DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 23, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: D. Thompson
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SUBJECT: Report on Hanford Emergency Response Exercise *Fraser*

1. **Purpose:** This report documents DNFSB Staff observations made during the conduct of Emergency Preparedness Exercise *Fraser*. Exercise *Fraser* was conducted by the Department of Energy (DOE) Richland Operations Office (RL) and the Pacific Northwest Laboratories (PNL), with simulated response by the DOE Headquarters Emergency Operations Center, on June 9, 1994.

2. **Summary:** In general, the exercise was well-conceived and competently controlled. Based upon the "hot wash" debrief conducted in the RL Emergency Operations Center and upon post-exercise interviews of selected evaluators and controllers, it appears likely that the final DOE/PNL evaluation report will be comprehensive and candid.

   With regard to performance of the exercise participants, the exercise failed to achieve significant objectives. Communications between the Building Emergency Director and the 300-Area Emergency Control Center (ECC), and between the ECC and the RL Emergency Operations Center, were poor, resulting in the failure to recognize the simulated off-site release; failure to appropriately declare a "General Emergency", even after being directed by the controllers to do so; poor control of off-site field survey teams, resulting in failure to locate the plume until very late; and failure to implement appropriate off-site protective measures.

3. **Background:** Exercise *Fraser*, an emergency preparedness exercise designed primarily to test the actions of members of PNL and RL response teams, was conducted on June 9, 1994, at the Hanford Site near Richland, Washington. The scenario for Exercise *Fraser* was based on a simulated crane failure in Building 327 (one of the Pacific Northwest Laboratory facilities) shortly after 8:00 am, June 9, 1994. The resulting cask drop accident involved the crushing of several irradiated, and unvented, power reactor fuel pins stored in a spent fuel pool in the building, releasing fission products to the pool, thence to the building air and out the facility stack. During the course of the accident, the broken crane cable struck the arm of one of the two nearby operators, causing a contaminated laceration.

When the local air and stack monitors alarmed upon the release of the fission product inventory, the operators and the assigned rad protection technician immediately exited the building to their assigned staging area, pulling the fire alarm as they left. In response to the fire alarm, other occupants evacuated the building. However, in his haste to leave, the assigned DOE Site Representative stumbled and fell (simulated), striking his head on a file cabinet, rendering himself unconscious - which is how he was simulated to have remained throughout the exercise - requiring search and rescue operations for his recovery from the building.

The release of fission products from the damaged fuel continued for approximately 15 minutes, and consisted mostly of volatile gases. Simulated meteorological conditions called for the plume to travel slightly north of east, across the river into privately owned agricultural areas. A subsequent shift in the wind direction toward the southeast occurred, with greater mixing due to a heightened instability class.

Federal Emergency Management Agency (FEMA) evaluation methodology was used for this review. This methodology is set forth in FEMA-REP-15, "Radiological Emergency Preparedness Exercise Evaluation Methodology", dated September 1991. The results of these evaluations are set forth in Attachment A.

4. **Discussion/Observations:** DOE/PNL identified 82 specific objectives for Exercise *Fraser*, not including objectives identified for local, county and state entities. These 82 objectives were associated with 15 emergency management organizational elements[1].

   The writer evaluated the following seven subject areas across the appropriate organizational elements involved in the exercise:

   - Facilities - Equipment, Displays and Work Environment
   - Direction and Control
   - Communications
   - Plume Dose Projections
   - Plume Protective Action Decision Making
   - Public Instructions and Emergency Information
   - Emergency Information - Media

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[1]Complete listing of emergency management organizational elements involved in the exercise appears in Attachment A.

In none of these seven subject areas was the participants' response completely satisfactory, primarily because of the failure to recognize the seriousness of the hazard involved in the scenario and/or the failure to adequately survey the downwind sector effectively.

Detailed evaluations of each of the above subject areas are presented in Attachment B.

