

## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 16, 1994

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director

**COPIES:** Board Members

**FROM:** William Shields

**SUBJECT:** Rocky Flats Buildings 371 and 771 Trip Report: January 24-26, 1994 Fire Protection

1. **Purpose:** This memorandum describes the results of the DNFSB staff visit to Rocky Flats on January 24-26, 1994. The principal purpose of the trip was to commence DNFSB review of fire protection in Buildings 371 and 771. The review was conducted by William Shields.
2. **Summary:** Building 771 is an old facility used for plutonium recovery. DOE plans to operate the facility only long enough to place it in a safe condition for eventual decommissioning and decontamination. Though no formal fire hazards analysis (FHA) has been performed for the building, installed fire protection features and manual firefighting capability (including a detailed pre-fire plan) are adequate to minimize fire risk during a short period of operations. A hazards assessment planned for the spring of 1994 may result in preparation of a detailed FHA.

Building 371 is a newer structure, originally intended as a replacement for Building 771. Plutonium processing will not be resumed in this building. However, DOE currently plans to use the building as a temporary storage area for plutonium until permanent storage arrangements are made. A fire hazards analysis has been done for the building, which is protected like most buildings at Rocky Flats with fire detection and sprinkler systems. The fire hazards analysis will require revision before storage of plutonium is commenced. However, fire protection features are currently adequate for existing use.

3. **Background and Scope of Review:** This trip initiated the staff's fire protection review of these buildings. However, many features of the fire protection program at Rocky Flats are site-wide and thus have been previously examined by the DNFSB staff in reviews of Buildings 559 and 707. These features include: RFP fire department, widespread use of sprinklers and heat detectors, structural integrity of interior walls and ductwork, use of detailed prefire plans, and full protection of filter plenums.

The staff has also reviewed and reported to the Board RFP's problems with aging detection/alarm equipment and the lack of detailed, building-by-building fire hazards analyses. Finally, the staff has previously examined RFP's use of probabilistic risk assessment techniques to analyze bounding fires in the SAR. RFP's work in this area is generally more sophisticated and conservative than comparable work at other defense nuclear sites.

This initial DNFSB staff review encompassed seven major subject areas:

- Installed Detection and Suppression Systems
- Special Hazards and Protection Features
- Pre-Fire Plans
- Compliance with Order 5480.7A, CSAs, Exemptions
- NFPA Code Compliance and Deviations
- Self-Assessment Results and Followup
- SAR Analysis of Limiting-Case Fires

EG&G and RFO provided oral briefings and documents on each of these topics.

- 4. Technical Discussion:** The two buildings will be discussed together in the succeeding paragraphs. Differences in protection systems, detection, etc., will be noted where applicable.

**a. Installed Detection and Suppression Systems**

Both buildings are covered by automatic sprinkler systems (except where criticality is a concern), filter plenum deluge systems, and glovebox overheat detection systems. Inside hose connections are provided for manual firefighting. Building interior areas are separated by fire barrier walls and fire doors. Suppression and detection systems considered "safety class" and thus essential to the safety envelope (including barriers) are maintained and tested according to site-developed OSRs and applicable NFPA Codes.

In various areas of these buildings where water sprinklers are not advisable (areas presenting criticality concerns), other suppression systems are used. These include Halon, CO-2, dry chemical, portable extinguishers, and inert atmospheres.

The electrical aspects of the glovebox overheat detection system will be reviewed in a separate trip report by A. Gwal.

## **b. Special Hazards and Protection Features**

At Rocky Flats, two special situations are constantly present: (1) the pyrophoricity of plutonium in certain forms, and (2) the reliance on HEPA filter plenums to mitigate atmospheric releases of plutonium or other radioactive materials in the event of a fire. The Rocky Flats approach to the first of these hazards is to provide an inert atmosphere where there is any risk of ignition of pyrophoric plutonium, for example, in gloveboxes used for machining operations. Inerting is used in the storage vault area of the Stacker-Retriever in Building 371. Atmospheric monitors alarm if the oxygen content rises above 5% in this area. In Building 771, inerting is used in one glovebox in Room 114A.

Protection of filter plenums from fires is accomplished site-wide by a combination of automatic (heat-activated) and manual water deluge systems. In the event of a major fire, these deluge systems are especially important because HVAC ducts at Rocky Flats are generally not provided with fire dampers. Fire products would thus be carried by the ventilation system (even without fans operating) to the filter plenums. The filter plenums for both Buildings 371 and 771 are protected by deluge systems. These systems possess redundant water supplies and are tested frequently by the Fire Department. They give considerable assurance that the HEPA filters would survive a major fire until it is extinguished by sprinklers and fire department attack.

