[DNFSB LETTERHEAD]

June 3, 1994

The Honorable Victor H. Reis
Assistant Secretary for
Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

On April 7, 1994, members of the Defense Nuclear Facilities Safety Board (Board) staff observed the 204th meeting of the Containment Evaluation Panel (CEP). This meeting was an exercise of the CEP's function and was focused on a notional experiment presented by Lawrence Livermore National Laboratory. The Board is providing the enclosed staff's observations on this meeting for your information and use.

The CEP appears to be performing its function properly by providing a comprehensive, independent, and technically-based review. You may wish to consider whether the successful attributes of this panel, and its operations, might serve as a model for your organization's ongoing efforts to enhance the performance of the Nuclear Explosive Safety Study Group.

It was noted that many of the concerns raised by the Board in their Recommendation 93-6, Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Comple~c, are relevant to the CEP and its process. The success of the CEP is a direct result of the extensive technical experience of the chairman and members--a majority of whom are at or past retirement age. The DOE Nevada Operations Office should be commended for its twoyear tasking of the CEP Chairman to capture and archive the containment technology and history that are resident in these experts. The lessons learned during the execution of this task should be evaluated for applicability to the data capture and documentation efforts that will be needed to implement Recommendation 93-6.

Sincerely,

John T. Conway
Chairman

c: Mark Whitaker, Acting EH-6
Nick Aquilina, Nevada Operations Office

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

April 29, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

FROM: Jan Preston, Nevada Test Site (NTS) Program Manager

SUBJECT: Trip Report on DNFSB Staff Observation of the Containment Evaluation Panel (CEP)

1. Purpose: This report documents an April 6-8, 1994, DNFSB Staff observation of the 204th CEP. This meeting of the CEP was an exercise of the Panel's function, and was focused on a notional Lawrence Livermore National Laboratory (LLNL) experiment, BABA. The observation was conducted by J. Preston, D. Winters, and R. Zavadoski.

2. Summary:

   a. Based on this initial observation, the CEP appears to provide a comprehensive, independent, and technically-based review of a proposed containment design. Overall, the CEP took an aggressive, conservative approach, especially to proposals which have not been previously demonstrated.

   b. Many of the Board's concerns expressed in Recommendation 93-6, "Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex," are germane to the CEP effort. Although independent efforts are ongoing to document containment-related expertise, these efforts do not appear to be integrated into DOE's 93-6 implementation efforts.

3. Background:

   a. Since nuclear testing was resumed in 1961, after a three year moratorium, almost all testing at NTS has been done underground. Ensuring that the debris and gases that result from a detonation remain underground is called "containment."

   b. Assurance of containment, by the sponsoring lab, is achieved (in a vertical shaft) by:

      (1) evaluating the maximum credible yield possible from a test device;

      (2) selecting a test location (geologic medium, depth of burial, etc.) that is appropriate for this yield, after careful characterization;

      (3) developing a "stemming plan" to re-fill the shaft with alternating layers of gravel, sand, and concrete/grout plugs after the test device has been

emplaced, to contain (structurally and from gas flow) the products of the explosion; and

(4) ensuring that the emplacement structure (pipes/wire ropes, cables, gas-sampling collection hoses, etc.) will not provide any pathways for prompt releases.

c. In the wake of the BANEBERRY containment failure in 1970, which released approximately 6,700,000 Ci, an existing Test Evaluation Panel was restructured to provide an enhanced review of containment. This restructuring included the addition of new members with a wider range of geologic and hydrologic expertise. The same individual has chaired the resulting CEP since it was established in 1971, through 204 meetings. The mission of the CEP, as stated in the group's 1992revised charter, is to:

- Evaluate, as an independent organization reporting to the Manager, DOE/NV, the containment design of each proposed nuclear test.

- Ensure that all relevant data, technical information, and concerns available for proper evaluation are considered.

- Advise the Manager, DOE/NV, of the technical adequacy of such design from the viewpoint of containment, thus providing the Manager a basis on which he/she may request detonation authority.

- Maintain the official record of each evaluation and of the data, proceedings, and discussions pertaining thereto. n

d. It should be noted that the CEP charter states that it is DOE policy that, nConsiderations of cost, schedules, and test objectives shall not influence the containment review of any test. n

e. Each member of the CEP produces an individual "categorization statement," or conclusion, about the containment proposal. The Chairman does not "categorize." No CEP consensus categorization is prepared, although the Chairman does write a nsummary of CEP deliberations for each test and make necessary recommendations. n The NVOO Manager, who must formally request authority from Headquarters to detonate the test device, must consider the aggregate of the individual CEP member categorizations to determine the adequacy of the containment proposal. The Detonation Authority Request package that is submitted to Headquarters includes copies of the individual CEP members' categorization statements.

