

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

May 31, 1994

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director**COPIES:** Board Members**FROM:** J. Kent Fortenberry**SUBJECT:** Hanford K-East Basin Summary DNFSB Staff Assessment

1. **Purpose:** This report provides a summary Defense Nuclear Facilities Safety Board (DNFSB) staff assessment of the Hanford K-East Basin program and the preparations for encapsulating fuel at this basin. The assessment is based primarily on two site visits conducted on April 11-15, 1994 and May 3, 1994, and discussions with the Department of Energy (DOE) and Westinghouse Hanford Company (WHC) staff.
2. **Summary:** K-East Basin activities have in the past been narrowly focused on encapsulating fuel. Recently, WHC has stated its intent to equally and aggressively address the issues of chronic and potentially catastrophic leakage, sludge, fuel, and tritiated water. WHC is also pursuing safety issues related to storage of spent ion exchange resins.<sup>1</sup> The staff considers these positive steps in managing the spent nuclear fuel at the K-East Basin. Because a significant delay in operational activities at the K-East Basin is expected, scheduled review efforts of the Board's staff are being adjusted. Results from reviews already performed are summarized. Although some of these reviews were performed some time ago, they are included to provide a baseline for future reviews. There are still significant issues to be resolved, as summarized in the attached issue sheets.
3. **Background:** WHC and the DOE Richland Operations Office (DOE-RL) initially planned to encapsulate fuel assemblies at the K-East Basin for underwater storage beginning on June 30, 1994, in accordance with a Tri-Party-Agreement target milestone date. WHC has now made changes in both the scope and schedule of the planned encapsulation activity. These changes are not well-defined at this time, but it is clear that encapsulation of fuel, as originally conceived, will not start on June 30, 1994.

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<sup>1</sup>May 12, 1994 trip report, "Waste Management at the K-East Basin," Steven Stokes.

4. **Discussion:** The status of the staff's review of the K-East Basin is outlined below.

<u>Review Topic</u>	<u>Date of Last Review</u>	<u>Issue Sheet Attached?</u>
Standards and Order Compliance	4/94	yes
Seismic / Structural	2/94	yes
Systems Engineering	4/94	yes
Fire Protection	4/94	yes
Waste Management	5/94	yes
Electrical and I&C	4/94	yes
Maintenance and In-Service Inspection	4/94	yes
Configuration Management	4/94	yes
Quality Assurance	4/94	yes
Criticality	4/94	no <sup>(1)</sup>
Conduct of Operations	12/93	no <sup>(2)</sup>
Training / Qualification	12/93	no <sup>(2)</sup>
Radiation Protection / ALARA	1/94	no <sup>(3)</sup>
Safety Envelope	not reviewed	no <sup>(4)</sup>
Facility Representative	not reviewed	no <sup>(4)</sup>
Occurrence Reporting and Lessons Learned	not reviewed	no <sup>(4)</sup>
Environmental Protection and Restoration	not reviewed	no <sup>(4)</sup>
Emergency Preparedness	not reviewed	no <sup>(4)</sup>

- (1) S. Pearlstein has reviewed documentation of criticality analyses at the K-East Basin and is satisfied with the approach and the results. There are no identified criticality issues.
- (2) Issues are presented in December 22, 1993 trip report, "Report on Training and Qualification at the Hanford Site," Ralph Arcaro.
- (3) Issues are presented in February 4, 1994 trip report, "Report on the Radiation Protection Program at the Hanford Site," J. W. Troan.
- (4) Future review topic.

5. **Future Staff Actions:** The staff will continue to closely pursue DOE's actions to clean up the K-East Basin. Specific topic reviews will be scheduled in the future when more is known of the scope and schedule of the K-East Basin activities.

**Subject:** STANDARDS and ORDER COMPLIANCE

**Staff Lead:** C. Keilers

**Status:** On April 8, 1994, the Department of Energy - Richland Operations Office (DOE-RL) requested Westinghouse Hanford Company (WHC) to reassess Order compliance at the K-Basins.

**Description:** In July 1992, DOE-RL initiated a pilot order compliance self-assessment program at Hanford, which assessed 12 Orders of interest to the Board at the K-Basins. The DNFSB staff reviewed this self-assessment activity and identified several deficiencies:

1. Procedures and quality assurance measures for self assessments needed strengthening;
2. Some Orders, assessed at the site level, also needed to be assessed at the facility level;
3. Requirements were assumed to apply to some facilities based on applicability assessments done at other facilities;
4. Four orders were not assessed requirement-by-requirement, but no technical justification was available;
5. Documented policies or procedures were the only evidence provided to show compliance in many assessments; and
6. DOE-RL inspections did not assure the adequacy of WHC self-assessments.

The Board transmitted these comments to DOE on April 1, 1993. A recent review by DOE-RL and the Office of Operations Assessments (EM-25) concluded that Order compliance at the K-Basins is inadequate. This led to the DOE-RL request that WHC reassess Order compliance at the K-Basins. The deficiencies identified by this EM-25 review are similar to those transmitted to DOE by the Board on April 1, 1993.

