DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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July 10, 2000

The Honorable Bill Richardson
Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Richardson:

As you are aware, the Department of Energy is preparing an Implementation Plan in accordance with your acceptance of the Defense Nuclear Facilities Safety Board's Recommendation 2000-2. The enclosed trip report provides additional details related to the maintenance of vital safety systems at the Hanford Site that you may wish to consider in your preparations.

We look forward to working out the details of an Implementation Plan with your staff.

Sincerely,

John T. Conway
Chairman

cc: The Honorable Carolyn L. Huntoon
Mr. Steven V. Cary
Mr. Keith A. Klein
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

May 9, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: R. W. Zavadoski
M. Sautman

SUBJECT: Procurement and Field Testing of HEPA Filters, Hanford Site

This memorandum describes observations made by members of the staff of the Defense Nuclear Facilities Safety Board (Board), R. Zavadoski and M. Sautman (Hanford Site Representative), during a March 20–24, 2000, visit to the Hanford Site. The purpose of this visit was to review issues associated with procurement and field testing of high efficiency particulate air (HEPA) filters used in confinement ventilation systems at Hanford's defense nuclear facilities.

Each issue in this report is similar to those already presented in the Board's report DNFSB/TECH-23, *HEPA Filters Used in the Department of Energy's Hazardous Facilities*, and Recommendation 2000-2. This report highlights specific deficiencies at Hanford Site facilities. This additional information may also be useful in the development of the implementation plan for Recommendation 2000-2.

Facilities reviewed included Buildings 233-S, 324, and 327; the Waste Encapsulation and Storage Facility (WESF); the high-level waste tank farms; the Plutonium Finishing Plant (PFP); and the Plutonium Reclamation Facility (PRF). Subject areas evaluated included inspection and testing programs for HEPA filters, as well as inspection and testing of bypass leakage past ducts and housings, duct dampers, and total systems.

Use of Filter Test Facility. The Department of Energy Richland Operations Office (DOE-RL) does not require HEPA filters intended for safety service to pass through the Filter Test Facility (FTF) at Oak Ridge, as is required by DOE Standard 3022-98, *DOE HEPA Filter Test Program*. The justification offered by DOE-RL relies on an analysis of 8 years of results from tests performed during the 1980s. Hanford procures HEPA filters only from the vendor that has the best performance at that time.

Beginning in 1995, DOE-RL has not required newly procured filters to pass through the FTF, nor has DOE-RL periodically reanalyzed the vendor's performance. DOE-Headquarters has not intervened in this decision.

The quality assurance of any safety-related product depends on continuing verification of objective data. The HEPA filter vendor's market has changed significantly since the 1980s, and DOE no longer dominates the market. The functions of the FTFs were not only to service all vendors and periodically report on their performance, but also to provide a reliable database of performance information associated with HEPA filters. DOE-RL's withdrawal from the FTF program undermines the value and relevance of this database.

PFP has purchased and installed only HEPA filters that had passed through the FTF. The large reserve of pretested filters from 1995 recently ran out. New HEPA filters purchased to support plutonium stabilization at PFP will be sent to the FTF.

In-Place Filter Testing. The Board's staff reviewed the implementation of guidance for in-place filter testing found in the American Society of Mechanical Engineers (ASME) National Standard N510, *Testing of Nuclear Air Treatment Systems*, for several facilities. The standard strictly applies only to systems designed and manufactured in accordance with ASME National Standard N509, *Nuclear Power Plant Air-Cleaning Units and Components*. However, N510 is fairly generic and is typically implemented to the extent practical in other applications. It is widely used throughout the DOE complex to meet Technical Safety Requirements (TSRs). At Hanford, it is commonly referenced in either authorization basis documents (e.g., TSRs) or procedures that implement those documents.

Some facilities (324, 327) reviewed during the staff's visit have a remaining life expectancy of approximately 5 years, and their inventories of hazardous materials are scheduled to be removed well before their end of life. Under these conditions, any change in implementing the requirements of a national standard should reflect the gains in safety achieved versus the cost of implementation. It should also be noted that the PFP and PRF facilities have more than 60 procedures for field testing their filtration systems, and each has a tailored visual inspection checklist.

Three facilities did not perform adequate visual inspections on the filters and filter housings during annual tests. At WESF, where the filter and housing were purchased pre-inspected, the filters are installed underground with radiation fields of more than 20 rem/hr. These in-service conditions clearly do not permit human occupancy and render visual inspections impractical. In Building 324, ALARA (as low as reasonably achievable) considerations were cited to explain not inspecting filters and housings. However, levels of radiation and contamination were not reported to be excessive, and the associated ALARA concerns do not appear to outweigh the need to inspect these systems periodically. Similarly, numerous filters and filter frames installed at Building 327 are not visually inspected as suggested in N510.

Ideally, duct and housing leakage tests are performed during initial installation or after a major system modification. Unfortunately, personnel at most of the facilities reviewed could not identify whether or when such tests had been performed. It would not be advisable to perform the positive pressure portion of this test on internally contaminated systems, and this test should not be necessary (for older systems) if bypass leakage is properly taken into account.

Sections of N510 addressing bypass leakage are particularly important for facilities using multiple HEPA filter banks and relying on a relatively high decontamination factor across each bank. Generally, filter bypass leakage can become progressively more serious as it bypasses each filter bank because of the loss of the bank removal efficiency. PFP and PRF have implemented a procedure for determining filter bypass leakage, but the sensitivity of the measurement is unknown. Filter bypass leakage is not measured at Buildings 324 and 327.

Airflow capacity and distribution tests and aerosol uniformity tests are also best performed during initial installation or after a major system modification. Of these tests, the more important is that of aerosol uniformity, which ensures that in-place HEPA filter efficiency testing provides valid results. At Hanford, however, such tests cannot be run on numerous systems without extensive modifications. One facility for which it does appear reasonable to conduct these tests is Building 324, where drawings indicate adequate space to conduct the tests in the walk-in plenums.

A common problem noted at several facilities was the inability to establish a measurable upstream aerosol concentration for in-place testing of HEPA filters, primarily as a result of inadequate numbers and sizes of ports for both aerosol injection and measurement. In some cases, to overcome this deficiency, the challenge aerosol was first injected and measured downstream. Then the injection equipment was transferred upstream and the filter tested, using the assumption that the upstream aerosol concentration was the same as that previously measured downstream. This methodology is not recognized in N510 because it requires that all downstream configurations, resistances, and flow paths for aerosol generation and measurement be identical, which is highly unlikely. There are a few instances in which this problem will be difficult to overcome, as with the exhausters for the three double-contained receiver tanks in the high-level waste tank farms. On the other hand, minor modifications at PRF may easily overcome this difficulty.

Possible Radiation Damage to HEPA Filters. Some filters at Building 327 have been in service for more than 20 years and contain sufficient internal aged fission products contamination to produce external dose fields of 0.5 to 1.0 rem/hr. These external fields correspond to an internal exposure of several million rads to the HEPA filters, which is sufficient for potential radiation weakening of the filters. The Board noted similar problems at B-Plant several years ago. In response, B-Plant prepared and brought into operation a previously unused filter bank and isolated the heavily exposed filter bank.