4. Discussion:

a. CEP Charter: The CEP charter, reviewed by the Staff and discussed with the CEP Chairman, clearly defines the policies and objectives of the Panel and the responsibilities of all involved in the evaluation process.

b. Oualifications of personnel: Since its inception in 1971, the current CEP Chairman has participated in selection of all members and consultants, with the intent of ensuring that adequate technical competence was represented to accomplish the Panel's mission, while also ensuring that the independence of the individual members from influence by their parent organization was maintained.

c. Observation impressions:

(1) The individual and combined technical competence and experiential background brought to bear by the CEP on the BABA proposal evaluation were impressive.

(2) The CEP meeting was well organized and efficiently run, with a comprehensive evaluation that was completed in less than four hours.

(3) The materials presented by LLNL (written, and by briefings) were comprehensive and technically detailed. The briefer was responsive to requests for additional information by the CEP members.

(4) The Staff was generally impressed by the Panel's aggressiveness and apparently conservative approach. The individual CEP members raised a variety of technical challenges to the materials presented, and pushed the LLNL briefer for their resolution.

(5) Issues that were not satisfactorily resolved were clearly documented as deficiencies in the individual CEP members categorization statements, and resulted in approximately 50% of the members down-rating the containment proposal at the conclusion of the exercise. It was clear that LLNL would need to resolve the issues raised in this CEP exercise prior to presenting an actual containment design similar to the notional BABA.

(6) In summary, based on this initial observation, the CEP appeared to be meeting its stated objectives as an independent review panel, by providing a thorough and in-depth evaluation of LLNL's containment proposal.

b. All technical issues associated with the BABA containment proposal that were identified by the DNFSB Staff were independently raised by the CEP, and documented for future resolution efforts. These included:

(1) Confidence in the prediction of "maximum credible vield": The BABA proposal has a device depth of only 45.7 meters, based on LLNL's

estimates of maximum credible yield equal to or only slightly in excess of the yield from the high explosive. If this projection of yield is incorrect, then the containment design could be inadequate. The CEP expressed some discomfort over the degree of confidence associated with this maximum credible yield estimate. It should be noted that the last CEP exercise considered a notional Los Alamos National Laboratory containment proposal for a permitted experiment of similar estimated yield that proposed a device depth of over 200 feet.

(2) Lack of relevant experience with low-yield. shallow depth of burial experiments:

(a) The CEP members were concerned that containment experience with high yield, deep burial tests might not transfer to proposals like BABA. One member stated that the Panel's "intuition" was "terribly calibrated. n While a high yield detonation is likely to overwhelm the micro features of the geology, a low or zero yield detonation might find natural or test-induced zones of weakness through which to vent. The members also questioned whether past site characterization efforts were adequate to locate the small cracks that might be relevant during this type of experiment.

(b) Several members expressed more general concern about the containment community's ability to interpret the relevance of past experience to current proposals. They stated that their discomfort would increase as the experimental design experience now present at the labs degrades over time.

(c) These unresolved issues appeared to lead some members to down-rate the BABA proposal. Some members recommended that a pure high explosive experiment (no nuclear material, non-radioactive tracers) be considered to help provide additional confidence about predicted shallow burial behavior.

LLNL proposes to use a new design, prompt gas-sampling system for BABA. Prompt and delayed gas sampling has been used on past, full-yield experiments, but the engineering details of this proposed system were not presented, apparently due to the stage of development. The CEP members raised issues about the mechanical design of valves, their actuation mechanisms, and the need for dependable position indication. The LLNL briefer acknowledged that, in addition, issues will need to be resolved with the new system regarding ultimate environmental "close-out" of the new gas-sampling trailer after experiment execution. A CEP member also noted that worker safety due to non-radioactive by-products of the non-nuclear explosion (i.e., hydrogen cyanide) was also a concern. These issues were

not fully resolved, and were highlighted in some of the individual CEP member categorization statements.

c. The strength of the current CEP membership may also be a long-term concern:

(1) Roughly 50% of the Panel members/consultants are retirees, including the Chairman. This CEP observation highlighted the extreme depth of experiential information resident with the individual members. The verbatim transcripts of all 204 CEP meetings, to date, represents a valuable historical record.

(2) In response to these significant personnel departures, NVOO initiated a documentation effort (headed by the CEP Chairman, who is also the current and past LLNL Archivist) in the area of containment technology and history approximately two years ago. The Chairman has produced approximately 40 oral histories, to date, and is committed to completing a "Containment History" report for NVOO by October 1994. As yet, it does not appear that the lessons learned from this commendable documentation effort have been incorporated into the DOE Headquarter's efforts to implement Recommendation 93-6 (particularly specific recommendation 5).

(3) The current, and only, CEP Chairman's involvement in selecting members and consultants, moderating the meetings, and arranging for general technical support for CEP deliberations appears to have been an important element in its past success. It is unclear how the CEP will change when this individual steps down.

5. Followup Activities

a. Conduct a Staff technical review of the elements, standards, and integrated process of containment design at the national laboratories, and through document review. Review trip scheduled for May 2-6. 1994.

b. Observe peer review of laboratory estimates of maximum credible yield for permitted experiments.

c. Incorporate the results of this review into ongoing interactions with DOE on Board Recommendation 93-6.