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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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April 11, 1997

Mr. Mark B. Whitaker, Jr.
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Mr. Whitaker:

Enclosed for your information and distribution are 25 Defense Nuclear Facilities Safety Board staff trip reports.

Sincerely,

Andrew L. Thibadeau
Information Officer

Enclosures (25)

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

July 24, 1996

MEMORANDUM FOR G.W. Cunningham

COPIES: Board Members

FROM: H. W. Massie, Jr.

SUBJECT: Hanford Site - Status of Plutonium Residue Stabilization

1. **Purpose:** This memorandum provides a report of a trip by the Defense Nuclear Facilities Safety Board (Board) staff members, H. W. Massie and W. G. Von Holle, on July 16-17, 1996, to review Hanford's progress in characterization and stabilization of plutonium-bearing residues under Board Recommendation 94-1.

2. **Summary:** Based on this review the Board staff notes the following:

   a. Hanford has met all of its near term (i.e., three-year) commitments under Board Recommendation 94-1 by stabilizing residue sludge and incinerator ash stored at the Plutonium Finishing Plant (PFP).

   b. Pyrolysis of polycubes, the next highest risk residue at PFP, is being developed by Los Alamos National Laboratory (LANL) under the Recommendation 94-1 research program. Hanford has chosen silent discharge plasma technology, from among several more mature technologies, for treatment of off gases from the pyrolysis unit.

   c. No plan exists for treatment of nitrated, plutonium-bearing rags stored at PFP. The staff believes that these rags are a potential fire hazard.

   d. Cementation is the chosen process for disposition of most residues, including sand, slag and crucible (SS&C), other incinerator ash, and low grade oxides. Installation, testing, and readiness assessment are scheduled for completion by August 5, 1996.

3. **Background:** Board Recommendation 94-1 specifically addresses the stabilization of plutonium-bearing residues at the Rocky Flats Environmental Technology Site (RFETS). The Department of Energy (DOE) in its Implementation Plan (IP) for Recommendation 94-1 committed to also stabilize higher risk residues found at Hanford (and at other DOE sites) and to process all remaining residues by the year 2002. The amount of higher risk residues at Hanford is significantly less than at RFETS, but still represents a significant worker safety risk.

4. **Discussion/Observations:** The majority of residues at Hanford are stored in vaults at the PFP. PFP has a total of 7,145 kilograms of residues containing over 600 kilograms of plutonium. Included in this amount are 3,000 kilograms of mixed oxides containing 2,000

kilograms of uranium. Generally the residues are stored in one of two configurations: (1) a slip-lid can within a plastic bag nested in two food-pack (i.e., crimped-lid) cans or (2) several metal cans in a lard-can (approximately 12 inches in diameter and 15 inches in height).

The staff reviewed the status of Recommendation 94-1 milestones, the vault characterization program, proposed treatment of combustible polycubes, and proposed cementation planned for most residues.

a. Near-Term Residue Stabilization Status: The IP identified residue sludge and incinerator ash for stabilization in muffle furnaces by October 1995 and March 1996, respectively. The incinerator ash originated from RFETS in the 1980s. Both of these residues were stabilized ahead of schedule. One concern reported in previous Richland Office monthly reports, was related to not achieving a 0.5% loss-on-ignition (LOI) stabilization criterion when the ash is calcined at 1000° Centigrade. Laboratory tests performed at Hanford resulted in significantly greater than 1% LOI due to impurities (e.g., salts) contained in the ash. Westinghouse Hanford Company (WHC) concluded that the LOI readings were anomalous because the samples contained volatile materials, and that performing the LOI test at lower temperatures (e.g., 450° C) would have to suffice. (Residues are less than 50% plutonium by weight and are not actually required to meet a LOI according to the residue interim storage criteria.) The treated ash will be immobilized by cementation.

b. Characterization: The vault characterization program is an attempt to establish risk-based priorization of plutonium materials (metals, oxides, and residues), which may need to be stabilized, and stored in PFP vaults . This program involves evaluation of records, radiographs of selected cans, and destructive examination of selected cans. Priority for sampling is established based on knowledge of contents, container age, and appearance. The selected samples are not based on statistics (i.e., random samples), but are conservatively biased towards worst case storage conditions.

   The attachment presents a priorization matrix of PFP's stored inventory of residues including liquids, wet solids, corrosive or reactive "dry" solids, metals and alloys, oxides and compounds, oxide and oxide-like residues stabilized below 950° C and oxides and oxide-like residues stabilized above 950° C. The key safety-risk parameter is the remaining container life. Materials stored in containers with either no or less than ten years remaining life are considered to be possibly unstable by WHC. The materials of highest risk are the polycubes, slag and crucible, and remaining liquids. The other high-risk items, which have been lined out, have already been stabilized under the Recommendation 94-1 program.