## **c. Pre-Fire Plans**

Detailed pre-fire plans have been prepared for each building by the Fire Department. These annually-revised plans, which are carried in the fire response vehicles, provide essential information in a quickly-accessed way. The plans warn firefighters of special hazards in each building (such as radioactive materials, toxic gases, and hazardous chemicals), point out electrical disconnects, and provide detailed information on water supplies, hose connections, and ventilation methods. The plans also describe the fixed and portable fire protection features in the building and give basic data on building structure and materials.

The most important feature of the plans is the "Plan of Attack." This plan is covered on a single page of the pre-fire plan, and consists of about 20 key elements of firefighting strategy for the building. It can easily be reviewed in the time (perhaps 5 minutes) from the receipt of an alarm to arrival at the affected building.

The pre-fire plans reviewed are of excellent quality and meet or exceed applicable DOE

and commercial standards. See DOE Fire Protection Resource Manual, Section 6.G, NRC Regulation 10 CFR Part 50, Appendix R, Section III.I.4.K.12. The pre-fire plans give considerable assurance that manual firefighting will be effective and the safety of firefighters protected.

**d. Compliance with Order 5480.7A, CSAs, Exemptions**

While both buildings are in substantial compliance with the fire protection order, some areas of non-compliance are covered by several Compliance Schedule Approvals (CSAs) and one exemption. The exemption has been discussed in previous DNFSB staff reports on the Rocky Flats fire protection program. It pertains to the lack of fire dampers in ventilation ducts. This lack is justified by the structural integrity of the ductwork itself (i.e. unlikely to collapse in a fire) and the need to ensure that in the event of fires or other accidents, the ventilation ducts remain open so that contamination is absorbed by the HEPA filters. This is Rocky Flats Exemption 1: "Use of Fire Dampers within HVAC Ductwork."

Several site-wide CSAs also reviewed in prior DNFSB staff reports apply to these two buildings. CSA 16I covers deficiencies in the fire and security central alarm system. This system is antiquated and is scheduled for replacement with modern equipment. Compensatory measures include increased testing by the Fire Department and trend analysis of failures. CSA 21A covers the use of non-UL-Listed deluge valves in the deluge systems protecting filter plenums. EG&G's study of this issue revealed that the existing valves are adequate until replaced provided a semi-annual flow test is conducted.

CSA 115, submitted by EG&G on December 13, 1993, addresses the lack of fire hazards analyses meeting 5480.7A criteria for Rocky Flats facilities. Because Rocky Flats is entering a D&D/storage phase, fire hazards analysis funding has been reduced or eliminated in recent budgets. The CSA applies to Building 371 even though an FHA exists for the building, because the FHA does not meet 5480.7A criteria; no FHA at all has been prepared for Building 771. Submittal of this CSA will force DOE to decide whether FHAs should or should not be prepared for various Rocky Flats facilities.

CSA 15F applies to Building 371 but not 771. This CSA addresses a property protection issue, namely, the fact that the installed CO-2 suppression system protecting the emergency diesel generator is ineffective. (The diesel's exhaust when operating immediately depletes CO-2 concentration below effective levels.) EG&G initially proposed supplementing the CO-2 system with a water sprinkler. Recently, however, EG&G requested that the CSA be cancelled. Rocky Flats has a spare emergency generator onsite that could be promptly hooked up in the event of a diesel fire. Installation of a

sprinkler system is not viewed as cost effective. The CO-2 system remains effective for any fire where the diesel is not operating.

Finally, CSA 24B applies to NFPA Code deviations on the Building 771 glovebox overheat detection system. This system is antiquated by current standards but may be adequate to support a limited cleanup run. Compensatory measures include limiting of ignition sources, installed automatic sprinkler system, and fire prevention inspections to ensure that combustibles and ignition sources are minimized.

**e. NFPA Code Compliance and Deviations**

Both buildings deviate from the NFPA Code requirements regarding use of listed deluge valves and inclusion of fire dampers in ventilation ducts. These Code issues are dispositioned by CSA 21A and Exemption 1, discussed above. In addition, Building 771 has outstanding Code issues on fire barrier wall penetrations and the glovebox overheat system (see CSA 24B discussion above). EG&G will resolve these issues with DOE approval prior to any hazardous operations commencing in these buildings.

