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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
(202) 208-6400

November 22, 1994

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

Dear Mr. Grumbly:

A Defense Nuclear Facilities Safety Board staff review team visited the Rocky Flats Environmental Technology Site on October 3-5, 1994, and focused on two issues central to the Board's Recommendation 94-1: stabilization of plutonium residue solutions and repackaging of stored plutonium metal and oxide. Our staff noted that progress is being made on these important tasks, but identified concerns with the manner in which plutonium metal items are being packaged after inspection as well as with the protracted schedule for repackaging plutonium metal and oxide for long-term storage.

The enclosed report is a synopsis of the observations made during the review, and is forwarded for your information. Mr. W. Kornack or Mr. R. Tontodonato of the Defense Nuclear Facilities Safety Board's staff will be available to provide any additional information you may require.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark Whitaker, EH-6

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

November 2, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Richard E. Tontodonato, Technical Staff

SUBJECT: Trip Report - Review of Plutonium Metal Repackaging and Plutonium Solution Stabilization at the Rocky Flats Environmental Technology Site, October 3-5, 1994

1. **Purpose:** This trip report documents a visit by Defense Nuclear Facilities Safety Board (DNFSB) staff members (Richard Tontodonato and William Von Holle) to the Rocky Flats Environmental Technology Site (RFETS) on October 3-5, 1994, to review the plutonium metal inspection program, plans for repackaging plutonium metal and oxides for long-term storage, and preparations for plutonium solution stabilization.

2. **Summary:**

a. Inspection of about ten percent of the plutonium metal items stored at RFETS showed some items to be heavily oxidized, but found no evidence of pyrophoric substances. Most of the approximately 1700 remaining metal items could be inspected and repackaged next year, but EG&G plans to only repackage a maximum of 238 items, because of lack of funding.

b. Under current plans, repackaging of plutonium metal and oxides to meet the forthcoming Department of Energy (DOE) standard for long-term plutonium storage will not begin until FY 1998 and will not be completed within the eight-year period identified in DNFSB Recommendation 94-1.

c. Preparations to stabilize plutonium solutions continue, but EG&G has not defined the critical path for the stabilization program. EG&G currently predicts that solutions other than Building 371 process piping residuals and tank heels will be stabilized within the two to three year period specified in Recommendation 94-1. Demonstration of the oxalate precipitation process at Los Alamos National Laboratory (LANL) has shown that flowsheet changes will be needed to produce filtrate with acceptably low plutonium concentrations.

3. **Background:** DNFSB Recommendation 94-1 established goals of two to three years to repackage plutonium metal stored in proximity to plastic and stabilize plutonium residues at RFETS, and eight years to repackage all plutonium metal and oxide in accordance with the forthcoming DOE standard for long-term plutonium storage. The DNFSB staff has been conducting reviews at several DOE sites including RFETS to assess progress toward remediating the safety issues identified in Recommendation 94-1.

4. **Discussion:** During this trip to RFETS, the staff noted the following items:

   a. Plutonium metal inspection: EG&G has nearly completed an inspection program for a representative sample of stored plutonium metal items. About 190 of 1858 total items (which excludes standards and pits) were examined and repackaged. EG&G has just begun to analyze the results, but the following initial observations were discussed:

      1. The predicted package contents and configuration were reasonably accurate for the great majority of the items examined.

      2. Some categories of material, such as electrorefined metal, oxidized rapidly enough that they should receive priority for repackaging. Other categories of material, such as "other ingots," deserve priority because of highly variable oxidation among samples stored in similar packaging and storage environments.

      3. The presence or absence of plastic bags in the packages did not appear to greatly affect oxidation of the stored plutonium. However, EG&G does not intend to use this observation to support continued storage of plutonium in contact with plastic.