5. **Future Staff Actions:**

The staff will monitor closure of the Deficiencies and Weaknesses identified in DOE's own Evaluation Report, upon its issuance, and will observe the conduct of future emergency preparedness exercises.

ATTACHMENT A

Emergency Management Organizations Involved in Exercise *Fraser*

1. RL Emergency Control Center
2. Unified Dose Assessment Center
3. Field Team Coordination Center
4. Joint Information Center
5. Emergency Management Center
6. 300 Area Emergency Control Center
7. Event Command Post
8. Occurrence Notification Center
9. Emergency Duty Officer
10. Hanford Fire Department
11. Hanford Patrol
12. Health Physics
13. Pacific Northwest Laboratories
14. Hanford Environmental Health Foundation
15. Facility Personnel

ATTACHMENT B

Subject Area 1 - Facilities, Equipment, Displays, and Work Environment

Demonstrate the adequacy of facilities, equipment, displays and other materials to support emergency operations.

Evaluator's Comments:

During its evaluation of Exercise *Fremont*, held in September, 1993, the DNFSB Staff noted that plans were prepared for modifications to the RL Emergency Control Center (ECC). During Exercise *Fraser*, these modifications were underway, forcing temporary alternate accommodations for the Emergency Management Team (EMT) and their direct support staff elements in the Emergency Action Coordinating Team (EACT), as well as the Unified Dose Assessment Center (UDAC) and the Field Team Coordinating Center (FTCC). The temporary facility is cramped, with poor acoustics and reduced audiovisual display capability. The EACT, UDAC and FTCC staffs appeared to adapt to the conditions adequately.

The scenario for Exercise *Fraser* involved irradiated power reactor fuel pins with a large enough fission product inventory to constitute a source term reflecting the worst case release analyzed in the existing safety analysis documentation. In his initial notification to the Pacific Northwest Laboratories' Single Point of Contact, the Building Emergency Director stated that: (1) the accident involved damaged power reactor fuel pins; (2) local Continuous Air Monitors and the Stack Monitor were confirmed to have alarmed. These conditions clearly meet the Building 327 Emergency Action Level (EAL) for declaration of a General Emergency.

The computer software available to the UDAC is capable of predicting off-site doses based on the source term used. If it was so used during this exercise, it was not used effectively. Apparently no questions concerning the relationship of the alarms to the EAL were asked by either the EMT or the staff in the UDAC when they were informed of the alarms.

In a strict sense, one must conclude that while the temporary facility in use at the time of the exercise imposed some inefficiencies and discomfort on the participants, those problems were not serious. Of greater concern was the failure to utilize the available equipment and software effectively, as evidenced by the very late determination that a significant off-site release had occurred.

Subject Area 2 - Direction and Control

Demonstrate the capability to direct and control emergency operations.

Evaluator's Comments:

Key participants; i.e., the Building Emergency Director, the 300 Area Emergency Control Center Director and the RL Emergency Director; were decisive in providing leadership to the staffs they directed. One must conclude, however, that their effectiveness was less than satisfactory, in view of the fact that they failed to ensure that appropriate protective actions were taken to protect the off-site public. The staff deficiencies that may have been more direct causes of the failure remain the responsibility of the senior managers.

The Building Emergency Director acted expeditiously to establish his command post and to initiate appropriate notifications. He mobilized the resources at his disposal quickly, assigned responsibilities for specific response actions, gathered information concerning the event, and reported information to the Area 300 Emergency Control Center. Three minutes after the cask drop, the Building Emergency Director declared an Alert; at + 5 minutes, he was given the control message informing him of confirmed CAM and Stack Alarms. He notified the PNL Occurrence Notification Center of this information at + 10 minutes.

The Area 300 Emergency Control Center was declared operational at + 34 minutes. It is unclear whether, or when, the information concerning the nature of the event and the alarm status was received in the Area 300 Emergency Control Center.