Building 371 has some Life Safety Code problems with respect to fire exit paths. The primary concern is with the exit stairwells for the building basement and subbasement. When personnel exit from these areas through the stairwells, they do not exit directly outside as required by NFPA 101, Life Safety Code, Chapter 5. A second, less significant concern is the length of exit corridors used for building evacuation. In several cases in Building 371, the Code's 100-foot maximum common path of travel is exceeded by about 30 feet.

EG&G's Fire Protection Engineering group is currently evaluating these problems. A possible solution to the exit stairwell problem is to consider the subbasement as an "area of refuge" based on its separation from the level above by a 4-hour-rated slab, protection by automatic sprinklers, and elaborate ventilation system. Should this prove technically sound, an exemption or equivalency determination would be required from DOE. The path of travel problem can probably be resolved by limitations on occupancy and by credit taken for the automatic suppression and detection systems installed throughout the building.

**f. Self-Assessment Results and Followup**

The most recent self-assessment of fire prevention and detection at the site was conducted by EG&G's Office of Standards, Audits and Assurance (SAA) during the period July-October 1993. The assessment report was issued January 19, 1994, and was made available to the reviewer a few days after the site visit. The report contains a number of

findings and observations affecting Buildings 371 and 771 requiring response and possible actions from both Fire Protection Engineering (FPE) and the Fire Department (FD). Responses to the audit are due in early March. The reviewer requested that DNFSB be provided with copies of the FPE and FD responses when they are available. Further DNFSB followup may be warranted when those responses are reviewed.

ORRs have not been conducted for these buildings, but will be conducted prior to commencement of any new operations in either building.

**g. FSAR Analysis of Limiting-Case Fires**

The FSARs for the two buildings under discussion use different methodologies: Building 771 uses PRA while Building 371 uses a deterministic approach (along the lines of commercial nuclear practice). Both FSARs consider limiting case fire scenarios. In Building 771, fires are analyzed using fault trees and event trees, starting with an ignition and following through to probability of offsite release. In Building 371, models of maximum credible accidents (essentially design basis accidents) are used to bound releases from fires.

Additional analysis of fires is planned for both buildings. A hazards assessment to be conducted this spring for Building 771 will include a fire hazards analysis meeting most of 5480.7A criteria. This information will be used to verify and validate the PRA work already done on the building in support of a cleanup run. The Building 371 FSAR will be upgraded per the requirements of 5480.23 in support of using the building for plutonium storage. If funded, the SEP program will also examine fire protection features of these buildings.

Additional DNFSB staff scrutiny of this subject will be conducted as part of the FSAR review for each building.

**5. Possible Privatization of Fire Department**

A January 20, 1994 memorandum from Mark Silverman, DOE-RFO Manager, to Harry Mann, General Manager of EG&G Rocky Flats, directs that the contractor explore privatization (i.e. use of off-site subcontractors) for various plant services including the Fire Department. Because of the special dangers attendant on fighting plutonium fires, and the absolute necessity of fighting such fires successfully to protect the public, close Board scrutiny of such a proposal (if it goes forward) would be warranted. In the reviewer's opinion, loss of the highly-trained RFP Fire Department would substantially reduce the margin of fire safety at Rocky Flats.

## **6. Future DNFSB Staff Review**

Additional site visits should be conducted following the ORR for Building 771, prior to commencement of any hazardous activities. The FSAR review team should carefully review the analysis of bounding case fires for both buildings. Special consideration should be given to the SAR analysis of fires in those areas of Building 371 in which large quantities of fissionable material will be stored.

## **Documents Reviewed**

1. Pre-Fire Plans, Building 371 (Jan. 10, 1994), 771 (Jan. 10, 1994).
2. EG&G Rocky Flats Fire Department, Operational Overview.
3. EG&G Fire Protection Engineering, Compliance Schedule Approvals/Exemptions Status Tracking System (Jan. 1994).
4. EG&G Fire Protection Engineering, Compensatory Measures Matrix.
5. EG&G Fire Protection Engineering, Factory Mutual Audit Action Plan.
6. Fire Hazard Analysis, Building 371 (April 16, 1992).
7. Fire Protection Engineering, List of Detection/Suppression Systems in Buildings 371, 707 & 771 (Jan. 1994).
8. EG&G Internal Assessment, "Fire Prevention/Fire Detection," Report No. A-SAA-93-49 (Jan. 27, 1994).