      4. Food pack cans did not appear to offer significantly more protection against oxidation than slip lid cans, even for items stored for less than five years. However, EG&G has not yet analyzed inspection data to account for the different types of materials stored in each type of can. Further, only two of the items inspected were sealed in nested food pack cans, which would have provided a more reliable seal than the typical configuration of a single food pack can stored inside a slip lid can.

      5. No evidence of pyrophoricity or past combustion inside the containers was found.

   Within the next year, EG&G plans to repackage all 138 items believed to contain plutonium metal in direct contact with plastic, and up to 100 additional items to be chosen after the inspection results are analyzed. Beyond the next year, EG&G plans to identify and repackage items from categories that exceed a yet-to-be-established oxide generation rate, and to institute weight surveillance for items not repackaged.

EG&G has made good progress on the inspection program, and their plan to rapidly eliminate plastic from the innermost containers is commendable. However, the DNFSB staff has two concerns with the repackaging effort:

1. EG&G is repackaging metal items into non-airtight slip lid cans after inspection. This conflicts with Recommendation 94-1, which states that repackaged metal items should be stored "such that containers need not be opened again for additional treatment for a reasonably long time." EG&G personnel stated that the only currently viable alternative was to use food pack cans, and the inspection data gave little reason to believe food pack cans would offer any improvement. The staff believes repackaging metal items into nested food pack cans, properly sealed and inspected, would significantly improve interim storage conditions at RFETS.

2. EG&G personnel stated that funding concerns are the reason that metal item repackaging will be limited to no more than 238 items next year. Based on the results reviewed by the staff, it is quite possible that the inspection program will show that many more items will require near-term repackaging for safety reasons.

b. Long-term storage: EG&G plans to build a facility in Building 371 to repackage all plutonium metal and oxides at RFETS to meet the DOE long-term storage standard. The process will use a welded container developed by LANL and will calcine plutonium oxides at 1000°C to preclude future container pressurization. However, this facility will not operate until FY 1998, and repackaging would not be completed until FY 2003, which is slightly beyond the eight-year period identified in DNFSB Recommendation 94-1.

Much time could be saved by installing equipment in Building 707 to repackage metal items only, because (1) an environmental assessment would not be required for such a project and (2) Building 707 has already received substantial upgrades. EG&G plans to roughly estimate the cost of doing this, but considers funding unlikely. The staff notes that the metal items in storage are continuously degrading. Delays in packaging metal for long-term storage will thus result in an increased risk for accidents as well as the need to continue to repackage metal items into different interim forms to ensure safe storage while awaiting readiness of the long-term packaging equipment.

c. Plutonium solutions: EG&G and DOE-RFO personnel stated that the critical path for completing the solution stabilization program had not been identified yet. However, several significant actions, discussed in the Attachment, must be completed before stabilization can begin. Based on EG&G's best estimates, solutions other than Building 371 piping and tank heels will be stabilized within the three-year goal specified in Recommendation 94-1. The estimated schedules are summarized below:

Task	Start Date	End Date
B771 Hydroxide Precipitation	April 1995	September 1995
B771 Oxalate Precipitation	November 1995	May 1997
B371 Hydroxide Precipitation of Tanks and Bottles	March 1996	August 1996
B371 Hydroxide Precipitation of Piping and Tank Heels	March 1996	Mid-1999

The schedule for Building 771 includes draining residual solutions from old process piping and recovering liquid heels left in "operationally empty" tanks. However, it will take two more years to recover similar liquids from Building 371. EG&G stated that activities were sequenced in this manner because piping in Building 771 is generally old, single-wall, and directly exposed to workers, whereas piping in Building 371 is newer, frequently double-wall, and often encased in the walls of the building.

DOE-RFO and EG&G consider that the oxalate precipitation process in Building 771 and solution stabilization operations in Building 371 will require operational readiness reviews according to DOE Order 5480.31. However, DOE-RFO and EG&G consider that the Building 771 hydroxide precipitation process is a restart requiring only a readiness assessment, because it is similar to past work that was terminated in an orderly manner when it was no longer needed in the early 1980s. The staff will thoroughly review the basis for these conclusions.