At + 46 minutes, a preplanned contingent scenario message directing the Building Emergency Director to declare a General Emergency was delivered. It is unclear whether, or when, the Building Emergency Director informed the Area 300 Emergency Control Center of this message injected by the controllers. However, at + 50 minutes, the controller log shows that an unidentified "ECC" (presumably the Area 300 Emergency Control Center) upgraded the emergency to a "Site Area Alert" (a category not included in the standard DOE lexicon of emergency preparedness terms); at + 1 hour and 2 minutes, the Area 300 Emergency Control Center also recommended a "Site Area Alert"; and fifteen minutes later, at + 1 hour and 17 minutes, the RL Emergency Action Coordination Team upgraded to "Site Area". It wasn't until nearly two hours into the event (at + 1 hour and 55 minutes) that the controllers' log indicates that a recommendation was made by the ECC (again, presumably the Area 300 Emergency Control Center) to the "EMC" (EMT?) to upgrade to a General Emergency. That recommendation was apparently not accepted, since an upgrade was not initiated until almost four hours into the exercise.

Subject Area 3 - Communications

Demonstrate the capability to communicate with all appropriate emergency personnel at facilities and in the field.

Evaluator's Comments:

No problems with communications equipment were observed during the exercise. However, numerous difficulties in interpersonal oral communications are discussed throughout this evaluation (cf Subject Area 2 above).

With regard to the functional effectiveness of communications equipment, it is of passing interest to note that the prepared scenario included provision for a (simulated) local television crew to eavesdrop on the initial radio dispatch of fire and rescue personnel, using their police scanner. This crew arrived on the scene before the ambulance, and proceeded to tape an on-scene report. (Reduction in the level of security provided in the 300 Area now allows access to most exterior portions of the facility without challenge by the guards.) The TV crew was not challenged by participants for several minutes, possibly because the actors were not intrusive on response activities. This matter is discussed further under Subject Area 7 below.

Subject Area 4 - Plume Dose Projection

Demonstrate the capability to develop dose projections and protective action recommendations regarding evacuation and sheltering.

Evaluator's Comments:

A number of factors apparently contributed to the complete failure of participants to meet the objectives in this subject area. First, there was a failure to communicate clearly the initial conditions of the scenario regarding the inferred fission product inventory in the fuel pins; oral comments overheard in the RL Emergency Operations Center throughout the exercise indicated that it was believed that the fuel had had only about six weeks irradiation time, leading the observers to conclude that the fission product inventory in the fuel was very low. Had that misinformation been true, the conjecture would have been valid. However, apparently no one thought to ask why such lightly irradiated fuel might have been sent to PNL for analysis, nor did it occur to anyone that the time period was more likely to apply to the post-irradiation cooling time. In any event, the participants who should have been able to develop dose projections and protective action recommendations apparently deluded themselves into believing that the problem couldn't be very serious because of the small inferred source term.

Second, the simulated meteorological conditions were correctly interpreted regarding where the plume might have gone, and field survey teams were dispatched to the outer lateral boundaries

of a reasonable predicted sector. The two survey teams involved were instructed to travel to the designated spots and to stand by for further instructions, apparently in accordance with standard operating procedures. However, they were not instructed prior to their dispatch to initiate their monitoring upon arrival. Unfortunately, they did just as they were told, and sat in their vehicles at the designated points, with their instruments off, until they were instructed by the Field Team Coordination Center to commence their surveys. By that time the short (15 minute) puff release had passed overhead.

Third, when the field survey teams were instructed to begin their surveys and the controllers properly informed them that only background readings were evident, the Field Team Coordinating Center directed them in directions that took them even further away from where the simulated plume was located (laterally rather then axially along the presumed plume direction).

Fourth, when on-site surveys near the base of the stack were performed, participants were properly informed by controllers that only background readings were evident, the Unified Dose Assessment Center staff incorrectly concluded that either no release had occurred, ignoring the confirmed Stack Alarm, or that the release was too small to have an effect at the base of the stack. They apparently failed to consider that a brief, but intense, puff might have occurred prior to the time they did their surveys, which was, of course, exactly the conditions set out in the scenario. These erroneous conclusions served only to strengthen the incorrect conviction of the Unified Dose Assessment Center staff, and the shared belief on the part of the Emergency Management Team, that the radiological consequences of the exercise were limited to contaminated wounds suffered by one of the operators.

