DEFENSE NUCLEAR FACILITIES SAFETY BOARD

October 5, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Herbert W. Massie, Jr.

SUBJECT: Rocky Flats - Condition of Facilities for Plutonium Residue Processing

1. **Purpose:** This memorandum provides a report of two trips by the Defense Nuclear Facilities Safety Board (DNFSB) Staff member, H. Massie, and outside expert T. Clark, on August 2-4, 1994, and on August 23-25, 1994, to review the condition of facilities, at Rocky Flats (RF) that could possibly be used for processing of plutonium residues.

2. **Summary:** Based on this review the DNFSB Staff notes the following:

   a. Building 779 contains Room 160, which is capable of processing plutonium bearing salts utilizing various oxidation techniques (e.g., oxygen sparing and calcium carbonate oxidation). This room appears to be in good condition. Additional near-term process development by Los Alamos National Laboratory (LANL) is needed.

   b. Building 771, which historically has been the plutonium residue recovery facility, is generally in poor condition. A substantial amount of work is required to repair the various residue processing lines in Building 771. Moreover, other problems exist such as plutonium in the ducts. EG&G does not recommend the extended use of Building 771 for residue processing.

   c. Building 371, which was constructed in the early 1980's as a replacement for Building 771, has facilities available for future processing of residues; more than one year of construction and startup activities are required.

   d. Building 776 contains Room 154A, in which a molten salt process used to separate metallic plutonium from americium, and then a molten salt scrub process was used to remove remaining actinides (americium and residual plutonium) from the salt. This facility is in fair condition and could be utilized for limited salt processing.

   e. Building 707, Module A, is to be utilized for the repackaging of LECO crucibles (which are small containers used for laboratory testing of plutonium), a low hazard plutonium residue. Module A has also been utilized for special nuclear material (SNM) packaging

activities. Module B could be utilized for some plutonium residue processing, but only if substantial upgrades and modifications are made.

f. EG&G has prepared a FY95 work package to prepare Building 779, Room 160 for salt oxidation activities in response to DNFSB Recommendation 94-1.

3. **Background:** Prior to the curtailment of production at Rocky Flats in 1989, many of the residues were processed quickly to recover the plutonium for production use. Since 1989, the plutonium residues have been stored in various containers (e.g., drums, cans) and in various forms.

4. **Discussion/Observations:** During August 1994, the DNFSB Staff and its outside experts visited Buildings 779, 771, 371, 776 and 707. These buildings were identified in the Department of Energy's (DOE's) response to DNFSB Recommendation 92-5 as possible candidate buildings for processing of plutonium residues. EG&G technical experts who were familiar with the building provided information on the history of processing operations, the condition of the building, and the capability for future residue processing. EG&G also identified additional modifications or construction which were needed for residue processing.

Based upon the above, the DNFSB Staff notes the following:

a. Building 779 was used for laboratory research and development, including chemical analysis and sampling of plutonium and plutonium compounds. The building has been seismically upgraded. Room 160 is in excellent condition and can be utilized to process salt residues with a limited throughput. Prior to curtailment of plutonium production, Room 160 was being set up to conduct oxygen sparging experiments on salt residues. Room 160 contains five glove boxes, four stationary furnaces, a calorimeter, and a moderate size staging capability (40 drums) in an adjacent room. A few upgrades are proposed by EG&G to utilize Room 160 for a new oxidation method with calcium carbonate; this method is being developed by LANL.

The DNFSB Staff walked down the support utilities (e.g., fans, emergency diesel generator, and batteries) and found them to be in good condition. Preventive and corrective maintenance activities have been reinstated.

It is significant to note that Building 779 has not been reviewed by the DNFSB for resumption of plutonium operations.

EG&G has prepared a FY95 work package to prepare Room 160 for salt oxidation activities in response to DNFSB Recommendation 94-1. (Update: The staff was informed, subsequent to the meeting, that this effort was not funded for FY95.)

b. Building 771 was used for recovery of plutonium from residues utilizing incineration, nitric acid processing, and some hydrochloric acid processing. Typically, the residues processed were combustibles, incinerator ash and chloride salts. Building 771 is generally in poor condition and is not seismically qualified.

The incinerator seems in fair condition but does not meet today's environmental standards (e.g., scrubbers) and will not be run again. Hence, no capability exists on site for processing of combustibles.

