



UNITED STATES
NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA ST., N.W.
 ATLANTA, GEORGIA 30323

Report No.: 50-297/88-03

Licensee: North Carolina State University
 Raleigh, NC 27607

Docket No.: 50-297

License No.: R-120

Facility Name: North Carolina State University

Inspection Conducted: May 23 - 26, 1988

Inspector: *F. Jape* 6/9/88
 for P. T. Burnett Date Signed

Approved by: *Frank Jape* 6/9/88
 F. Jape, Section Chief Date Signed
 Engineering Branch
 Division of Reactor Safety

SUMMARY

Scope: This routine, unannounced inspection completed the biennial inspection of North Carolina State University, Class II research reactor. Recent activities to reduce and monitor pool leakage were reviewed.

Results: Two action items and one violation were identified.

Inspector Followup Item 297/88-03-01: Establish Administrative procedures to require that non-intent changes to any RPC-approved procedure be reviewed by the RPC within sixty days - Paragraph 3.b.

Unresolved Item 297/88-03-02: The issue of full implementation of the operator requalification program is unresolved pending receipt of more information from the licensee - Paragraph 3.c.

Violation 297/88-03-03: An interval of over ten months elapsed between RSAG meetings. TS 6.2.7 requires RSAG meet at least every six calendar months - Paragraph 3.f.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- S. J. Bilyj, Chief of Reactor Maintenance
- T. L. Brackin, Reactor Safety Specialist
- *T. C. Bray, Reactor Operations Manager
- *K. V. Mani, Reactor Health Physicist
- *G. D. Miller, Associate Director Nuclear Reactor Program
- *D. W. Morgan, Radiation Protection Officer
- *H. Palmour III, Chairman, Reactor Safeguards Advisory Group

Other licensee employees contacted included Nuclear Engineering Department faculty, operators, and office personnel.

*Attended exit interview

Acronyms and initialisms used throughout this report are listed in the last paragraph.

2. Initial Interview and Facility Tour

Immediately upon arrival on site, the inspector received a briefing from management on the activities conducted to identify and isolate the leaks in the reactor pool liner and the sump drain line. Video tapes of the inspection of the liner by hydrophone were reviewed. The audio signal gave an obvious hissing sound in the vicinity of a raised area about one-quarter inch in diameter, in the south spent fuel pit. This area is now called the wart. The licensee stated this was the only leak identified following a 100% survey of the liner by hydrophone. Another area of visible deposits about three inches square, now called the growth, was observed in the same pit. It shows no signs of leaking, and has been tentatively identified by a material scientist as corrosion products from foreign material in the surface of a weld. Another video tape showed a cloth thread being sucked into the hole in the wart. The hole was not visible in the picture, but the motion of the thread into the hole was clear and obvious.

The inspector also inspected the prototype of the hole-sealing device used to temporarily cover the wart with a neoprene seal. The in-place device and the growth were observed in the pool using binoculars. The licensee's periodic surveillance of the hole-sealing device revealed that the closed-cell neoprene in use tended to collapse after extended, more than two week, exposure to the twenty-seven foot pool head. The first neoprene device has been replaced with identical closed-cell material. The next replacement will be with open cell material, which is not expected to exhibit the same response to pool pressure.

3. Records Review

a. Review of Operating Logs and Records

The operations log was reviewed for the period February 17, 1988 to May 23, 1988. During the period February 27 to May 2, 1988, the reactor was shutdown to attend to leaks in the reactor pool liner and the reactor building sump discharge line. On May 2, the reactor was restarted. The ECP was rods banked at 16.9 inches, and the ACP was rods banked at 16.7 inches, which was acceptable agreement.

Incorporated in the log for May 2, 1988 was the Fuel Movement Checklist for Biennial Fuel Inspection Per PS-40-7:51 and Dose Rate Measurements Around Core and South Storage Pit. All fuel assemblies on the grid were removed to either the fuel storage pits or the storage racks. Graphite reflector assemblies were removed one-at-a-time, inspected for swelling or cracking, and returned to the grid. Fuel assemblies were then visually inspected one-by-one and returned to the grid. That inspection was limited to the condition of the assembly box surface and the screws attaching the bales, grids and nose pieces to the box. No inspection was made for flow channel plugging, but the licensee stated that operators are trained to observe the flow channels when working over the core during operation. The Cherenkov illumination is better for that May 5, 1988.

The review of operating parameters revealed no discrepant entries for the period ending May 23, 1988.

