December 22, 2006

Mr. Andrew Cook
Nuclear Reactor Program
Department of Nuclear Engineering
North Carolina State University
P. O. Box 7909
Raleigh, NC 27695-7909

SUBJECT: NRC INSPECTION REPORT NO. 50-297/2006-202

Dear Mr. Cook:

This letter refers to the routine inspection conducted on December 4 - 8, 2006, at your PULSTAR research reactor facility. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concerns or noncompliance with NRC requirements were identified. No response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records Systems (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/reading-rm/adams.html.

If you have any questions concerning this inspection, please contact Marcus Voth in Rockville, MD at 301-415-1210.

Sincerely,

/RA/

Johnny H. Eads, Branch Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-297/2006-202

cc w/enclosure:
Please see next page

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Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No:	50-297
License No:	R-120
Report No:	50-297/2006-202
Licensee:	North Carolina State University
Facility:	PULSTAR Reactor
Location:	North Carolina State University, Raleigh, NC
Dates:	December 4-8, 2006
Inspectors:	Marcus H. Voth Johnny H. Eads
Approved by:	Johnny H. Eads, Branch Chief Research and Test Reactors Branch B Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

North Carolina State University
Report No. 50-297/2006-202

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class II research reactor operation including: procedures; requalification training; surveillance and limiting conditions for operation; experiments; emergency planning; and fuel handling logs and records.

Procedures

- The licensee was maintaining and implementing written procedures in accordance with Technical Specification (TS) requirements.

Requalification Training

- Operator requalification was conducted as required by the approved Requalification Program and NRC regulations.

Surveillance and Limiting Conditions for Operation

- The limiting conditions for operation and surveillances required by TS Sections 3.0 and 4.0 were being properly implemented.

Experiments

- The licensee's reactor experiment program was found to effectively implement the TS requirements.

Emergency Planning

- Emergency plan and implementing procedures were current and readily available to users as required.

- Emergency response facilities and equipment were being maintained as required and responders were knowledgeable of proper actions to take in case of an emergency.

- The licensee maintained current Emergency Support Agreements with offsite agencies which indicated that support would be available in case of an emergency.

- Annual drills were being held and documentation was maintained concerning the follow-up critiques and subsequent corrective actions.

- Emergency preparedness training for staff and off-site personnel was being conducted as required.

Fuel Handling Logs and Records

- Fuel movements were performed safely in accordance with TS requirements.

REPORT DETAILS

Summary of Plant Status

The North Carolina State University (NCSU) (the licensee) Nuclear Reactor Program (NRP) one megawatt (1 MW) PULSTAR research reactor continues to be operated in support of instruction, laboratory experiments, reactor operator training, and various types of research and irradiation service. During the inspection, the reactor was started-up, operated, and shut down as required to support experiments and research.

1. Procedures

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed the following to ensure that the requirements of Technical Specification (TS) Section 6.3, Operating Procedures, were being met:

- PULSTAR Operations Manual, specifically procedures:
  - NRP-OP-101, Reactor Startup and Shutdown, Rev. 3, July 25, 2006
  - NRP-OP-103, Reactor Operations, Rev. 1, July 13, 2005
  - NRP-OP-104, Reactor Experiments, Rev. 1, March I, 2005
  - NRP-OP-105, Response to SCRAMS, Alarms and Abnormal Conditions, Rev. 0, April 1, 2005
  - NRP-OP-301, Reactor Fuel Handling, Rev. 0, September 13, 2004
- Special Procedure Manual, specifically procedures:
  - SP 2.1, Review and Approval of Documents, Rev. 8, March 22, 2001
  - SP 2.4, PULSTAR Drawing Control System, Rev. 3, February 1, 1989
  - SP 2.6, PULSTAR Operator Requalification Program, Rev. 6, January 19, 1995
  - SP 3.5, Gang Worth Curve Verification, Rev. 1
- Health Physics Procedure Manual
- Security Plan Implementing Procedure Manual
- Emergency Plan Implementing Procedure Manual
- PULSTAR Surveillance and Maintenance File

b. Observations and Findings

The inspector observed that the licensee maintained written procedures covering the areas specified in TS Section 6.3. A systematic approach was being used to update and reissue procedures with priority given to those most subject to change and important to safety. New procedures and major changes were reviewed and approved by the Reactor Safety Audit Committee (RSAC) and the Radiation Safety Committee (RSC) in accordance with a written procedure on document control. Minor changes did not require approval but were reviewed by the committees; the reviews and approvals were documented in the minutes of the respective committee meetings. The inspector observed procedures being used by reactor operators during reactor startup and experiment insertion and removal operations.

c. Conclusions

The licensee was maintaining and implementing written procedures in accordance with TS requirements.