Several of the process lines in Building 771 are in fair condition and could be upgraded to process chloride salts. However, significant upgrades are required, such as inspection of glove box exteriors, interiors, and waterwalls, replacement of gloves/bagout bags, inspection of electrical systems, replacement of all High Efficiency Particulate Air (HEPA) glovebox filters, replacement of window gaskets and windows, evaluation and remediation of plutonium in the ducts, and evaluation and possible replacement of other support utility systems. Many of the tanks and piping systems with Teflon gaskets are expected to leak during processing. Hence, substantial efforts to replace many of the gaskets would be required.

Proficiency of chemical operators has degraded; out of 24 existing chemical operators for Building 771 only about six have "hands in" glovebox experience in that building. Worker radiation exposure is another concern. In the past, processing of salt residues caused relatively high doses (5 Rem per year per operator).

c. Building 371 was designed in the 1970's to replace Building 771. It first began limited operations in 1981. However, processing rates were unsatisfactory and remotely-operated equipment was difficult to operate. Building processes were eventually shut down pending resolution of these problems. The plutonium Recovery Operation Verification Exercise (PROVE) facility, located in Room 3701 of Building 371, was developed to be a prototypical plutonium recovery facility without remote operations. The PROVE facility was about 90% complete when construction was stopped in 1989. PROVE was a large pilot facility for improved aqueous processing of residues (e.g., incinerator ash and low-fired oxides). Completion of PROVE for residue processing would require a substantial effort, including gathering of design and construction information, completion of electrical and piping terminations, addition of glovebox windows and gloves, and checkout and startup of all systems. EG&G estimated that an effort of three to four years and about $50-100 million for completion would be required. This may be a good intermediate term option compared to construction of a new facility.

d. Building 776 was used for solid waste processing. A supercompactor is currently in operation for volume reduction of transuranic waste. Building 776 is in generally fair condition but does not meet seismic requirements. The size reduction vault in Building 776 is being utilized as a containment cell for drum opening and gas sampling activities.

Room 154A of Building 776 had been used to conduct "salt scrubbing" of molten salts to separate the salt from the actinide materials (plutonium & americium). Actinide materials were sent to F-canyon of Savannah River Site for processing. Room 154A is in fair condition. When in operation, workers received a radiation dose of about 5 Rem/year. Room 154A contains twelve molten salt production furnaces and a vault for plutonium. It could be used for limited processing of salt residues.

e. Building 707 was the main pit production facility. Thermal stabilization of plutonium oxides is planned in Module J, and inspection of special nuclear material is ongoing in Module A. EG&G also plans to repackage LECO crucibles, a lower priority residue, in Module A. In FY95, a total of 100 out of 161 drums are planned to be repackaged. Pilot work on two drums of LECO crucibles has been initiated. The repackaging of LECO crucibles will allow them to be designated as transuranic waste. Other residue repackaging could be performed in Module A.

The staff noted that Module B contained uncompleted gloveboxes that could be removed to provide space for other processing equipment . EG&G estimated a total cost of $90M to set up Module B for future residue processing.

f. EG&G presented a long list of obstacles to processing of plutonium residues including: National Environmental Policy Act of 1969 (NEPA) documentation, Resource Conservation and Recovery Act of 1976 (RCRA), safety assessments, procedures, training, waste disposal limits, need for substantial line item funding, administrative dose guidance of 750 mrem/year, plutonium in the ducts, shrinking access zones, and seeking DNFSB approvals. The staff believes that the only substantive issues that need to be resolved are: plutonium in the ducts, need for dose reduction/ALARA for salt processing, building seismic capability for longer term operation, waste minimization, and working smarter to develop criticality limits for each evolution. This latter issue was identified by EG&G as a real time restraint, whereby the nuclear safety group needs to re-review all of the criticality limits for all evolutions. Initially, EG&G needed 980 manhours of work to develop each critically limit; LANL support has reduced these to about 300 manhours.

g. EG&G has completed some work related to the safety of plutonium residues including: (1) venting drums to eliminate hydrogen buildup in residue categories related to wet combustibles, Fulflo filters, leaded gloves with acid contamination, plastics, dry combustibles, other leaded gloves, and filter media; (2) obtaining gas samples in seven drums of ER salts; (3) developing a conservative model for prediction of hydrogen gas generation rates, and; (4) conducting tests at the Colorado School of Mines related to leaded gloves and pyrochemical salt oxidation.

5. **Future Staff Actions:** The staff will continue to closely follow DOE/EG&G efforts to process unstable residues at Rocky Flats; this will be done on a priority basis and in accordance with Recommendation 94-1.