Entries are made in the Primary Water Inventory Log every working day. The gross leakage is determined from the change in reactor pool level and then adjusted for estimated evaporative losses and measured losses from the reactor coolant pump seal. Averaged over the last 18 entries, the unidentified leakage is less than 2.2 gallons per day.

b. Procedure Changes

TS 6.3.b requires that temporary changes to procedures that do not change the original intent of the procedure be reviewed subsequently by the RPC. The Operations Manual has a requirement that non-intent changes to its procedures be reviewed by the RPC within sixty days, but a similar limit for changes to surveillance, maintenance, and special procedures has not been specified. As a result, some non-intent changes to some of the SMPs discussed later in this report had not been reviewed within sixty days of the changes. At the exit interview, the licensee made a commitment to establish administrative procedures to require that non-intent changes to any RPC-approved procedure be reviewed by the RPC within sixty days (Inspector Followup Item 297/88-03-01).

c. Requalification Training

Review of the operator license requalification program records identified fifteen lectures that had been presented in the two years beginning May 1986. Those lectures did not appear to address all of the topics listed in the approved requalification program. The person responsible for the program was absent due to illness, and others were not familiar with his record system. Hence, the issue of full implementation of the operator requalification program is unresolved pending receipt of more information from the licensee (Unresolved Item 297/88-03-02).

d. Maintenance Activities

The leaks in the reactor pool liner and drain line were discussed in Inspection Report No. 50-287/88-01. To identify the leak locations and to effect the necessary repairs, the following special procedures were written, approved by NRP management and the RPC, and performed by the NRP staff:

- (1) SMP#PL-1, Procedure for Removing Primary Cold Leg Lagging in Reactor Building Air Intake Area, was completed on March 15, 1988.
- (2) SMP#PL-2, Procedure for Excavating Primary Cold Leg Piping in Vicinity of Reactor Building Air Intake Backfill Retaining Wall, was completed on March 16, 1988.
- (3) SMP#PL-3, Procedure for Reactor Pool Liner Visual Inspection with Underwater Camera, was completed on March 22, 1988. In a test of resolution, it was determined that the camera could resolve holes drilled in an aluminum plate as small as 0.015in when immersed in water. Two suspect areas were identified for further investigation.
- (4) SMP#PL-4, Procedure for Acoustic Inspection of Reactor Pool Liner Surface, was completed on March 23, 1988. Only one leakage path was identified in the pool liner. It was in the south fuel storage pit in a defect now called the wart. There were two deviations from the written approved procedure as performed: The microphone was not wrapped in a polyethylene sleeve because it increased the background noise and the microphone was not attached to a handling tool because it was not needed.
- (5) SMP#PL-5 and SMP#PL-6 were not issued for performance.
- (6) SMP#PL-7, Procedure for Excavating and Repairing the Sump Transfer Piping, was completed on March 23, 1988. This procedure led only to the temporary repair of the piping, and the

details of the repair were not provided in the documentation. However, a photographic record was maintained of the excavation and the temporary repairs, which were performed by the university maintenance department. The temporary fix was used only to service facility laboratory drains. The final repair is discussed in subparagraph e. below.

- (7) SMP#PL-8, Procedure for Ultrasonic Testing of Reactor Pool Liner Surfaces, was completed on March 23, 1988. This was a sampling rather than a 100% inspection. All surface areas tested showed full thickness of liner aluminum. The test did not provide interpretable results in the area of welds or at the wart; since a smooth surface is required. The inspection was performed by Nuclear Energy Services Inc., and was witnessed by an NDE specialist from CP&L.
- (8) SMP#PL-9, Installation Procedure for the Primary Tank Hole-Sealing Device, was completed on April 15, 1988. The hole-sealing device is called a dam in other licensee records. On drawing 6401, it is called the pool tank plug assembly.

e. Design Changes

Design change 88-01, Reactor Building Sump Line Replacement, was necessitated by a leak in the the original Duriron pipe, which had failed under externally applied stress and provided a path for leakage of reactor waste water to the environment. The replacement piping was polypropylene, which had a demonstrated capability to withstand any chemicals which might be present in the laboratory waste that also passed through the line. As part of the modification a new isolation valve was installed in the line adjacent to the waste tank vault and a testing tee was installed in the line in the reactor building sump. These changes along with the existing isolation valve in the sump make it possible to pressure test the line to monitor its integrity. That test was performed successfully before the trench containing the pipe was backfilled. Drawing No. 3100 was revised to reflect the changes. The modification was approved by both RSAG and RPC.

f. Committees

Review of RPC minutes for the two-year period preceding this inspection confirmed that meetings were held with the required quarterly frequency. The minutes contained records of reviews of PULSTAR operations, procedures, and inspection results.

Review of the RSAG minutes for period December 1985 to February 1988 showed that six routine meetings had been held in the period, of which five were to discuss appraisals of the PULSTAR facility and operations. Only one meeting was held in calendar year 1987, on

April 7, and the next meeting was held February 26, 1988, an interval of over ten months. Since TS 6.2.7 requires RSAG meet at least every six calendar months, this extended interval has been identified as a violation (VIO 297/88-03-03).

Since the discovery of the leaks in the pool liner and the sump drain line, RSAG has held five meetings on that issue and appears to be functioning as an effective advisory and oversight group.

4. Exit Interview

The inspection scope and findings were summarized on May 26, 1988, with those persons indicated in Paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

5. Acronyms and Initialisms

ACP	- actual critical position
CP&L	- Carolina Power and Light Company
ECP	- estimated critical position
NDE	- nondestructive examination
NRP	- Nuclear Reactor Project (The University's reactor operating organization)
RPC	- Radiation Protection Council
RSAG	- Reactor Safeguards Advisory Group
SMP	- special maintenance procedure
SMP#PL	- special maintenance procedure related to pool leakage problems
TS	- Technical Specifications