DEFENSE NUCLEAR FACILITIES SAFETY BOARD

November 26, 1996

MEMORANDUM: G. W. Cunningham, Technical Director
COPIES: Board Members
FROM: Lester Clemons
SUBJECT: Observations of Rocky Flats Building 771 Readiness Assessment

1. **Purpose**

This report documents the results of observations of the Kaiser-Hill (K-H) Readiness Assessment (RA) for startup of the processing system for plutonium/uranium (Pu/U) hydroxide precipitation, which will be used to stabilize Pu/U solutions. The hydroxide precipitation system is located in Building 771 (B771) of the Rocky Flats Environmental Technology Site (RFETS). The observations were made during September 16-19, 1996, by Lester Clemons, member of the staff of the Defense Nuclear Facilities Safety Board (Board); David Boyd, outside expert; and, on a part-time basis, Board Site Representatives Mark Sautman and Robert Warther.

2. **Summary**

The K-H RA Team identified 15 findings during the RA, 11 of which were pre-start. The Board staff is closely monitoring the K-H procedures for closure of the identified findings prior to startup, and has the following concerns:

- The dry run did not demonstrate the adequacy of all procedures and training needed to perform hydroxide precipitation operations safely. In particular, it did not demonstrate the removal, handling, and transporting of bottles and processed materials (e.g., oxides/urinates) from the gloveboxes.

- The staff observed deficiencies in the training of workers in approved procedures and in some workers' overall understanding of the hydroxide precipitation process. Some workers provisionally qualified in handling of surrogate materials had not taken or passed the comprehensive written examination.

- Based on measurements made by K-H radiation protection on October 22, 1996, the radiological work planning and controls for protecting the health and safety of workers do not appear to be conservative for dose rates from some feed solution bottles. The bottles are not routinely surveyed before being handled.

- The staff observed that the drill response teams for drills simulating upset conditions were poorly organized and the drills marginally successful.

3. **Background**

The hydroxide precipitation processing system is scheduled to operate for about 3 months to process approximately 310 liters of Pu/U-bearing liquids of various isotopic concentrations in plastic containers. The processing to be conducted inside and outside of gloveboxes will involve primarily hands-on operations. K-H has identified the following potential radiological hazards to the workers during hydroxide precipitation operations: (1) external exposure from the 60 kilo electron volt (keV) gamma ray of the Americium-241 (Am-241) isotope, a daughter product of Pu; (2) potential internal exposure from spills of radioactive liquids outside of gloveboxes, which could become airborne; and (3) the potential for radioactive releases from small fires inside the gloveboxes.

4. **Discussion/Observations**

Readiness Assessment Dry Run. The dry run simulating the hydroxide precipitation process did not consider some hazardous aspects of the process and did not demonstrate all the procedures in place to protect the health and safety of workers. The dry run operations were limited to the handling of radioactive materials inside gloveboxes. They did not include the removal, handling, and transporting of bottles and processed materials (e.g., oxides/urinates) from the gloveboxes. The RA Implementation Plan indicated that these were interface and support activities, and thus ongoing and "not subject to this RA." K-H's explanation was that the procedures outside the gloveboxes have been used over the years during production operations and are used routinely site wide. The Board staff is concerned that the process specialists assigned to this project did not demonstrate methods for the safe handling of potentially high radioactive materials during the dry run.

Training. The knowledge, skills, and abilities of workers were assessed during their performance of the dry run, during drills that simulated upset conditions, through a review of training records, and through personal interviews held by the RA Team members. The RA Team indicated that procedure development and approval had been in a state of flux, such that final training on approved procedures had not been completed prior to the start of the dry run. During the interview sessions, it was clear that some process specialists' knowledge and understanding of radiological hazards and the potential consequences from these hazards were weak. Most did not understand clearly the purpose and importance of information on the Radiation Work Permit (RWP). Training records indicated that some process specialists provisionally qualified in handling surrogate materials had not taken or passed the comprehensive written examination. In addition, radiological control technicians (RCTs) and their supervisors had very little knowledge and understanding of the hydroxide precipitation process. It was clear during staff observations that the training program had been less than effective, and that more training on approved field procedures and radiological control methods was necessary; the RA Team agreed. Training has been identified as a pre-start finding from the RA evaluations.

Radiological Controls and Procedures. During RA observations, the staff reviewed the as low as reasonably achievable (ALARA) study of September 13, 1996, developed by K-H Radiological Engineering (RE) for the hydroxide precipitation process in B771. This study was based on a July 24, 1995, RE assessment of dose rates calculated

for the Building 771 Integrated Safety Assessment (ISA). It evaluated the removal (bag-out/bag-in) of 108 bottles currently stored in various gloveboxes and their transfer to another room for processing. It also included the removal (bag-out) of canisters of processed materials, resulting in a total of several hundred bag-in/bag-out operations.

The ALARA study indicated that a major concern was the potential for radiation exposure to the workers during the handling of radioactive materials in bag-in/bag-out operations. Yet direct reading dosimeters (DRDs) are being replaced by supplemental thermoluminescence dosimeters (TLDs) based on the assumption that dose rates are too low to be measured using DRDs on a daily basis. This assumption is contrary to the recommendations in the RE assessment, which is based on detailed calculations of dose rates from the bottle and canister sources. The rationale given for the change is that lead aprons will be worn and that the average daily individual exposures would be such that it ". . . would be difficult for the DRDs to quantify the dose." This may not be the case since a contact dose rate of over 400 milliroentgens/hour was measured by K-H radiation protection on October 22, 1996, for a 4 liter bottle of Pu/U solution with a high concentration of Am-241. This dose rate is orders of magnitude higher than the threshold limit of DRD measuring capability. While TLDs may be more accurate than DRDs, they lack the versatility of DRDs for in-process monitoring of personnel exposures in potentially high dose fields and the ability to implement immediate corrective actions, if necessary. It should also be noted that the ALARA study did not address the frequency of in-process surveys of radiation levels of feed solutions in the bottles before handling.

Emergency Response. Two drills simulating upset conditions were observed. One of these consisted of simulating a cut to a worker's hand through a glove while working inside the glovebox, and the other involved a simulated electrical fire starting inside the glovebox. In both of these drills, there appeared be a considerable amount of confusion about the appropriate steps to be taken to mitigate the incident. In the cut hand incident, it took several minutes for the RCT to put a respirator on the injured worker. It also took several more minutes to acquire a containment device (plastic bag) in which to insert the worker's hand in order to avoid the potential for spreading contamination.

During the fire drill, members of the site Fire Department were stopped at the entry to the Material Access Area as part of the drill simulation (to prevent fire hose contamination) while they discussed their plan of action with the drill controllers. A recent memorandum to B771 facilities support stated that the Building Emergency Support Team members and glovebox operators are limited to suppressing incipient-stage fires only. Also, it is understood that training and qualification of Building Emergency Support Team members have been discontinued. Since the site Fire Department has the total responsibility for suppressing significant fires in B771, the Board staff believes that holding the entire Fire Department at the entry to the Material Access Area may have been unnecessary. Selected members of the Fire Department could have gone to the scene of the fire. The RA Team has identified inadequacies in the glovebox firefighting drill as pre-start and post-start findings.

5. **Future Staff Actions**

The Board staff will review closure documents for the pre-start findings identified in the RA for startup of the hydroxide precipitation processing system in B771.