APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-602/90-01 Construction Permit: CPRR-123

Docket: 50-602

Licensee: University of Texas
College of Engineering
Department of Mechanical Engineering
Nuclear Engineering Program
Austin, Texas 78712

Facility Name: Nuclear Engineering Teaching Laboratory (NETL) (Triga Mark II)

Inspection At: NETL, Balcones Research Center

Inspection Conducted: March 20-22, 1990

Inspectors: M. E. Murphy, Reactor Inspector, Test Programs Section, Division of Reactor Safety — Date 4/16/90

D. L. Kelley, Reactor Inspector, Test Programs Section, Division of Reactor Safety — Date 4/16/90

H. F. Bundy, Reactor Inspector, Test Programs Section, Division ~~of Reactor~~ Safety — Date 4/12/90

Approved: W. C. Seidle, Chief, Test Programs Section Division of Reactor Safety — Date 4/12/90

Inspection Summary

Inspection Conducted March 20-22, 1990 (Report 50-602/90-01)

Areas Inspected: Routine, announced inspection of facility completion status, open items required to be completed prior to licensing, and followup to allegations.

Results: Within the areas inspected, no violations or deviations were identified. Nine open items were closed; six items remain open. Six public allegations identified in newspaper articles were examined, and five of the allegations were found to be of no safety concern. The sixth allegation, involving the possibility that a water spring exits under the NETL building, remains open pending further hydrogeological review. The NRC's construction phase inspection was not completed at the conclusion of the inspection, and, therefore, a finding could not be made that the reactor was ready for operation.

DETAILS

1. PERSONS CONTACTED

*J. R. Howell, Chairman, Department of Mechanical Engineering
*T. L. Bauer, Reactor Supervisor
*M. G. Krause, Senior Reactor Operator
*B. W. Wehring, Director, Nuclear Engineering Teaching Laboratory
J. Green, Construction Inspector

*Denotes attendance at exit interview.

2. OPERATIONAL READINESS REVIEW

The purpose of this area of the inspection was to determine the status of the preoperational test, checkout, and evaluation program. The inspectors reviewed the open items previously identified in NRC Inspection Reports 50-602/89-05 and 50-602/89-06.

The following open items in NRC Inspection Report 50-602/89-05 were closed:

- Leak test of each beamport cavity
- HVAC system balancing

The following open items in NRC Inspection Report 50-602/89-06 were closed:

- Correction of FSAR diagrams for pool cooling and purification systems
- Completion of the following checkout and evaluation sheets:
  - HVAC system - control room panel (CRP) alarms
  - Argon purge system
  - Fuel storage cells
  - Fuel handling tools
  - Radioactive waste
  - HVAC-CAM (airborne radioactive isolation)

The following items remained open for resolution and/or completion:

- Repair of the joint seal between the reactor building foundation and the lift slab walls (work was in progress)
- Correction of "mode" terminology in the operating procedures to agree with the Safety Analysis Report and Technical Specifications
- Approval of the Test Program Manual
- Issuance of the Nuclear Reactor Committee Charter

completion of the fuel handling and evaluation sheet

- Completion of the instrumentation and control system (ICS) - installation checks checklist

The ICS system noise problem that was causing spurious alarms had been identified and determined to be a design problem. The resolution had been referred to General Atomic Technologies and as of the date of this inspection, the problem had not been corrected.

Several hardware tests were found incomplete; however, all of these items had been identified by the licensee as "cannot complete until after the core is loaded." The rationale for the deferral was reviewed by the inspectors. The inspectors agreed that the deferral was reasonable, and that reactor safety would not be jeopardized.

The inspectors witnessed the reactor bay ventilation isolation test. The test was initiated by a high airborne radioactivity signal. The licensee initiated the bay isolation using a sealed check source. The reactor bay ventilation isolated as designed.