5. **Future Staff Actions:** The DNFSB technical staff will further assess the adequacy of planned readiness reviews for solution stabilization activities and will continue to closely follow actions to implement Recommendation 94-1 at RFETS as well as at other sites.

Attachment

Summary of Significant Actions Needed to Begin Plutonium Solution Stabilization at RFETS

1. DNFSB Recommendations 90-2 and 90-6 must be addressed. EG&G has defined a strategy for satisfying Recommendation 90-2 for these operations, and plans to complete the necessary evaluations in time to support the scheduled start-ups. To satisfy Recommendation 90-6, EG&G has located stabilization operations in portions of Building 771 that have little plutonium holdup in the ductwork. However, some high-level plutonium solutions are in tanks served by ventilation ducts with significant plutonium holdup. These deposits have proven difficult to remove, and thus EG&G and DOE-RFO are seeking authorization to drain the tanks without remediating the ducts. For many months, EG&G, DOE-RFO, and DOE headquarters have discussed revising the Recommendation 90-6 implementation plan to allow pre-remediation actions when supported by appropriate safety analyses, but it is not clear when such a change will be finalized. In the absence of an approved revision to the 90-6 plan, a Secretarial exemption will be needed to drain the affected tanks.

2. An environmental assessment for solution precipitation in Buildings 771 and 371 must be completed and the findings addressed. EG&G expects a Finding of No Significant Impact to be issued by March 1995.

3. Permits must be obtained from the State of Colorado. If applications to the state are not submitted and approved in a timely manner, permitting issues could end up controlling the schedule.

4. Nuclear material safety limits (NMSLs) must be calculated for each operation. EG&G initially believed that this activity would control the schedule, but is now confident that improvements in the process for creating NMSLs and advice from LANL have eliminated this problem.

5. The LANL demonstration of solution stabilization processes must be completed and the results evaluated. Significant results obtained to date are summarized below:

    a. The baseline oxalate precipitation flowsheet will require modifications to more effectively remove plutonium from solution. LANL tests showed this process produced filtrate plutonium concentrations above the receiving limit (24.5 ppm Pu) for the Building 774 carrier precipitation process that will be used to further decontaminate the solutions. EG&G personnel speculated that the ascorbic acid used as a reducing agent may yield reaction products that interfere with the precipitation process. LANL is attempting to find another reducing agent, and has identified hydroxylamine as a first candidate, according to EG&G personnel.

b. The hydroxide precipitation process for Building 771 solutions containing high uranium and/or chlorides may also be modified. Tests of the baseline process, which uses potassium hydroxide, produced acceptable plutonium concentrations in the filtrate, but required long filtration times. Precipitation with magnesium hydroxide showed great improvement, reducing the filtration time by nearly an order of magnitude.

6. Means for draining residual solutions from piping systems and tank heels must be finalized. EG&G plans to drain these systems using commercially available tapping fixtures. In this process, a fixture is clamped on the pipe and sealed with gaskets and epoxy, a hole is drilled or punched though the pipe, and liquids are drained through a valve in the fixture. EG&G is evaluating how long such seals can be considered reliable, to determine whether the tap hole should be plugged soon after the pipe is drained. Welded taps might be used on piping containing neutral solutions, but will not be used on piping containing acid or caustic solutions due to corrosion concerns.

   EG&G estimates that a total of about 2800 taps will be required to fully drain tanks and pipes in Buildings 771 and 371. EG&G personnel working on plans for eventual decommissioning of these buildings stated that even this large number of taps is not considered a problem, because the piping will most likely be removed without flushing.

   Recovered solutions will be pumped through plastic tubing to pencil tanks using a portable pumping station with a peristaltic pump and HEPA filtered exhaust. In order to begin solution draining, the pumping station must be built and operating procedures developed.