The result of these errors was the complete failure of the combined response team to recognize the character of the event until it was almost time to conclude the exercise, when controllers finally were able to induce the dose assessors to move the field survey teams into positions where simulated ground contamination levels were consistent with the scenario (probably exceeding reasonable bounds of controller involvement in the response). By that time, little could be gained by continuing the exercise, and the Exercise Director properly terminated the exercise.

Subject Area 5 - Plume Protective Action Decision Making

Demonstrate the capability to make timely and appropriate protective action decisions (PAD).

Evaluator's Comments:

To the extent decisions were made on the basis of what the responsible participants believed to be true, they were both timely and appropriate. Unfortunately, in most cases the information on which those decisions were based was seriously in error. Thus, objectives in this subject area were not achieved. Factors contributing to the flawed information are discussed under Subject Area 4 above.

Subject Area 6 - Public Instructions and Emergency Information

Demonstrate the capability to coordinate the formulation and dissemination of accurate information and instructions to the public.

Evaluator's Comments:

Information flow to and from County and State Representatives was generally prompt. Except for the inaccuracies in the information developed to characterize the emergency, the information provided was consistent with the instructions of the Emergency Director and the members of the Emergency Management Team. No evaluation was made of the simulation of County and State notifications of affected members of the public. Clearly, however, since the off-site effects were not correctly assessed, any instructions to the public were not appropriate to the scenario.

Notifications to next-of-kin of injured personnel was timely, but it was only simulated. Thus one can only presume that these contacts would have been conducted with consideration and sensitivity. Follow-up actions to escort spouses to the side of injured and/or contaminated personnel were also timely, but only simulated.

The Joint Information Center was established in a timely fashion and, insofar as information was available, its organization was generally effective in responding to public inquiries. Accurate information concerning the nature of the emergency and the participants' response to it was difficult for the Joint Information Center staff to obtain. In view of the inability of the technical elements of the response organization to correctly characterize the seriousness of the event, this is not surprising.

Midway through the exercise, this evaluator was present in the Joint Information Center when a copy of the videotape made by the actors portraying a local television crew (See discussion under Subject Area 3 above) was delivered. Because of the temporary displacement of the RL Emergency Operations Center, no cable connection between the Joint Information Center and the Emergency Operations Center was available, so it was not possible to transmit the recording directly. Apparently, no attempts were made to deliver a copy of the tape to the Emergency Operations Center. That judgement call by the Director of the Joint Information Center is open to question. Although the tape did not include crucial information, it did provide an opportunity for members of the Emergency Management Team and the Emergency Action Coordination Team to observe the immediate post-incident activities in the Building 327 staging area. That visualization has some value in reducing the feelings of isolation often experienced by members of those teams.

Subject Area 7 - Emergency Information - Media

Demonstrate the capability to coordinate the development and dissemination of clear, accurate, and timely information to the news media.

Evaluator's Comments:

Those members of the Joint Information Center staff assigned to media relations performed their tasks professionally and competently, reflecting their background and experience. Press conferences were less frequent than the seriousness of the simulated event would appear to warrant, but it was consistent with the technical staff's (incorrect) evaluation.

Developers of the scenario for this exercise included some vigorous simulated challenges to the Joint Information Staff, including not only the successful penetration of the immediate post-event staging area (see discussion under Subject Area 3 above), but also attempts by actors playing media members to gain physical access to the Joint Information Center and the RL Emergency Operations Center, and attempts to obtain telephone interviews with various members of the technical response organizations. Except for the initial on-scene taping by the television crew, these were handled adeptly by the staff of the Joint Information Center or other public information specialists.