3. FOLLOWUP TO PUBLIC ALLEGATIONS

The NRC Region IV office became aware of allegations made by a former construction contractor for the University of Texas Triga Mark II Facility in newspaper articles appearing in the December 1989 issues of the "Austin American Statesman" and "The Daily Texan." These newspapers serve the Austin area. Subsequent telephone contacts with the contractor and his successor to clarify the technical issues resulted in the identification of six specific concerns. These specific concerns and the NRC-Region IV examination of these concerns are discussed below.

3.1 Concern: There is a potential design flaw that could permit backflow of reactor water into the chill water system and eventually into the domestic water supply.

The inspectors reviewed the design information provided by the licensee and inspected the as-built condition of the reactor pool cooling water system. There are two sections to this system; the main cooling loop and the purification loop. The main cooling loop interfaces with the chill water system at the heat exchanger and the differential pressure sensors. These are blind interfaces with no direct contact between the two fluids. The purification system interfaces with the facility deionized water loop through which makeup water is supplied to the reactor pool. The deionized water loop is supplied from the facility potable water system. This is a direct contact interface.

The main cooling loop was designed for a minimum operating differential pressure with the chill water system of 5 to 10 psi. The actual operating

differential pressure is approximately 35 psi. The heat exchanger is designed for a differential pressure of 150 psi.

The diaphragm of the pressure sensors is the boundary for the two fluids. The sensors are connected to the system by ¼-inch metal tubing through isolation valves. These sensors are installed for the specific purpose of isolating the chill water system if a low differential pressure occurs such as a loss of chill water system pressure.

Administrative procedures will be in effect during reactor operation that require isolation of the main cooling loop and the chill water system for periods when the reactor is not operating. This provides positive isolation protection for loss of chill water system pressure during nonoperating periods.

The purification system will be connected to the makeup water supply only when actual makeup water supply is required. The system is normally disconnected when not in use. The connection and use of the makeup system will be under direct operator control in accordance with approved operating procedures. By design, the makeup water system pressure is 60 psi and the maximum purification system pressure would be 15 psi. In the event that makeup water system pressure was lost during a fill operation, the system also has a check valve in line with the isolation valve to prevent backflow.

Based on the review of the information provided by the licensee and a walkdown of the as-built system, this allegation could not be substantiated and no safety concerns were identified.

3.2 Concern: A path exists for discharge of contaminated waste water from a storage tank into the sanitary sewer system.

The inspectors reviewed the design specifications and conducted a walkdown of the as-built system. There is no permanent connection between the liquid radioactive waste system and the sanitary waste sump. NRC Inspection Report No. 50-602/88-05, dated October 17, 1988, reported the existence of a piping error that had already been identified by the licensee that connected the radioactive waste storage tank vent line directly to the sanitary waste sump. This was corrected during the construction phase.

NRC Inspection Report No. 50-602/89-04, dated July 13, 1989, reported on the review of the liquid radioactive waste system to determine compliance with the requirements of the draft Technical Specifications and 10 CFR Parts 20.106, 20.301, and 20.303. There were no violations, deviations, or concerns identified in the report.

Based on the review of available information and a walkdown of the as-built system, the allegation could not be substantiated and no safety concerns were identified.

3.3 Concern: The aluminum liner was damaged during transit to the UT facility and required extensive repairs prior to installation. The liner was inadequately braced during tests after repairs were completed.

The inspectors reconstructed the sequence of events and reviewed the documentation relevant to the aluminum liner receipt and installation.

- The liner was received onsite in late 1987.

- Receipt inspection disclosed some dents and abrasions from packaging materials. One area of abrasion had resulted in minor wall thinning. This area was subsequently repaired by welding and successfully tested.

- A General Atomics representative inspected the liner. This inspection determined that the damage was limited to surface scratches and indentations that were subsequently removed using aluminum oxide sandpaper and a stainless steel brush except for the one area that was repaired by welding.

- On January 7, 1988, the liner was inspected by an independent laboratory using the dye penetrant test technique. This test resulted in the identification of some questionable indications. Subsequent review by the vendor of the fabrication process radiographs resulted in acceptance of the liner.