WHC intends to accelerate their Standards / Requirements Identification Document (S/RIDs) development schedule, but this may not occur in time to support use of S/RIDs for encapsulation preparations. In May 1994, WHC anticipates starting to identify requirements for S/RIDs. In FY 95, WHC will continue S/RIDs development to include assessing administrative compliance and floor-level adherence.

**Issues:**

1. The demonstration of Order compliance at the K-Basins continues to be inadequate as described in the April 1, 1993, Board letter and the recent EM-25 review.

**Subject:** SEISMIC / STRUCTURAL

**Staff Lead:** C. Keilers

**Status:** Westinghouse Hanford Company (WHC) is updating their seismic analyses to try to quantify the potential basin leak rate following an earthquake. Basin leakage has been declared an Unreviewed Safety Question (USQ).

**Description:** An unreinforced expansion joint separates the K-Reactor building and the K-East Basin chute area. The joint is sealed by 40 year old rubber water stops and has leaked before. The joint has been previously repaired with epoxy.

In the event of a design basis earthquake, WHC has predicted differential displacement between the reactor building and the basin chute area of 0.2 to 0.75 inches, which may be unrealistically low. Follow-on WHC analyses predict leak rates from 200 to 2000 gpm, depending on soil permeability, for a 0.75 inch joint displacement.

WHC recognized the joint leakage concern at least two years ago and planned to fill the chute with concrete. This has been postponed until after encapsulation (FY 96).

**Issues:**

1. Several WHC assumptions increase uncertainty in the predicted joint motion and in the overall seismic capacity of the basin. Examples include assuming incompatible motions at the joint; using two-dimensional (2D) models to capture three-dimensional (3D) soils-structure interaction effects; and assuming the chute is filled with concrete in the analyses.

Since the analysis is so uncertain, WHC has initiated efforts to modify the basin to mitigate the potential for leakage following an earthquake and is considering installing cofferdam doors that will isolate the chute area.

2. The basin roof and superstructure are interconnected to the reactor building by vertical columns that could be a weak structural link during an earthquake. Recovery plans to mitigate the effects of an earthquake will need to take into account the possibility of a collapsed roof.

**Subject:       SYSTEMS ENGINEERING**

**Staff Lead:**   Kent Fortenberry

**Status:** The Spent Nuclear Fuel Project Team, formed in February of 1994, has assigned engineering resources to systems engineering for dispositioning the K-East Basin fuel. There is now a significant effort in this area. This systems engineering effort has not yet yielded tangible results.

**Description:** Earlier Board staff trip reports<sup>(1)(2)</sup> have indicated deficiencies in the systems engineering aspect of the proposed fuel encapsulation at the K-East Basin.

**Issues:**

1. The site level systems engineering effort does not extend down to the K-East Basin project, or to the Spent Nuclear Fuel Project. As such, the site level systems engineering effort has not yet influenced the K-East Basin project.
2. Options for the assumed end state for the spent fuel and sludge in the K-East Basin have not been sufficiently explored. For instance, the question of the sludge categorization as spent nuclear fuel or as waste subject to management under the Resource Conservation and Recovery Act (RCRA) is a major decision that must be pursued at the DOE-HQ level. This decision is not being pursued aggressively.

<sup>(1)</sup> October 2, 1992 trip report, "Composite Trip Report - Review of KE-Basin Fuel Encapsulation Program, Summer 1992," Paul Gubanc.

<sup>(2)</sup> January 12, 1994 trip report, "Review of K-Basins at Hanford," Dan Burnfield.

**Subject:** FIRE PROTECTION

**Staff Lead:** Ajit K. Gwal

**Status:** Westinghouse Hanford Company (WHC) has several upgrades planned related to the K-East Basin fire protection system. Also, WHC is currently in the process of performing a fire protection compliance evaluation against the requirements of DOE Order 5480.7, *Fire Protection*, and the NFPA code.

**Description:** The K-East Basin has a wet-pipe sprinkler system and heat detectors in the areas where occupancy is expected. The water for this sprinkler system is provided by the basin service water system. The heat detectors initiate alarms in the basin control room, locally, and in the local fire house.

**Issues:**

1. The service water pumps that supply the sprinkler system are motor-driven, with a single source of power. As a result, during a loss of power, which may happen during a fire, the K-East Basin will be without any fire protection. Thus, the water supply to the fire protection system is not reliable and does not meet the NFPA Life Safety Code 101. A dedicated fire pump backed by a diesel generator is required to meet the NFPA requirements.
2. The existing wet-pipe sprinkler system covers office areas only. During the encapsulation process many personnel will be present in the discharge chute area of the basin. This condition has not been evaluated by WHC.
3. A fire hazards analysis (FHA) does not exist, but WHC has committed to perform a FHA for K-East Basin.
4. Presently, emergency lights at K-East Basin provide inadequate coverage, but WHC plans to add more emergency lights. In addition, emergency lights are not seismically supported. This condition may make evacuation unsafe during a seismic event.
5. Compliance Schedule Agreements (CSAs) for DOE Order 5480.7A, *Fire Protection*, are not yet approved by DOE.