2. Requalification Training

a. Inspection Scope (IP 69001)

The inspector reviewed the following to determine if the reactor operator requalification program was being conducted in accordance with the NRC-approved requalification plan and 10 CFR 50.55 "Operators' Licenses":

- Procedure SP 2.6, "PULSTAR Operator Requalification Program" Rev. 6, dated January 19, 1995
- NRC-Issued Operator Licenses
- Operator training records
- Operator medical records

b. Observations and Findings

The inspector verified that the licensee was maintaining five NRC-licensed Senior Reactor Operators (SRO) and three NRC-licensed Reactor Operators (RO) consistent with NRC records. At the time of the inspection the NRC was processing a recent licensee request that nine RO licenses be terminated. The five SROs and three ROs were included on lecture attendance records and distribution manifests for information required by the approved requalification program. The inspector reviewed the content of the written and oral examinations used for the 2005-2006 requalification cycle and found them adequate. The inspector selected one SRO licensee and one RO licensee and reviewed their training and medical records in detail. Records showed that Abnormal Operating Procedures, Emergency Plan Procedures, and the Operations Manual were reviewed as required.

c. Conclusions

Operator requalification was conducted as required by the approved Requalification Program and NRC regulations.

3. Surveillance and Limiting Conditions for Operation

a. Inspection Scope (IP 69001)

The inspector reviewed the following to determine if limiting conditions for operation specified in TS Section 3.0 were being effectively implemented and if the periodic surveillance tests on safety systems were being performed in accordance with TS Section 4.0:

- Procedure NRP-OP-101, Reactor Startup and Shutdown, Rev. 3, July 25, 2006 along with Appendix A, Startup Checklist, and Appendix B, Startup Checklist Instructions
- Procedure PS-1-03-4A:S1, Linear Channel Calibration, Rev. 1, April 15, 1998
- Procedure PS-2-02-5:S1, Pool Level Channel Calibration, Rev. 4, February 5, 1997
- Procedure PS-4-07-1:B1, Fuel Inspection, Rev. 2, October 1, 1990
- Procedure PS-5-03-3, Containment Fan #1
- Procedure SP-2.5, PULSTAR Reactor Surveillance, Rev. 1, February 1, 1989
- PULSTAR Surveillance and Maintenance File
- PULSTAR Surveillance Master Schedule
- NCSU PULSTAR Reactor Console Logbook, October 25, 2005 to date of inspection

- Test Report Documentation for New Third Floor Installation, NCSU PULSTAR Reactor HEPA Filtration and Carbon Adsorption Systems, Milholland & Associates, July 3, 2006

b. Observations and Findings

Since the inspector was present for a reactor startup, he focused on verifying proper implementation of those limiting conditions for operation specified in TS Section 3.0 which were part of pre-startup and startup checks. The RO performed the appropriate checks, logged completion in the reactor console logbook, and reviewed results with the SRO before commencing reactor startup.

The inspector also focused attention on the reactor confinement heating, cooling and ventilation system, specifically checking that appropriate procedure and checklist changes were made to reflect recent system modifications.

The inspector verified documents in the surveillance file which indicated that TS Section 4.0 requirements were completed on schedule and in accordance with licensee procedures. All the recorded results were within the TS and procedurally prescribed parameters. The records and logs were complete and were being maintained as required.

c. Conclusions

The limiting conditions for operation and surveillances required by TS Sections 3.0 and 4.0 were being properly implemented.

4. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed the following selected maintenance and reactor operations records to ensure effective implementation of the requirements of TS Section 3.7, Limitations on Experiments; TS Section 3.8, Operation with Fueled Experiments; and TS Section 6.4, Review of Experiments:

- Procedure NRP-OP-104, Reactor Experiments, Rev. 1, March 1, 2005
- Procedure SP 2.1, Review and Approval of Documents, Rev. 8, March 22, 2001
- NCSU PULSTAR Reactor Console Logbook, October 25, 2005 to date of inspection
- NCSU PULSTAR Reactor Protocols for Radioisotope or Sealed Source Use, January 1, 2000
- Reactor Utilization Request (RUR) forms (requests to perform an experiment under an approved protocol)
- Minutes of the most recent Radiation Safety Committee (RSC) and Reactor Safety Audit Committee (RSAC) Meetings

b. Observations and Findings

The licensee maintained a written procedure (NRP-OP-104) describing the implementation of requirements for reactor experiments (e.g., review by the RSC or RSAC). Protocols for a variety of experiments were reviewed, approved, and maintained in a current status. Users requested approval to perform an experiment using the RUR form. If the Associate Director and the Reactor Health Physicist concurred that the experiment met the TS requirements and was within the umbrella of an existing protocol, the experiment was approved. The procedure (SP 2.1) called for

experiments that raised new issues to be referred back to the RSC or RSAC committees or, if they did not screen under 10 CFR 50.59 criteria, to the NRC. There were no requests for experiments requested during the past year that did not fall under one of the existing approved protocols.

The inspector observed reactor personnel load and unload routine experiments and reviewed records of other experiments performed during the past year.

The licensee discussed with the inspector an ultra-cold neutron source design in progress to better utilize the reactor thermal column facility.

c. Conclusions

The licensee's reactor experiment program was found to effectively implement the TS requirements.