- On January 22, 1988, an attempt was made to subject the liner to a hydrostatic test using a vendor procedure. The bracing was inadequate and failed as the liner was being filled with water. The procedure was stopped and the liner emptied. Although there was bulging of the liner wall when the bracing failed, there was no permanent wall deformation.

- On January 26, 27, and February 1, 1988, an independent testing laboratory conducted dye penetrant tests on welds, interior and exterior to the liner, in areas of possible stress during the test attempt. The tests were conducted in accordance with ASME, Section V and evaluated in accordance with ASME, Section VIII, Division I, Appendix VIII. Relevant indications were visually examined and a repair procedure recommended.

- Between February 1 and 4, 1988, the repairs were made as recommended.

- On February 4, 1988, the repair areas were again dye penetrant tested and found to be satisfactory.

- As a result of the bracing problems encountered, the licensee decided to perform the helium leak test as originally specified by the vendor and between February 9 and 15, 1988, the liner was subjected to a helium leak test and found to be satisfactory.

The documents reviewed consisted of contract specifications, memoranda, daily logs, test procedures, and test results.

Based on this review, the allegations were substantiated; however, the damage to the liner was minor, appropriate repairs were made, and no safety concerns were identified.

3.4 Concern: The epoxy and asphalt coatings used for the exterior surface of the aluminum liner were intended for use on horizontal stainless steel surfaces and were alleged to be an incompatible combination for aluminum vertical surfaces.

The inspectors reviewed the design and construction specifications, correspondence files, daily logs, and file photographs of the installation phases. This review confirmed that the protective barrier system for the liner was in accordance with the vendor's specifications.

Prior to the coating application, the licensee became aware of the fact that the specifications for the epoxy coating did not refer to aluminum. The manufacturer was contacted and the licensee received confirmation that the application requirements, conditions, and results would be acceptable for aluminum. The licensee was advised that the epoxy coatings were compatible with the aluminum liner even though the specification sheets only listed stainless steel. The application procedure included the necessary surface treatment to assure bondability of the epoxy to the aluminum.

The asphalt coating system is not recommended for vertical applications; however, with care in application it has been used successfully on several similar installations at other research reactors. The file photographs support the licensee's contention that the process was successfully completed for this installation.

Based on document reviews and personnel interviews, the allegation could not be substantiated and no safety concerns were identified.

3.5 Concern: Either during initial fabrication or repair of the aluminum liner, the reactor beam ports were misaligned. The beam ports were allegedly altered to permit proper alignment prior to cementing the liner in place.

The inspectors reviewed the design and construction specifications and a General Atomics field engineer's memorandum to file concerning the beam ports.

There are beam port stubs integral to the construction of the liner. Once the liner is in place, it is necessary to fit the stainless steel extensions on the stubs. This provides for the beam port penetrations through the concrete shield wall.

During the initial fit of the extensions, it was found that the stainless steel tubes were oval shape and did not properly fit over the liner stubs. The problem was corrected by shaping the extensions and grinding the outer diameter of the stubs for proper fit. This work did not require placing any stress or strain on the liner stubs.

Based on the document and file photo review, the "misalignment" allegation could not be substantiated and no safety concerns were identified.

3.6 Concern: The reactor site has an underground spring that was capped during construction. The spring is alleged to be located on the ramp side of the reactor building approximately 12 feet inside of the reactor building bay door. Water inleakage has occurred in the fuel storage tubes, sump areas, and the heat exchanger room.

The inspectors reviewed the project specifications, Section 02010, the contractor's daily construction quality control record, and the foundation inspection report. The construction inspector's daily diary for the time period in question was not available for review. The inspectors also reviewed numerous file photos of the site excavation activities.

The information gathered from the inspectors' reviews was considered to be inconclusive. This allegation will remain an open item. (602/9001-01)

4. EXIT INTERVIEW

The inspection scope and findings were discussed with personnel designated in paragraph 1 at the conclusion of the inspection on March 22, 1990. The licensee did not identify as proprietary any of the material provided to, or reviewed by, the inspectors.