**Subject:** WASTE MANAGEMENT

**Staff Lead:** Steven Stokes

**Status:** Westinghouse Hanford Company (WHC) has declared a potential Unreviewed Safety Question (USQ) concerning hydrogen accumulation in stored spent resin columns. WHC is also preparing to conduct an order compliance assessment for DOE Order 5820.2A, *Radioactive Waste Management*. Certification of the K-East Basin transuranic (TRU) waste streams is being pursued to support fuel encapsulation activities as well as continued basin operation.

**Description:** Two types of waste are generated at the K-Basins; low level waste (LLW) and TRU. There are three LLW streams generated: (1) compactable (disposable anti-contamination garb, paper, rags, etc.); (2) non-compactable (inoperable machinery, pipes, etc.); and (3) spent ion exchange modules. Two TRU waste streams are generated: (1) spent ion exchange columns; and (2) spent cartridge filters.

**Issues:**

1. Currently, neither of the two K-East Basin TRU waste streams (spent cartridge filters and ion exchange columns) can be demonstrated to meet the Hanford site waste acceptance criteria and must be stored at the K-Basins.
2. Build-up of hydrogen gas in stored ion exchange columns poses an unanalyzed safety risk. This issue is being evaluated as a potential unreviewed safety question (USQ).
3. Compliance with DOE Order 5820.2A has not been adequately assessed. Demonstrated noncompliances include lack of (1) inspection and (2) contingency plans for temporary storage of TRU waste.

**Subject: ELECTRICAL and INSTRUMENTATION & CONTROL**

**Staff Lead:** Ajit K. Gwal

**Status:** Westinghouse Hanford Company (WHC) has several upgrades planned for the electrical system at the K-East Basin. Some examples are removing the PCB transformers, providing alternate power, performing a load study, upgrading 480V breakers, updating electrical drawings, and upgrading aged cables.

**Description:** The electrical system for K-East Basin is classified as safety class 3 by WHC. The site 230 kv distribution grid supplies power to various K-Reactor loads through stepped down voltages at 13.8 kv, 4160 volts, 480 volts and 208/120 volts. Electric power is supplied to the K-East Basin through a single circuit breaker, located on the 4160 volt switchgear Bus C of the shutdown reactor, using a 1000 kva 4160v/480v PCB transformer. Most of the Bus C circuit breakers are in lock-out/tag-out status and this switchgear is not adequately maintained. At present there is no backup power to the facility.

**Issues:**

1. The electrical distribution system is unreliable, and does not meet requirements of DOE Order 6430.1A, *General Design Criteria*, or IEEE-141, *Recommended Practice for Electrical Power Distribution for Industrial Plants*. The planned upgrades / modifications will not resolve the concerns of reliability and non-compliance to DOE Orders and industry standards. Also, there is no documentation of load studies, voltage profiles, short circuit studies, protective device coordination analysis and cable size verification.
2. Lightning protection is inadequate per NFPA 78 and DOE Order 6430.1A.
3. Battery room ventilation does not meet ANSI-C2, *National Electrical Safety Code*, for reducing the possibility of explosion due to hydrogen accumulation.
4. There is no procedure for a loss of electrical power as required by DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*.
5. Currently, seven out of the eight radiation detectors in the K-East Basin are required to be operable to encapsulate fuel. This criteria does not provide adequate coverage at the location of encapsulation activity (discharge chute).
6. K-East Basin personnel have not been trained to the *DOE Electrical Safety Guidelines*, DOE/ID-10600, and are not aware of the recommendations from the *Report of the Task Group on Electrical Safety of DOE Facilities*, DOE/EH-0298.

**Subject: MAINTENANCE, INSPECTION, CONFIGURATION MANAGEMENT  
and QUALITY ASSURANCE**

**Staff Lead:** Herb Massie

**Status:** Westinghouse Hanford Company (WHC) is preparing a project-specific Quality Assurance (QA) Project Plan and a Maintenance Implementation Plan (MIP) for the K-East Basin. WHC has upgrades planned for completion in two years to simplify the K-Basin electrical and water supply systems. Also, a standby surveillance program (SSP) has been developed to manage preventive maintenance.

**Description:** The K-East Basin was previously managed by the N Reactor operations organization and has been neglected for over 30 years. The basin equipment was not properly maintained, and was allowed to deteriorate. Even simple preventive maintenance, such as lubrication, was not routinely performed. Last year the K-Basins organization was separated from N Reactor and provided with new management, including separate maintenance and QA organizations.

Current plans indicate that the K-East Basin will be in operation until the year 2002. In 1991, WHC funded a life extension study by an outside consultant that assessed the material condition of the safety class 3 and 4 basin systems. The safety class 1 and 2 items were not assessed (safety class 1 and 2 equipment consists of the basin structure, underwater storage racks, and the railcar control system). These WHC consultant recommendations are in the process of being implemented.

**Issues:**

1. The current activities to revise/upgrade the work control program are not complete. (This includes additional training for maintenance workers.)
2. The facility Maintenance Implementation Plan (MIP) has not been completed or approved by the Department of Energy - Richland Operations Office (DOE-RL) as required by DOE Order 4330.4A, *Maintenance Management*.
3. The life extension recommendations are not yet implemented.