

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

April 22, 1993

MEMORANDUM FOR: Technical Director

COPY TO: Board Members

FROM: R. E. Kasdorf, Program Manager
Rocky Flats Plant

SUBJECT: Rocky Flats Plant - Trip Report on the Review of Building 371
Seismic and Systems Design Bases, Special Nuclear Material
Storage, and Systematic Evaluation Program Status

1. **Purpose:** This memorandum provides a summary report of a March 23 - 25, 1993 trip by the DNFSB staff and outside experts (Haltiwanger, Stevenson, and Rizzo) to review Building 371 seismic issues, Special Nuclear Material (SNM) storage, and the status of the Systematic Evaluation Program (SEP) at the Rocky Flats Plant (RFP).

2. **Summary:**

a. Geotechnical data and the structural analyses for Building 371 were reviewed. The geotechnical data for the building appeared to be adequate. The analyses for the building appear to indicate that the building may be structurally adequate for the design basis earthquake at RFP. However, neither EG&G nor DOE-RFO had a sufficient understanding to discuss the details of the site conditions or the analyses performed by the original architect-engineer. It is particularly noted that the foundation design is not understood by DOE-RFO or EG&G. There was not enough information that had been reviewed and understood by EG&G or DOE-RFO to make an independent assessment of the adequacy of the structural analyses.

b. During a tour of the Building 371 it was noted that a drainage system below the sub-basement portion of the building appeared to be partially blocked, indicating that the drain had not been adequately maintained. This system appears to provide a dewatering function; perhaps to minimize hydrostatic and corrosion effects on the structure. The drain system would also serve to reduce bouyancy forces on the structure in conjunction with an earthquake. EG&G indicated they would take action to ensure proper drainage from this system.

c. The design documentation for three vital safety systems (fire protection, emergency power and criticality alarm) was reviewed. These systems do not appear to have been

seismically designed. EG&G has not performed a detailed review of these systems to determine their seismic qualification. However, based on outside expert observations during a tour of the building, it would appear that these systems could be made seismically adequate with a minimum of hardware modifications.

d. EG&G presented a discussion on SNM storage at RFP. EG&G considered further review was necessary to address how safety envelope considerations are covered during vault inspections and surveillances; and how material is controlled to ensure safety analysis assumptions are still valid when material is moved.

e. EG&G presented the status of the SEP program at RFP. Pilot applications to demonstrate a revised SEP process is ongoing. It is anticipated that DOE will propose changes to the Implementation Plan for Recommendation 90-5 in the near future consistent with the revised process.

3. **Background:** Building 371 is one of five buildings that compose the Plutonium Recovery and Waste Treatment complex at the RFP. It first began limited operations in 1981. Scrap materials containing plutonium were processed through dissolution, ion exchange, and precipitation processes to form plutonium buttons. The facility also cleaned and prepared plutonium-contaminated material for discard. These processes were shut down because the processing rates were unsatisfactory, and the remotely-operated equipment was difficult to operate and maintain. DOE has recently indicated that this building will be the primary building used for consolidation of SNM at the RFP. The building is currently being prepared to receive SNM from Building 991.

4. **Discussion:** The following discussion summarizes the material presented by EG&G and DOE-RFO and discussed with the DNFSB staff and outside experts:

a. EG&G presented information concerning Building 371, including layout of the building, overview of the safety analysis, geotechnical data, structural and safety system design; SNM storage at RFP; and the status of SEP. The detailed agenda and list of attendees are available separately.

b. Geotechnical data and the structural analyses for Building 371 were reviewed. The geotechnical data for the building appeared to be adequate. The analyses for the building appear to indicate that the building may be structurally adequate for the design basis earthquake at RFP. However, neither EG&G nor DOE-RFO had a sufficient understanding to discuss the details of the site conditions or the analyses performed by the original architect-engineer, C. H. Braun and Company. It is particularly noted that the foundation design is not understood by DOE-RFO or EG&G. There was not enough information that had been reviewed and understood by EG&G or DOE-RFO to make an independent assessment of the adequacy of the

structural analyses. To understand the adequacy of the structural analyses would require someone with the appropriate technical background to review the design analyses to better understand such items as the modelling used for both static and dynamic analyses, the bases for the input parameters, the design features of the building, applied loadings and primary load-carrying members. EG&G (Berman) agreed a better understanding of the previous analyses was needed, especially as this facility begins to store large quantities of weapons grade plutonium and highly enriched uranium being removed from other RFP buildings.

- c. During a tour of the building it was noted that a drainage system below the sub-basement portion of the building appeared to be partially blocked, indicating that the drain had not been adequately maintained. This system appears to provide a dewatering function; perhaps to minimize hydrostatic and corrosion effects on the structure. The construction drawings reviewed indicated that the floors are mounted on drilled reinforced concrete caissons socketed into bedrock. By design, it appears a gap (typically between one and two feet) was maintained between the excavation bottom and the floor slabs for all basement floor levels to allow for expansive heave of the foundation soils.

