DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004-2901
(202) 694-7000

July 21, 2004

Mr. Paul M. Golan
Acting Assistant Secretary for
Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Mr. Golan:

Enclosed is a report detailing observations made by members of the staff of the Defense Nuclear Facilities Safety Board concerning ventilation systems being designed for the Hanford Site's Waste Treatment Plant. These observations were developed through document reviews and discussions with representatives of the Office of River Protection and Bechtel National, Incorporated. In general, the design requirements for the ventilation systems in the Waste Treatment Plant facilities are sound. Several specific areas were noted, however, that warrant increased attention as the design progresses. Of particular note is the design of the ventilation system for the safe haven, which is manned during an accident to allow for remote process shutdown, located in the Pretreatment facility annex. Other specific comments are discussed in the enclosed report, which is forwarded for your information and use, as appropriate.

Sincerely,

John T. Conway
Chairman

c: Mr. Roy J. Schepens
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

June 14, 2004

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: R. Kasdorf and R. Zavadoski

SUBJECT: Hanford Waste Treatment Plant—Ventilation Systems

This report documents a visit to the Hanford Site made by the staff of the Defense Nuclear Facilities Safety Board (Board) to continue its review of the design of various ventilation systems for the Waste Treatment Plant. The previous ventilation review occurred in June 2002. Participants in the review included the Department of Energy's (DOE) Office of River Protection and it's primary contractor, Bechtel National, Incorporated.

Confinement and Process Ventilation Systems. The contractor provided the status of the confinement ventilation systems in each of the Waste Treatment Plant facilities—High Level Waste, Low Active Waste, Pretreatment, and the Analytical Laboratory. The staff toured the first three partially complete facilities. The review included the confinement ventilation systems, as well as the process and melter off-gas systems. The review focused on the derived safety classification for each system in each facility, including the criteria and standards applied to each. Additionally, the staff evaluated the seismic and electrical power supply requirements specified for the ventilation systems.

Safety Classification—The safety classification of the various sections of the ventilation systems and support systems was logical and consistent with requirements. The staff did note that one support system in the Pretreatment facility supplying hot air to help protect safety-class high-efficiency particulate air (HEPA) filters was classified as a nonsafety system. The staff requested the technical basis for this classification.

Standards Applied—The *Code on Nuclear Air and Gas Treatment*, designated AG-1a-2001 by the American Society of Mechanical Engineers, is the code of record for the Waste Treatment Plant project. This code is appropriate for most components of nuclear air-cleaning systems. The contractor noted that the code does not address radial HEPA filters. The contractor provided a comparison of the Waste Treatment Plant specifications with the requirements of Section FC, HEPA Filters, of the AG-1a-2001 code. The contractor also noted that the new *DOE Nuclear Air Cleaning Handbook*, DOE-HDBK-1169, has been used for guidance in complying with the authorization basis for the Waste Treatment Plant project and the Washington Administrative Code.

Seismic Design—The contractor has determined the level of seismic robustness required for each component in the confinement and process ventilation systems. The most stringent level is designated Seismic Criteria I and the least Seismic Criteria IV. The requirements for

each designation (the relevant portions of the AG-1a-2001 code) are specified in procedures and equipment specifications. The planned ventilation filter housing shaker table tests are scheduled for this summer. The contractor stated that a bounding seismic spectra will be used as input for the shaker table tests. The staff will review the bounding data for suitability.

Electrical Supplies—The contractor presented a tabulation of the ventilation systems' electrical components and their source of electrical power. Those components designated as safety-class received their electrical power from redundant, independent, emergency diesel generator-backed power trains. Certain risk reduction class and non-important-to-safety loads have power supplied from a power source that is backed up by a standby diesel generator. The standby diesel generator is a single commercial-grade generator that is rated Seismic Criteria III. The staff noted that the Analytical Laboratory's ventilation systems did not have a source of auxiliary power. The consequences of recovery after a loss of power, which could result in a spread-of-contamination event, need to be considered before the decision is made on whether a source of auxiliary power is necessary.

Staff Concerns. Based on the review, the staff has the following concerns.

