

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

December 8, 1994

MEMORANDUM FOR: G.W. Cunningham, Technical Director

COPIES: Board Members

FROM: F. Bamdad

SUBJECT: Nuclear and Criticality Safety at Rocky Flats
Trip Report (November 28-December 1, 1994)

1. **Purpose:** This trip report documents a visit by the Defense Nuclear Facilities Safety Board (DNFSB) staff (F. Bamdad, J. Roarty, A. De La Paz, D. Moyle, and R. Kasdorf) to the Rocky Flats Environmental Technology Site (RFETS) to review nuclear and criticality safety organization and processes.

2. **Summary:** The staff made the following observations:

a. Despite the calculated site boundary doses of about 1000 Rem Committed Effective Dose Equivalent (CEDE), Building 371 is considered a Hazard Category 2 facility. In the final hazard categorization of Building 371, RFETS utilizes the results of the Defense Programs (DP) Safety Survey Report to justify their position.

It is noted that the Safety Survey Report was not intended to be used for hazard categorization. This, combined with unjustified use of 10 percent reduction in the release fraction of the material at risk, has resulted in defining a facility with potential off site consequences of thousands of Rem as Hazard Category (HC) 2.

b. The Implementation Plan (IP) for Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports*, including the Basis for Interim Operation (BIO) and Hazard Categorization of RFETS facilities, with the exception of Building 707, has not been approved by DOE. The EG&G representatives stated that at the direction of DOE-Headquarters (HQ), submittal of these documents for final approval has been put on hold pending the issuance of the Nuclear Safety Management Rules expected in mid 1995.

c. All the operations in Building 771 and operations involving more than 200 grams of plutonium in other buildings at RFETS have been suspended following the criticality infraction in Building 771 in September 1994. Suspended operations will have an Operational Readiness Review (ORR) or Readiness Assessment (RA) performed prior to start-up. Whether there is an ORR or RA, however, is determined based on the hazard categorization of the "activity" rather than the hazard categorization of the "facility". DOE Order 5480.31, *Start up and Restart of Nuclear Facilities*, allows the use of the hazard

categorization of an activity only when the activity can be completely segregated from the facility.

d. The Los Alamos Technology Office at Rocky Flats (LATO) performed a safety study of plutonium and uranium solutions in October 1993 and identified some safety issues with regard to hydrogen generation in solution tanks. The EG&G safety engineers, however, did not analyze this issue for resolution mainly due to the fact that off site consequences were negligible. The DNFSB staff believes that worker safety issues have not been adequately resolved.

3. **Background:** DOE Order 5480.23, *Nuclear Safety Analysis Reports*, and DOE Order 5480.24, *Nuclear Criticality Safety*, were issued on April 30 and August 12, 1992, respectively. Each of these orders required submittal of an implementation plan within 180 days of the issuance of the Order for meeting its requirements. Order 5480.23 also required preparation of a preliminary hazard categorization and BIO for the facilities which are to be submitted with the implementation plan in order to justify continued operation until the requirements of the Order are implemented. The hazard categorization is defined by Order 5480.23 to be based on "consequences of unmitigated releases of radioactivity and/or hazardous material". If the hazard analysis shows "potential for significant off site" consequences, the facility is Hazard Category 1; if it results in the "potential for significant on site" consequences, the facility is Hazard Category 2. Hazard Category 3 is specified for a facility that has the potential for localized consequences.

The focus of this trip was (1) to review the status of implementation of these safety orders, (2) the recommendations made by the Rocky Flats Nuclear Criticality Safety Committee resulting from their annual review, and (3) safety issues identified by LATO with regard to criticality safety at RFETS.

4. **Discussion:**

- a. The detailed hazard analysis of Building 371 has identified 12.9 metric tons of plutonium as the material at risk. Five metric tons of plutonium is in the form of dispersible powder with the rest as massive metals with significantly lower respirable release fractions. Application of the methodology and recommended assumptions of DOE-STD-1027-92 to this 5 metric tons of dispersible powder (Nuclear Regulatory Commission's stability F at 1m/sec meteorological conditions and NUREG 1140 release fractions of 1E-3) would result in a Maximum Offsite Individual (MOI) dose of about 10,000 Rem CEDE. EG&G has reduced the MOI dose to about 1,000 Rem CEDE by using a 10% reduction factor for the release fraction for this material as noted in the DP Safety Survey Report. In the final analysis for hazard categorization of this facility, DOE Rocky Flats Office (RFO) used the results of the DP Safety Survey Report to recommend hazard categorization level 2. EG&G has concluded

