff members conducted a general review of DOE Order Compliance self-assessment activities at Hanford. The PFP figured prominently in this review. A separate trip report, which was transmitted to DOE for their use on April 1, 1992, documents the results of this review.

On February 22 through 25, 1993, DNFSB staff members conducted additional reviews at the PFP to follow-up on items from the December review trip and to assess three new subjects: Conduct of Operations, Sampling & Analysis, and DOE Facility Representatives.

On April 26 through 29, 1993, members of the DNFSB staff visited the facility to follow-up items from previous reviews and to make initial assessments of Radiation Protection, Electrical Systems, Ventilation Systems, Instrumentation and Control, Fire Protection, Emergency Preparedness, Environmental Protection, Maintenance and Plant Modifications/Repairs.

Finally, on June 15, 1993, the DNFSB staff visited the facility to observe work control activities and operator training drills.

These reviews were conducted through briefings, facility walkthroughs, and document reviews. Significant observations made during the course of these reviews are discussed below by topical area.

a. Conduct of Operations and DOE Facility Representatives

1. The PFP does not have a complete and separate set of procedures to define the immediate and subsequent actions to be taken in the event of potential emergencies, abnormal events, or operational upsets. It is obviously beneficial to have a set of procedures that address abnormal or emergency conditions such as fire, chemical spill, contamination, loss of ventilation, loss of process water, earthquake, loss of power, etc. These procedures are particularly useful when they identify the immediate actions to be taken by the operators. DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, provides guidelines that emergency procedures be distinguishable from other procedures to enhance rapid retrieval (Chapter XVI, Section C.2.a.). In addition, Order 5480.19 requires that the immediate actions of emergency procedures be committed to memory by the operators (Chapter XVI, Section C.7). The PFP conduct of operations manual (WHC-IP-0821-PUO, Chapter 2) also requires that operators be able to perform the immediate actions of plant and system recovery procedures without referring to the procedure. Some procedures do exist to address emergency or abnormal conditions, but these procedures are not separated or consolidated. Some of these procedures are located in the PFP Building Emergency Plan. A copy of the PFP Building Emergency Plan was not located in the PRF control room. Immediate actions are not identified in the existing emergency procedures. Therefore, operators do not have the immediate actions of emergency procedures committed to memory as required by DOE.

2. PFP operator training in responding to abnormal events teaches the specific drill but does not emphasize the process. It is certainly good to train operating crews on the response to specific plant upsets or events. However, it is important that this training be done with some emphasis on process. The DNFSB staff observed several drills at PFP and noted that:

   (a) no emergency or abnormal event procedures were used,

   (b) no Alarm Response Instructions were used,

   (c) alarms that came in during the drill were not generally announced by the operators,

(d) there were no repeat-backs used in control room communications,

(e) there was not a clear demonstration of command function,

(f) operators performed activities such as defeating automatic controls, initiating transfer activities, etc., without informing the supervisor, and

(g) operators did not feedback the status of assigned activities to the supervisor.

3. PFP is not using an integrated operating procedure to control the status and configuration of the facility. A detailed integrated operating procedure is essential for controlling major facility evolutions such as start-up and shutdown. The use of such a procedure during the training run would be valuable both for validation and for training. The PFP Administration Manual, WHC-CM-5-8, Section 1.23 "Start-up Checklist" provides some degree of integrated control over facility configuration. This procedure is not in use for the PRF training run. PFP management stated that the PRF Training Run Plan (WHC-SD-CP-TC-029) was being used in its place until the actual restart, at which time the startup checklist would be used. The PRF Training Run Plan does not provide status or configuration control. This was evidenced by a recent occurrence involving an open tank drain line and confusion over the facility configuration (see occurrence report RL-WHC-PFP-1003-0019).

4. PFP is having difficulty achieving procedural compliance. DOE Order 5480.19, *Conduct of Operations Requirements at DOE Facilities*, identifies "the responsibility of the on-shift operating crew to safely operate the DOE facility through adherence to operating procedures and technical specification or operational safety requirements." This responsibility is applicable not only to operators performing plant evolutions, but in the administrative controls established to ensure proper operating activities. Some examples of procedural noncompliance are:

(a) Chapter 12 of the PFP conduct of operations manual (WHC-IP-0821-PUO) requires the use and the subsequent retention of turnover checklists. Neither requirement is being met at PFP.

(b) Chapter 19 of the WHC-IP-0821-PUO procedure provides a tickle file for tracking OSR required activities. The tickle file sheet from a previous month (March 1993) was reviewed and found to be incomplete in that some of the signature lines used to track completion of OSR surveillance were blank.

(c) Lack of procedural compliance with the lock and tag procedures is evident by a monthly performance goal for lock and tag non-conformance of 40 percent.