Habitability Systems—The Waste Treatment Plant project will use anhydrous ammonia in amounts up to 12,000 gallons. Rupture of the storage tanks could produce unacceptable concentrations of ammonia in about 2 minutes at the unprotected control areas. The safe haven for remote process shutdowns is located in the Pretreatment facility annex. This safe haven comprises approximately 100,000 cubic feet, with a cleanup recirculation unit that turns over only 1,000 cubic feet per minute. A turnover rate of once per 100 minutes does not appear adequate to protect the personnel who are expected to remain in the safe haven.

The staff urged that more attention be given to the design of the safe haven. Consideration ought to be given to experience gained from control rooms at licensed nuclear power plants. This experience has been captured by the U.S. Nuclear Regulatory Commission in regulatory guides (R.G.) entitled: R.G. 1.194, *Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants*; R.G. 1.196, *Control Room Habitability at Light-Water Nuclear Power Reactors*; and R.G. 1.197, *Demonstrating Control Room Envelope Integrity At Nuclear Power Reactors*. The commercial nuclear industry, as represented by the Nuclear Energy Industry (NEI), has also distributed in draft form NEI 99-03, *Control Room Habitability Assessment Guidance*. In addition, the staff questioned plans for protecting the workers not in the safe haven given the rapid propagation of ammonia in a potential tank accident.

Damper bypass leakage is a particularly important consideration for the habitability of the safe haven. With the potential for high concentrations of anhydrous ammonia outside the facility and the current low turnover rate of 100 minutes, small amounts of bypass leakage through isolation dampers could contaminate the safe haven with ammonia fumes. The capability to test for bypass leakage is challenging. In view of the importance of the habitability of the Pretreatment Annex Control Area, the staff will pay particularly close attention to the resolution of this issue.

The structural adequacy of the safe haven is still uncertain. At present, a steel architectural clad siding is specified. This type of clad siding is currently not designed to withstand a seismic event. The contractor noted that it was considering extending the concrete so that the clad siding would not be used for this portion of the structure.

In-Bleed Filter Units from the C-3 to the C-5 Zones—In an earlier design, the in-bleed filter units going from the lower-contaminated C-3 zone to the high-contaminated C-5 zone had HEPA filters for backflow prevention of contamination. The HEPA filters (rated at 99.97 percent removal efficiency) have been replaced by a filter (rated at 85 percent removal efficiency) and a fire damper (about 97 percent efficient). This represents a factor of 15 reduction in removal efficiency. The safety basis analysis was not available during the review, but will be examined by the staff to ensure adequate protection is being provided for facility workers during an accident.

Vessel and Process Ventilation Capacity—The contractor discussed the impacts of pulse jet mixers and air spargers on the Process Vessel Ventilation systems. At the Pretreatment facility, the Process Vessel Ventilation system cannot handle the full flow of all five non-Newtonian vessels being sparged simultaneously at full flow; in fact, the sparger air flow for just the two lag storage vessels exceeds the Process Vessel Ventilation system capacity. Changes are required to accommodate the sparge air flow. Consideration is being given to sequencing the sparging rather than using continuous sparging. The staff will continue to follow the resolution of the limited capacity of the Process Vessel Ventilation system and the need to sparge to safely reduce hydrogen levels.

In reviewing the Pretreatment facility's Process Vessel Ventilation system, the staff noted a hot air in-bleed system was classified as nonsafety, commercial grade. This system protects the process ventilation HEPA filters, which are classified as safety-class. The staff questioned the use of commercial-grade equipment in this application. The contractor will provide the technical basis for this classification.

Issues Related to HEPA Filter Bypass Leakage—During its previous review, the staff noted that bypass leakage around the HEPA units in the C5 ventilation system, which must be maintained remotely, could present a problem. The contractor has looked into the matter and has identified the potential for leakage past dampers, which would bypass one bank of HEPA filters. There is no clear method for measuring this bypass leakage. The contractor has considered three potential test methods for examining leakage during facility startups. The staff will review the test methods as they are finalized.

Overhead Sample Transfer System—During discussions regarding the Waste Treatment Plant's Analytical Laboratory, the staff learned that the contractor currently envisions using a pneumatic, overhead sample transfer system to move samples from the three facilities to the laboratory. The staff noted that this could prove problematical if the samples were to become stuck and suggested that the contractor may wish to consider other methods of transferring samples.