   WHC has prepared a technical evaluation report containing preliminary findings of the vault characterization program based on 2% of the total number of containers. A preliminary review of this report by the staff, indicates fairly stable storage conditions with no major surprises. Subsequently, 107 additional containers were radiographed; when these data are available, the staff will also review it. The PFP vault

characterization program is a sound attempt to determine safety risks associated with the plutonium-bearing material storage.

c. Treatment of Polycubes: Pyrolysis of PFP polycubes and other combustibles is being developed by Los Alamos National Laboratory (LANL) under the 94-1 research and development program. Hanford has chosen "silent discharge plasma technology" for treatment of off gases from the pyrolysis unit from among two others: secondary combustion and catalytic conversion. The chosen technique has not been completely tested for treating pyrolysis gases from these materials. Delivery to PFP of the pyrolysis unit with the associated off gas treatment equipment is scheduled for October 1996. The staff has learned from LANL that the choice of off gas treatment may be premature and that the scheduled start up date is unlikely.

d. Cementation: Cementation is the chosen process method for disposition of most residues at PFP, including SS&C, incinerator ash, and low grade oxides (<50% Pu by wt). An appendix to the draft Environmental Impact Statement for PFP describes cementation of residues as the chosen alternative for immobilization of most of the PFP residues, which will be packaged for shipment to Waste Isolation Pilot Project (WIPP). The SS&C, ash, and other residues can be cemented and packaged for shipment to WIPP in about 1,400 drums. This assumes that the six-inch pipe overpack, which will allow a maximum of 200g of plutonium per drum and 2800g per TRUPAC II shipment, is already approved by the Nuclear Regulatory Commission (NRC). If the NRC does not approve the six-inch pipe overpack configuration, the maximum inventory limit for a TRUPAC II shipment is 325g; this results in an increase of 8.6 times the number of drums of residue for shipment to WIPP. Moreover, for residues that are stored in three layers of plastic, the calculated inventory limit is only 14g per drum (i.e., 196g of plutonium per TRUPAC II). Drum shipment costs to WIPP are estimated to be about $20,000 total cost per drum. Hence, the advantage of volume reduction for final shipment of residues and for other waste is significant (e.g., $20 million of cost savings for each 1,000 drums eliminated). Cold and hot testing of the finished cemented waste indicates that PFP will be able to meet all WIPP storage and shipping requirements. Installation and testing in Rooms 235 B and C of PFP and a readiness assessment will be completed by August 5, 1996.

e. Other Issues:

(1) The staff was told that some nitric acid, plutonium-bearing rags are stored in glove boxes in the plutonium reclamation facility of PFP. There are seven 4-liter and three one-half-liter plastic jars of rags with holes in the bottom (i.e., as vents). The rags are about seven years old and contain a total of 1,149 grams of plutonium from glove box clean-out. The staff was told that, at most, 1.5 Molar nitric acid was used in the clean-out, and the staff expressed concern over the potential fire hazard. The response was that the rags will be disposed of by pyrolysis or by other means. Currently there is no plan to treat the rags.

(2) The staff visited the control room for PFP ventilation systems. In response to staff inquiry, WHC stated that the ventilation systems were not safety-significant and that no operational safety requirements (OSRs) were available. Subsequent to the meeting, the DOE Richland Office informed the staff that only the two stages of high efficiency particulate air filters in the ventilation system are safety class. The safety analysis report for PFP defines the basis for this safety class designation based upon calculated radiological releases to the public. This PFP authorization basis issue requires further examination by the staff.

(3) The staff noted that the radiation surveys for vaults numbers 174 and 175 had expired. Vault 175 is used as a staging area for stabilized oxides and residues and hence can have varying radiation levels. The maximum dose listed on an April 4, 1996, radiation survey posting was 32 millirads per hour.

(4) The staff spent two hours visiting Pacific Northwest National Laboratory (PNNL) and received a quick tour of Building 324. PNNL has a moderate amount of plutonium (thousands of grams) that is held up in building ducts and also some plutonium that is contained in stored fuel rods. Other radionuclides are present as work-in-progress or in sealed sources. The staff requested an inventory of the special nuclear material stored in PNNL. Since PNNL is relatively close to the Hanford site boundary, any source term material would place the general public at greater risk, if it is not properly stored.

5. **Future Action:** The Board staff will continue to follow the implementation of Recommendation 94-1 commitments with particular emphasis on pyrolysis of polycubes, treatment of nitrated rags, and results of the characterization program.