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

Report No.: 50-297/90-02

Licensee: North Carolina State University
Raleigh, NC 27607

Docket No.: 50-297 License No.: R-120

Facility Name: North Carolina State University

Inspection Conducted: October 29 - November 1, 1990

Inspector: _____ 11/14/90
P. T. Burnett Date Signed

Approved by: _____ 11/14/90
G. A. Belisle, Chief Date Signed
Test Programs Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, unannounced inspection addressed the biennial inspection of Class II research reactors. A recently completed repair of the pool liner and open items were also reviewed

Results:

The licensed operator requalification program was current with respect to regulatory requirements, but has fallen behind the licensee's planned schedule by seven lectures (four days of activity). The slippage in training was caused by the loss of two key reactor staff members in the spring. Both positions have been filled, and the licensee expressed confidence that the program would be completed by the end of the year. One strong feature of this program is the annual evaluation of operator proficiency conducted by the chief reactor operator. (Paragraph 4.c)

The Radiation Protection Committee and the Reactor Safety Advisory Group have been meeting with greater than prescribed frequency and their review and oversight of reactor activities has been performed with care, obvious competence, and timeliness. (Paragraphs 4.d and 4.f)

Surveillance activities have been performed at the required frequencies with satisfactory test methods. (Paragraph 4.e)

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The repair of the pool liner leak was well managed, and a permanent fix appears to have been accomplished. (Paragraph 4.d)

Three open items were closed. (Paragraph 5)

No violation or deviations were identified.

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
*D. J. Dudziak, Head, Department of Nuclear Engineering
K. V. Mani, Reactor Health Physicist
*G. D. Miller, Associate Director Nuclear Reactor Program
D. W. Morgan, Radiation Protection Officer

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

*Attended exit interview on November 1, 1990.

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

2. Initial Interview (30703)

The deputy director gave the inspector a full and candid briefing on facility status and staffing immediately upon the inspector's arrival on site. No material problems with the facility were identified. The staff recently lost two SRO-licensed people, including the chief reactor operator, who is still at NCSU and available for consultation. Some staff members are currently functioning in dual roles to assure that all of the functions described in TS 6.1.1 are performed. By the end of the inspection, both positions had been filled, but it will be some months before the new people are prepared for an operator's license examination and are able to fulfill their duties.

3. Facility Tour and Observations (40750)

A tour of the facility gave a strong impression of good cleanliness control and well-maintained facilities and equipment. Control room staffing was always in compliance with TS 6.1.2, when observed, and the operators appeared to be attentive to the controls. The inspector's observation of the coolant flow channels as illuminated by the Cerenkov glow showed all to be free of obstructions.

4. Records Review

a. Review of Operating Logs and Records

The Operations Logbook was reviewed, on a sampling basis (more than 10 percent of the pages were examined), for the period from May 24, 1988 to October 26, 1990. Particular attention was paid to entries of reactor power. The licensee's calibration records show that 1.0 MWth is equivalent to a core temperature rise of 13.8 °F at 500 gpm and to 0.405 E10-08 amperes indicated on the N^{16} monitor. No entries in excess of 0.405 E10-08 amperes were observed. In the few instances in which the temperature rise appeared to be high, the reactor pool was not in equilibrium, and the measurement was not reliable.

Paired entries of ECP and ACP were all within acceptable agreement, and all entries of SDM indicated at least twice the TS minimum of 400 pcm.

Other entries in the operating log documented control rod worth measurements, fuel movement, and other surveillance activities, which are discussed further below.

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; the pump runs constantly. Since the repair of the pool liner, all water loss can be accounted for from the known losses listed above. The licensee is considering increasing the interval between surveillances to weekly.

b. Procedure Changes

The Operations Manual was revised in its entirety in 1989, Revision 5. Procedure format was improved for readability and details were expanded. The new manual reflects extensive and successful effort on the part of the licensee.

c. Requalification Training

Review of the operator license requalification program records for 1990 indicated that the 1990 program is behind by seven lectures, four training days. At least two of the lectures, Technical Specifications and 10 CFR Chapter 1, will be overdue for the biennium if not completed by the end of 1990. Licensee management acknowledged the slippage in training lectures; ascribed it to the loss of the CRO; and expressed confidence that the entire series of lectures, annual examination, and annual evaluation of operator proficiency, conducted by the CRO, would be completed by the end of the year. The proficiency evaluation will be conducted by either the reactor operations

manager or the deputy director. The annual evaluation of operator proficiency is a strong feature of this program.

d. Maintenance Activities

The leak in the reactor pool liner was repaired in February 1990 by a contractor experienced in the application of underwater epoxy patches. The contractor's final report, which was reviewed by the inspector, is

> R and D Report No. 1649 (Issue A) March 1990, "Application of Epoxy Reinforcing Patch to the Fuel Storage Wall Liner in PULSTAR REACTOR, M. F. Taylor and M. J. Mudihimer.

