DEFENSE NUCLEAR FACILITIES SAFETY BOARD

March 27, 1996

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Monique Helfrich

SUBJECT: Hydrogen Generation Issue at the Rocky Flats Environmental Technology Site

1. **Introduction:** A concern has recently been expressed by members of Environmental Protection Agency staff regarding the issue of radiolytically generated hydrogen in tanks and pipes in facilities at the Rocky Flats Environmental Technology Site (RFETS). Members of the Defense Nuclear Facilities Safety Board's (Board) technical staff have been reviewing this issue for the last year and working with the technical staff at the RFETS to address the hydrogen accumulation hazards in Buildings 371 and 771.

2. **Discussion:** In October 1993, a study on the safety of plutonium and uranium solutions was issued by the Los Alamos Technical Office (Reference 1) which concluded that hydrogen could accumulate in the tanks if not vented. This study also stated that "[p]reliminary calculations indicate that even if an explosion did occur in one of the tanks undergoing the most hydrogen generation, the tank would remain intact, although gaskets would in all likelihood fail," and that this rupture could cause worker injury and contamination. Consequently, the Department of Energy required that all the solution tanks be passively vented. RFETS believed that passive venting of the tanks was adequate to prevent the hazards. Calculations performed by the Board's technical staff in March 1995 (Reference 2) indicated that passive venting of tanks was not sufficient to prevent hydrogen accumulation and the potential risk of explosions in the tanks. The results of these calculations were confirmed by analysis performed by the RFETS technical staff (Reference 3). Subsequently, RFETS confirmed the potential for hydrogen accumulation by sampling the tanks and analyzing the samples.

   In May 1995, EG&G Rocky Flats issued an Unreviewed Safety Question Determination (USQD) (Reference 4), which stated "that radiolytic gas generation and accumulation does not represent an undue hazard if tanks containing actinide solutions have been properly vented during the course of operational curtailment." The USQD also stated that "[w]hile the offsite consequences of a potential hydrogen explosion are bounded by the existing safety analysis there are unevaluated worker safety issues that emerge resulting from the postulated scenario(s) associated with hydrogen detonation and tank rupture." Therefore, compensatory measures were implemented to protect the workers.

A hydrogen explosion in a tank is not expected to breech the building containment, or damage the building ventilation and filtering systems. The radioactive materials released into the building by a hydrogen explosion would be filtered prior to release to the environment. Therefore, the Board's technical staff has concluded that the issue of hydrogen generation is one of worker health and safety, not public safety or the environment.

In January 1996, the Board sent a letter to the Department of Energy (Reference 5) expressing its concern about the limited progress that had been made in mitigating the hazards associated with hydrogen accumulation in Buildings 371 and 771. The letter also stated that the Board believed that the RFETS should take immediate action to determine where additional problems of this sort exist and to reduce the hydrogen concentration in all tanks and piping which are found to exceed 25 percent of the lower flammability limit (LFL), National Fire Codes Standard 69, Explosion Prevention Systems. The Board requested that a plan of action be developed to aggressively address the hydrogen generation issue. The Board's technical staff has reviewed the RFETS plan of action (Reference 6) to address this issue and finds the plan of action reasonable, as long as the commitments (i.e., schedule and technical) are met.

3. Future Staff Actions: The Board's technical staff will continue to closely follow the implementation of the RFETS plan of action, as well as the overall issue of hydrogen generation at RFETS. In the event that the Board's technical staff receives evidence that the RFETS schedule is slipping or that the tanks will not be vented, this information will be promptly provided to the Board.

4. References

1. LANL, "Plutonium and Uranium Solutions Safety Study", October 1993 [94:3523]

2. DNFSB staff report, "Radiolytic Hydrogen Generation in Rocky Flats Plutonium-Nitric Acid Solution Tanks" [95:3412]

3. EG&G Rocky Flats, CALC-RFP-95.0386-RGC-USQD, "Analysis of Pressure Rise and Explosion Potential in Unvented Pu-HNO_3 Solution Tanks Due to Hydrogen Generation" [95:1929]

4. EG&G Rocky Flats, USQD-RFP-95.0387-CAS, "Gaseous Hydrogen Generation and Accumulation in Solution Tanks in Buildings 371 and 771 [95:4768]

5. Letter from Conway to Grumbly (January 22, 1996) [96:107]

6. Plan of Action, Mitigation of Risks from Radiolytically Generated Hydrogen in Tanks and Piping Systems at Rocky Flats [96:529]