EG&G did not know the impact on the structural capability of the building from hydrostatic pressure, buoyancy forces or material degradation which could arise from inadequate drainage from the drainage system. EG&G noted that the outlet of the drainage system was now considered a wetlands area so maintenance could be hampered. EG&G (Berman) indicated they would take action to ensure that the system is draining properly and to determine if the drainage system should be considered a safety system with all the appropriate surveillance and maintenance requirements. Also, if such action would be needed, a review of the drainage system outfall would be performed to determine if this is a federal wetland area and if any special permitting actions are necessary to adequately maintain the drainage system.

- d. EG&G indicated that the fire protection system, emergency power system, and the criticality alarm system should be seismically qualified. However, based on review of the design documentation provided by EG&G and a physical walkdown these systems do not appear to have been seismically designed. Additionally, EG&G had not found any analyses for qualification to the appropriate standards (e.g., ANSI 8-3 for criticality). EG&G has not yet performed a detailed review of these systems, as well as other vital safety systems not specifically discussed, sufficient to determine their seismic qualification. However, based on outside expert observations during a tour of the building it would appear that these systems could be made to be seismically adequate with a minimum of hardware modifications using procedures similar to those developed for the K-reactor at the Savannah River Site.
- e. There were no personnel in the EG&G engineering group who were specialized in

seismic engineering. At other DOE sites (e.g., SRS, Hanford), the operating contractors have such technical expertise. EG&G (Berman) indicated they needed to give consideration to development of a group in engineering dedicated to seismic engineering.

- f. During a tour of Building 371 the following items were noted:
1. Numerous pieces of equipment (e.g., ladders, carts, welding equipment) that had not been adequately secured were observed through out the building. Industrial safety practices per OSHA requirements would call for equipment to be secured to preclude its inadvertent movement (which may occur during an earthquake or during routine work if bumped into by mistake) from becoming a safety hazard or affecting vital safety systems.
 2. Criticality detectors were tied down with cloth/canvas straps. This type of tie down which depends on friction has not performed satisfactorily during earthquakes in the past. Components of vital safety systems should be held down with positive lateral and vertical restraints.
- g. EG&G presented a discussion on SNM storage at RFP. Most of this discussion was classified since it presented specific amounts, forms, and types of SNM in specific building locations. The information presented identified that ultimately almost all SNM on site would eventually (over a ten to twenty year period) be moved to Building 371 for interim storage. During this discussion, two items were raised which EG&G (Berman) considered required further review. These were:
1. Considering most storage locations are only opened and inspected for safeguards and security purposes, how are safety envelope considerations covered by safeguards and security procedures for vault inspections and surveillances? These procedures likely do not include inspection provisions for design items typically referred to as "in service inspection" that might impact safety envelope considerations. For example, safeguards and security inspections may only look for holes or cracks that would allow access by someone and would not be concerned with water in-leakage (e.g., as previously seen in Building 991) or structural cracking (smaller than a certain size for safeguards and security considerations) which may result in a larger pathway for material release than assumed in current safety analyses.
 2. There was not a clear understanding of how material (amount, forms, and locations) is controlled in the vaults to be consistent with safety analysis assumptions. Also, it was not clear whether the safety analysis group would be included in appropriate reviews to ensure planned material moves were within the facilities' safety bases.

EG&G noted that a study of the aircraft crash hazard had been recently produced and that this study demonstrated that the probability of radiological release in excess of specified limits is below 10^{-6} /year. Based on this study, EG&G does not consider aircraft crash as a design basis. The DNFSB outside experts expressed an interest in reviewing this study to verify its conclusions and to determine if it might serve as an example for other DOE sites for the evaluation of the aircraft crash hazard.

- h. EG&G presented the current status of the SEP program at RFP. A report on completion of Phase 1 of the DOE Implementation Plan for Board Recommendation 90-5 has been issued. Sixteen SEP evaluation topics have been developed and topic evaluation plans have been issued. Phase 2 evaluations in Buildings 559 and 707 have been started but are not yet complete. Changes to the SEP process have been proposed to DOE to reflect the new mission of RFP. Two pilot applications - seismic structural and Zone II confinement ventilation - to demonstrate the new process are ongoing in Building 707. It is anticipated that DOE will propose changes to the Implementation Plan for Recommendation 90-5 in the near future.

- 5. **Conclusions:** This was the first staff and outside expert review of Building 371 seismic issues and specific plans for SNM storage at RFP. Based on the items discussed above, follow-up reviews of these matters are planned by the staff later in 1993. The change in mission of RFP, including a recent announcement that Building 707 will no longer be considered a contingency building for weapons production, makes it necessary for DOE to revise the Implementation Plan for Recommendation 90-5 on SEP. The staff will follow DOE's preparation of this revision.