The actual application of the patch was performed under the control of

> PULSTAR Maintenance Procedure, "Procedure for Applying Epoxy Reinforcement to Liner in PULSTAR REACTOR (Revision 3, February 22, 1990).

Other pertinent documents reviewed included memoranda generated by RSAG and RPC reporting on their witnessing, oversight, and review activities.

These references and the absence of any evidence of leakage since the repair lead to the conclusion that the repair activities were well managed by the facility staff, properly monitored by the oversight committees, and successfully completed.

No other maintenance activities of significance were performed during the period reviewed.

e. Surveillance Activities

Surveillance activities completed over the past two years were reviewed for conformance to TS-specified frequencies and acceptance criteria. The completed surveillances reviewed are ordered below by TS:

4.1.a PS-40-7:B1, Fuel Movement Checklist for Biennial Fuel Inspection 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. The inspection was performed on May 29, 1990.

Based upon the results of this inspection, two graphite assemblies were retired and replaced.

4.2.a The Operations Logbook and the PULSTAR DATA SUMMARY, Volume II, Reactor Operator's Data, confirm that control rod worth measurements were performed annually and whenever the core constituents were changed. With the decreasing excess reactivity of the core due to burnup, it is not possible for the core to be critical with any rod fully inserted, hence the reactivity worth of the lower portion of each rod must be determined by extrapolation based upon the shapes of earlier-determined rod worth curves. This practice is reasonable and acceptable.

4.2.b The drop and drive times of the scrammable rods were determined annually. Review of the results of the past several years indicates no significant change in control rod drop times, which are significantly less than the TS limit. The procedures used for this activity are surveillance/maintenance procedures, and not all steps must be performed for surveillance activities that do not follow maintenance, but the procedures are not completely clear as to which steps must be performed when. Licensee management agreed to annotate the procedures to indicate which are required to accomplish the specified surveillances.

4.2.c Visual inspections of the control rods were performed biennially. The records of the last three inspections indicate only minor surface scratches on the rods.

4.3.c A calorimetric calibration of the nuclear instruments has been performed, with unchanged results with respect to the N^{16} monitor, every six months for the past three years.

4.3.d The records confirmed that the pool water temperature monitor, primary cooling and flow monitor, pool water level monitor, primary heat exchanger RTDs, and safety and linear power channels were calibrated every six months for the past three years.

f. Committees

Review of RPC and RSAG 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.

e. Experiments

No new experiments have been performed in the last biennium. The major applications of the facility continue to be support of student

laboratories, neutron activation analysis by the faculty, short-lived isotope production for on-campus use, and use in the reactor operator training programs for local utilities.

5. Action on Previous Inspection Findings (92701)

(Closed) 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.

Operations Manual 2.4.3 and Special Procedure 2.1 implement the desired review.

(Closed) Unresolved item 297/88-03-02: Full implementation of the operator requalification program was unresolved pending receipt of more information from the licensee.

The licensee forwarded to the Regional Office the necessary information to confirm full implementation of the operator requalification program.

(Closed) Violation 297/88-03-03: RSAG did not meet at least every six calendar months.

Since the violation was identified, RSAG has been meeting with the required frequency. RSAG has also been expanded to five members from three to make it easier to obtain a quorum, and the meetings have been placed upon the annual calendar of the facility and the members.

6. Exit Interview (30703)

The inspection scope and findings were summarized on November 1, 1990, 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.

7. Acronyms and Initialisms Used Throughout This Report

ACP	actual critical position
CFR	Code of Federal Regulations
CRO	chief reactor operator
ECP	estimated critical position
MWth	megawatts thermal
NCSU	North Carolina State University
pcm	percent millirho, reactivity units
RPC	Radiation Protection Committee
RSAG	Reactor Safeguards Advisory Group
RTD	resistance temperature device
SDM	shutdown margin
TS	Technical Specification