5. Emergency Planning

a. Inspection Scope (IP 6900)

To verify proper implementation of the licensee's Emergency Preparedness Program, the inspector reviewed selected aspects of:

- Emergency response facilities, supplies, equipment, and instrumentation
- Training and emergency drill records for the past two years
- Offsite support as documented in Emergency Support Agreements.
- North Carolina State University Pulstar Nuclear Reactor Emergency Plan, Revision 8 dated July 19, 2006, and emergency plan implementing procedures including:
  - EP 1, "Emergency Plan Activation, Response, and Actions," Rev. 15 dated July 19, 2006
  - EP 2, "Offsite Notification," Rev. 11 dated July 19, 2006
  - EP 4, "Emergency Classification," Rev. 5 dated July 19, 2006
  - EP 6, "Training," Rev. 6 dated July 19, 2006
  - EP 9, "Emergency Locker Inventory," Rev. 5 dated July 19, 2006

b. Observations and Findings

The Emergency Plan (E-Plan) in use at the facility was submitted to the NRC by letter dated August 17, 2006. The inspector reviewed the facility's 50.54(q) evaluation for Revision 8 of the E-Plan which determined that the revision did not decrease the effectiveness of the plan. The E-Plan was audited and reviewed annually by the Reactor Safety and Audit Committee as required. Implementing procedures were also reviewed annually and revised by the licensee as needed to implement the E-Plan effectively. The E-Plan and implementing procedures were current and readily available to users as required. It was also noted that emergency response equipment at the facility was being maintained and inventoried as required.

Through records review and through interviews with licensee personnel, emergency responders were determined to be knowledgeable of the proper actions to take in case of an emergency. Emergency response facilities and equipment were being maintained as required. An Emergency Support Agreement with Rex Hospital in Raleigh, to treat potential victims of a radiological event, had been updated and maintained as necessary. Agreements were also being maintained with the North Carolina

Department of Crime Control and Public Safety, the Wake County Department of Public Safety, and the City of Raleigh Fire Department (RFD) as required. Communications capabilities were acceptable with the support groups and were tested periodically. Personnel from these off-site support organizations visited the facility periodically and were familiar with the facility and what would be required during a response.

The inspector reviewed records from an emergency drill conducted on January 25, 2006, which included significant participation by the City of Raleigh Fire Department. As a result of reviewing the licensee's records documenting drills and training, the inspector verified that RFD personnel were well trained, properly equipped, and knowledgeable of the actions to take in case of an emergency at the reactor facility. The inspector determined that the licensee was maintaining a good working relationship with this support group.

Emergency preparedness and response training for staff and specific support group personnel was being completed annually as required. The licensee was also conducting drills annually as stipulated in the E-Plan in order to test communications procedures and check on the response of facility personnel to simulated radiological, industrial hazards, or security problems. The inspector verified that the drills were structured to involve the participation of off-site support agencies and personnel. Critiques were conducted following the drills to discuss and identify any strengths or weaknesses noted.

c. Conclusions

The emergency preparedness program was conducted in accordance with the Emergency Plan.

6. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001)

The inspector reviewed the following records to verify implementation of the requirements of TS Section 6.3.b:

- Procedure NRP-OP-301, Reactor Fuel Handling, Rev. 0, September 13, 2004
  - Appendix A, Confirmation of Conditions for Fuel Movement, data sheet for fuel movements on August 21, 2006 and August 24, 2006
  - Appendix A, Fuel Movement Schedule, data sheet for fuel movements on August 21, 2006 and August 24, 2006
- Core Map Record of Fuel Element Locations
- NCSU PULSTAR Reactor Console Logbook entries on August 21, 2006 and August 24, 2006

b. Observations and Findings

Since there were no fuel moves planned during the inspection the inspector reviewed the most recent fuel movement records. The inspector found the procedures and data sheets used for fuel handling to provide for the safe handling of fuel elements and to adequately documented the location of fuel elements at all times.

c. Conclusions

Fuel movements were performed safely in accordance with TS requirements.

7. Exit Interview

The inspection scope and results were summarized on December 8, 2006, with members of licensee management. The inspector described the areas inspected and summarized the inspection findings. No dissenting comments were received from the licensee. The licensee stated that none of the subject matter covered in this routine inspection was considered to be proprietary information.

PARTIAL LIST OF PERSONS CONTACTED

Licensee:

L. Broussard, Chief Reactor Operator
A. Cook, Associate Director, Nuclear Reactor Program and Reactor Operations Manager
A. Hawari, Director, Nuclear Reactor Program
K. Kincaid, Chief of Reactor Maintenance
M. Bourham, Interim Nuclear Engineering Department Head
G. Wicks, Reactor Health Physicist and Acting Nuclear Reactor Program Associate Director
S. Lassell, Manager, Nuclear Services

INSPECTION PROCEDURES USED

IP 69001	Class II Non-Power Reactors

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened:	None
Closed:	None
Discussed:	None

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
E-Plan	Emergency Plan
HEPA	High Efficiency Particulate Absolute
MW	Megawatt
NCSU	North Carolina State University
NRC	Nuclear Regulatory Commission
NRP	Nuclear Reactor Program
RFD	Raleigh Fire Department
Rev.	Revision
RO	Reactor Operator
RSC	Radiation Safety Committee
RSAC	Reactor Safety and Auditing Committee
RUR	Reactor Utilization Request
SRO	Senior Reactor Operator
TS	Technical Specification