5. DOE does not plan to fully qualify DOE Facility Representatives for PFP prior to re-start. It is understandable that training and qualifications relating to the RMC Line operation might be delayed until after restart of the PRF but prior to restart of the RMC Line. However, the Facility Representative training and qualification plans presented to the staff indicated that balance of plant training and qualification requirements (i.e., general plant operations, power operations, environmental waste operations, facility surveillance, etc.) would not be required until after the restart of both the PRF and RMC Line. Given that these general support areas are relevant now, as well as during and after the processing campaigns, the plan to delay training in this area is not consistent with the training needs.

b. Electrical / Instrumentation & Control, Fire Protection, and Ventilation Systems

1. PFP has not provided correction or compensation for electrical system weaknesses in the area of protective device coordination, age related degradation, preventative maintenance procedures, and Hydrogen accumulation in the battery rooms. Review of the electrical load study and the protective device coordination study revealed a lack of proper protective device coordination. PFP personnel indicated that they were aware of these deficiencies. No definite corrective or compensatory actions were identified.

The DNFSB staff has serious concerns with electrical age-related failures at PFP. There is ample documentation of age-related failures of electrical components at PFP (e.g., fans, compressor bearing windings, circuit breakers, cables, etc.). Age-related embrittlement of cables in a motor

junction box was noted by the DNFSB staff. No corrective or compensatory actions have been identified to address age-related failure and degradation of electrical equipment. Replacement and spare parts are difficult to find for these aging components. In most cases, preventative maintenance and testing procedures do not exist for the electrical equipment.

Hydrogen accumulation in the battery rooms represents an explosion hazard. PFP has no indication or alarm for the failure of battery room exhaust fans. There are also no calculations available to determine the adequacy of the battery room ventilation.

2. PFP has not considered the requirement of NRC RG 3.16, *General Fire Protection Guide for Plutonium Processing and Fuel Fabrication Plants,* in their fire protection system design. There is a reluctance to accept the applicability of this industry standard. Based on a cursory review, the DNFSB staff determined that the PFP fire protection system does not meet the single failure criteria of NRC RG 3.16. Other non-conformances to NRC RG 3.16 may exist at PFP.

3. A review of the Ventilation Seismic Shutdown System revealed a serious design deficiency. The PFP ventilation system was designed to shutdown during a seismic event to limit radioactive releases. Specifically, upon detection of a seismic event, the AC exhaust fans are automatically shutdown. However, two backup steam-turbine-driven exhaust fans are not shutdown, and will contribute to the release of radioactive material. This deficiency was discussed with DOE-RL/WHC.

c. Industrial Hygiene and Non-Radiological Safety

A baseline industrial hygiene survey to quantify chemical exposures during operations has not been completed. DOE Order 5480.10, *Contractor Industrial Hygiene Program*, specifies that once potential hazards have been identified the industrial hygienist must determine the extent of the hazard and report findings to the first line supervisor. Based upon schedules provided by the industrial hygiene staff, air sampling of PRF chemical preparation areas to quantify chemical exposures was to be pursued prior to restart and in conjunction with cold chemical runs. This sampling has not been completed, primarily due to the work stoppage, however even with the resumption of the training run no measurable progress has been made to complete this effort. Additionally, DOE Order 5480.10 specifies that the industrial hygiene staff identify and document

existing and potential health hazards. The review of new and existing procedures by industrial hygiene personnel to facilitate the identification of hazards brought about by poor work controls or newly introduced hazards has not been accomplished. This type of review may have prevented the chemical exposure documented in occurrence report RL-WHC-PFP-1993-0016 (over-exposure to Nitrogen Oxide). One of the root causes for this occurrence was an inadequate procedure which did not indicate that adding sodium nitrite to nitric acid can result in the evolution of nitrogen oxide fumes.

d. Maintenance, Engineering Reviews, Aging Management, and Plant Modifications/Repairs

1. There is no change control process at PFP for the SAR. DOE is currently reviewing an SAR which is to be implemented prior to the PFP restart. DOE Order 5480.23, *Nuclear Safety Analysis Reports*, specifies that any part of an SAR that has been upgraded is immediately subject to periodic updates (Section 4.f.(11).(c)) because situations may arise in which part of a facility SAR has been upgraded for long enough to require updating even though other parts of the same facility SAR have yet to be upgraded. It is reasonable to expect that changes affecting the proposed SAR would be formally controlled, even though DOE has not yet approved the document. With formal control, any changes made to the facility as described in this proposed SAR would be subjected to an Unreviewed Safety Question evaluation, and then documented with an SAR change request. When the proposed SAR is approved, these changes could then be incorporated. The proposed SAR for PFP is not being maintained or updated. This proposed SAR is dated January 31, 1991. As of May, 1993, no PFP procedure existed to make changes to the SAR. It is not clear how changes made to the facility as described in this proposed SAR have been accomplished during this 2 year period. When approved by DOE, the SAR may not adequately represent the facility.