that since the DP Safety Survey Report shows site boundary doses of one to two orders of magnitude larger for commercial nuclear power plants (for a core melt without reactor vessel and containment boundary) than that of Building 371, Building 371 should be of lower hazard category than a commercial reactor. It should be noted that the DP Safety Survey Report was not intended to be used for hazard categorization and is not being used at other sites for this purpose. On the other hand, the "potential significant consequences" referred to in the Order 5480.23 have not been quantitatively defined by DOE's Office of Environment, Safety, and Health in any guidance document.

- b. The implementation plan for Rocky Flats facilities, prepared by EG&G and submitted to HQ in September 1993, assigned Hazard Category 1 for Buildings 371, 707, and 776/777. These three facilities were subsequently reduced to Hazard Category 2, using DOE-Standard (STD)-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23*, guidelines recommended by HQ. The latest revision of the IP, which has the schedule for complying with the requirements of Order 5480.23 was submitted to HQ in September 1994. HQ did not approve this document however, because some comments are still unresolved and directed EG&G not to submit a new revision of the implementation plan until the corresponding section of the Nuclear Safety Management Rule, 10 CFR 830, is issued in mid 1995. Rocky Flats is not in compliance with the requirements of Order 5480.23, even two years after the due date set in the Order.
- c. Following the criticality infraction in Building 771 in September 1994, a root cause analysis, prepared by EG&G, identified several issues which contributed to the incident. Conduct of operation, training, supervision, and controls and barriers were identified as contributing factors which led to the incident. Consequently, all operations in Building 771 and activities involving more than 200 grams of Pu in other buildings have been curtailed pending corrective actions. EG&G intends to comply with Order 5480.31 prior to resumption of activities. For some activities, EG&G will use the HC of the activity to determine the type of restart. This is consistent with Order 5480.31 for activities that can be segregated from the facility safety envelope. The DNFSB staff believes that many of the activities planned for restart cannot be segregated from the facility's operation.
- d. At the request of DOE/RFO, LATO performed a safety study of plutonium and uranium solutions at RFETS in 1993. The study indicated that hydrogen generation resulting from radiolysis of acidic solutions in the tanks was a safety issue. According to LATO calculations, sufficient hydrogen could be generated in high plutonium concentration tanks to reach the lower explosive limit (LEL) in about 12 hours if the hydrogen was not vented. Due to significant consequences of a hydrogen explosion, LATO recommended that it was "extremely important that ventilation be maintained on all solutions in tanks".

Subsequent sampling of some of the tanks revealed up to 17 percent of LEL hydrogen concentration at the vent discharge. It should be noted that this sampling at the glovebox may not be representative of the concentration in the tanks due to rather long extensions of piping and existence of elbows and bends between the tanks and the glovebox. Although the vent/vacuum valves were left in the vent position, by design, there is no positive air flow through the tanks. Operations, as well as the nuclear safety divisions, maintained that hydrogen generation is not a significant issue and no further action was taken. No safety screening analysis was performed by EG&G to see what the consequences of such explosion would be, and no administrative controls were put in place to ensure that the tanks were, in fact, vented.

In response to the DNFSB staff's questions with regard to the Safety Screening of hydrogen explosion scenario for determination of Unreviewed Safety Question, EG&G representatives stated that there would be no off site consequences and since workers would only be affected, EG&G considered it was not necessary to pursue. Preliminary staff calculation shows that if the tanks were properly vented, there should have been 1 to 3 percent annual reductions in the tank level due to evaporation. The tanks levels, however, have been steady according to the measurements over the last 5 years. The DNFSB staff believes that this safety issue has not received proper attention by the safety engineers as is evident by lack of proper monitoring and lack of adequate analysis of consequences of such hazard. The potential for hydrogen explosion is more of a concern during sampling of these solutions. Each tank will be sparged before sampling. If hydrogen concentration in the tank is significant, the sparging could cause movement of hydrogen bubble through the system where there is greater likelihood of the hydrogen being exposed to a spark.

Westinghouse Savannah River Company (WSRC) has identified similar conditions in solution tanks at FB Line. WSRC, however, has implemented procedures to purge the tanks on a frequent basis (at least once a day) in order to prevent hydrogen generation from reaching the LEL.