2. PFP does not have a systematic approach for addressing potential aging effects on plant equipment. The DNFSB staff believes that aging of plant equipment is a serious safety issue at PFP. Several recent incidents at PFP have resulted in personnel plutonium contaminations. Preliminary conclusions presented to the DNFSB staff indicated that aging of equipment played a major role in each of these events. More of these events can be expected to occur in the future because of the age of the facility and equipment. The corrective actions resulting from these recent events may have shifted too much responsibility for protection to the

workers. The corrective actions presented to the DNFSB staff relied exclusively on the worker recognizing the risks of working on an aged facility and planning additional protective barriers as necessary. However, it is also line management's responsibility to systematically address the risks of operating and maintaining an aged facility. DOE Order 4330.4A requires that nuclear facilities develop a formal program for addressing the potential deterioration of structures, systems, and components (SSC). In addition, this issue may merit consideration under DOE Order 5480.21, *Unreviewed Safety Questions*.

e. Managerial Controls & Oversight

1. The PFP management controls in place to ensure compliance with OSRs are inadequate. Facility OSR compliance status is provided to the PFP plant manager by a weekly letter from the Facility Operations Assurance group. DNFSB staff randomly selected the week of April 19 - 25, 1993 for review. Although a weekly letter had been written stating that the facility was in compliance with all OSRs, evidence had not been obtained that the required surveillances had been performed.

   A computerized system (PISCES) appeared to be used effectively to track and schedule OSR required equipment calibration and maintenance activities. However, administratively controlled OSR surveillances were not tracked or scheduled with this system. A list of the administratively controlled OSR surveillances due during the current week could not be produced by the Facility Operations Assurance group.

   A spot check of one OSR inspection requirement revealed additional shortcomings. One OSR inspection requirement was to externally inspect sealed containers of plutonium for visible signs of pressurization. All of the required data sheets for this required inspection could not be provided. The OSR inspection procedure for this OSR is ZO-200-032. For some vaults, the inspection was being performed using a separate procedure (Security procedure No. 9). Although a record of the inspection was available, the Security procedure No. 9 did not identify the required inspection activity as an OSR requirement, and did not provide criteria for determining the acceptability of the inspection. The personnel performing Security procedure No. 9 were unaware of any OSR requirement related to their inspection. For some vaults a computerized safeguards system was used to perform the required inspection. No data sheets were filled out. No alarm response instructions relating this computerized system to the OSR requirement existed. PFP investigated this matter further and

documented other examples where the OSR inspection requirements were not being met (see occurrence report RL-WHC-PFP-1993-0028).

2. Deficiencies were observed in the processes for audits and independent assessments, commitment tracking, records management, and corrective action management.

   (a) The Management Overview Program (MOP) and the Senior Supervisory Watch (SSW) lack effectiveness as means to improve conduct of operations. The recent addition of the morning and evening SSW turnover meeting with the Plant Manager is a very positive step in resolving this ineffectiveness. However, observations and comments in reports of tours and watches are not adequately tracked and followed up. Processes are not in place to evaluate findings and to ensure remedial action is taken and root causes are corrected to prevent recurrence of problems. During tours of the plant, observations of housekeeping and material condition, operator activities and record keeping indicate that these managerial oversight programs lack effectiveness.

   (b) Requirements and commitments are not being tracked. When requirements and commitments are not tracked, the review of a proposed procedure change relies on the reviewer's knowledge of DOE Order requirements, OSR requirements, and other commitments to ensure that the change does not subvert the original requirement. One of the benefits of the DOE Order Compliance Self-Assessment activity recommended by the Board (Recommendation 90-2) was to provide a baseline of compliance information relative to DOE orders and standards to be used in the operation of the facility. DOE's Implementation Plan in response to Recommendation 90-2 states that the standards implementation assessment (including DOE orders) is documented in detail for configuration control. However, information obtained from the Order Compliance Self-Assessment activity at PFP is not being maintained or updated and is not being utilized to ensure that compliance with the orders is maintained. Likewise, commitments contained in the OSR and other authorization bases documents are not being tracked to ensure their continued compliance.

   (c) Deficiencies in the monthly Plutonium Finishing Plant Performance Monitoring Management Information report reduce its usefulness for managerial control and oversight. The PFP monthly report

contains inconsistencies, missing explanations and indicators of questionable significance. DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, provides guidance for establishing an effective performance monitoring program (Chapter I, Section C.3). A process is not established at PFP for selecting performance indicators important to the success of the PFP Plant Manager's organization and the organizations supporting PFP. A process is not established for setting goals, collecting and evaluating data, and developing corrective action based on trends in the indicators.

3. The Plutonium Finishing Plant Administration Manual, WHC-CM-5-8, does not reflect some important elements of the organizational structure described in the proposed SAR. DOE Order 5480.23, *Nuclear Safety Analysis Reports*, specifies that the safety basis to be analyzed for a nuclear facility shall include management (Section 8). In particular, the Safety Analysis Report (SAR) is to address management, organization, and institutional safety provisions (Section 8.b). There are differences in substance between the organizational structure as described in the proposed SAR submitted to DOE as a basis for restart approval and the organization described in the Introduction section of WHC-CM-5-8 (and the actual organization as it has evolved). Documentation is not available which shows that divergences from the proposed SAR were addressed and justified in developing the Introduction section of WHC-CM-5-8.