

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

Docket No: 50-05

License No: R-2

Report No: 50-05/96-201

Licensee: Pennsylvania State University

Facility: Penn State Breazeale Reactor (PSBR)

Location: University Park, Pennsylvania

Dates: December 10-12, 1996

Inspector: Marvin M. Mendonca, Senior Project Manager

Approved by: Seymour H. Weiss, Director, Non-Power Reactors and  
Decommissioning Project Directorate

*SBW* 1/24/97  
(for)

## EXECUTIVE SUMMARY

This routine, announced inspection consisted of the review of selected conditions and records since the last inspection, and related discussions with licensee personnel. This inspection was conducted in accordance with the guidance of NRC Inspection Manual Inspection Procedure 40750. Activities were safely implemented as described in the report details and summarized in the following.

- Operational logs and records were acceptably maintained. Events were acceptably identified and resolved by the licensee. Two Non-Cited Violations were identified. One for a licensee identified and resolved violation, and one for a minor failure to accurately specify Safety Analysis Report conditions in the associated Reportable Occurrence Report. Operations were in accordance with Technical Specifications.
- Surveillances for startup were completed as required.
- Procedures could and were effectively used by the operator. Changes to procedures were acceptably reviewed and approved.
- Requalification training and activities were focused on safety and were as required. A committee was established to improve training and to be more responsive to operators. This effort is ongoing.
- The changes to personnel and the organization met requirements and acceptably addressed associated safety issues. On-shift staffing and conduct of operations met or exceeded the requirements. The facility staff meeting was an open and free exchange to resolve issues.
- Review and audit functions were acceptable, and the licensee resolution program was thorough and well controlled. Safeguards Committee Chairman and Associate Deans plan to increase direct communications to provide additional assurance that issues are promptly addressed.
- The experimental review, approval and implementation program was effective and met regulatory requirements.
- Records show that the fuel was handled as required during fuel movement.
- Maintenance activities were in accordance with approved procedures.
- Design changes appear to be acceptably reviewed, approved, implemented, tested, and controlled. The new Systems Expert program is an ongoing improvement in engineering for the facility.
- The radiation protection personnel and reactor staff have an effective working relationship, and the licensee is working to improve laboratory access and radiation monitor calibration sticker controls.
- The emergency plan was acceptably implemented. Acceptable training was provided to licensee personnel.

## Report Details

### Summary of Facility Status

During the onsite inspection period, the facility was being started up and operated several hours a day to allow for the conduct of various experiments. Operational power had been administratively limited to 750 kilowatts to address several issues that the licensee was evaluating.

## I. Operations

### 01 Conduct of Operations

#### 01.1 Operational Logs and Records

##### a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed operational logs and record, selected events and research reactor operational parameters.

##### b. Observations and Findings

Operational logs and records since the last inspection were prepared and maintained as required by Technical Specification 6.7.1. Logs were clear and provided an acceptable description of operational activities.

Events were first recorded in the console logbook. The essential event information was transferred to a form for identification and evaluation in accordance with the applicable administrative procedure (AP-4). This form tracks completion of the corrective actions. The inspector reviewed selected events as follows.

The inspector reviewed an October 31, 1996, manual scram. Logs and the AP-4 form showed that the manual scram was initiated when it was determined that a rabbit had not returned to the terminus of the pneumatic experimental injection system. These records showed that the licensee with radiation protection personnel participation acceptably retrieved the rabbit. Planned corrective actions included instruction to personnel and a modification to the terminus of the pneumatic experimental injection system to ensure that experimenter could more positively determine that rabbits had or had not returned.

The inspector also reviewed an event reported by the licensee in a letter dated October 18, 1996, for a software problem on the control console monitoring computer. The problem was that a software crash occurred almost immediately after a long update periods was input to the trend display. The licensee worked with the manufacturer, verified that the problem could not impact safety related protection equipment or actions, and provided corrective action to avoid the problem in the future.

The inspector also reviewed an August 27, 1996, event related to higher than expected tritium activity in the primary coolant. This event was identified and resolved by the licensee. The activity was from the heavy water tank and was within regulatory limits. The transfer of tritium to the primary coolant was due to a small valve that was found in the open position on the heavy water tank surge volume sample line. No reason has been determined for the incorrect position of the valve, but the licensee plans to change the system which is to include changes to avoid such minor problems in the future. In the interim the licensee has sealed the valve closed and augmented operator training and observations on the system.

The inspector reviewed an inaccurate control rod calibration event that was a licensee identified Reportable Occurrence. Written follow-up communications and notifications were in accordance with Technical Specifications 6.5.2 and 6.6.2 for Reportable Occurrences. The detailed report by the licensee was provide by letter dated July 7, 1995, and a supplement dated October 24, 1995. The event involved inaccurate rod calibrations in July 1994 that were subsequently discovered by the licensee in June 1995 based on a comparison of 1994 and 1995 rod calibration results. The licensee's letters attributed the physical cause of the inaccurate rod calibrations to the operator not ensuring critical conditions were achieve and not waiting for the stabilization of delayed neutrons on rod bumps. The use of computerized indications, that were not adequate to ensure that the neutron multiplication had stabilized, contributed to these operator errors. The corrective actions included improved training, procedures, and supervisory review. The corrective action have been acceptably completed. Analysis showed that the core excess reactivity could have been \$7.06, exceeding the Technical Specification limit of \$7.00, during operations between July 1994 and June 1995 when the core was next to the D<sub>2</sub>O tank. Because of conservative operating policies and

conditions, no accident analysis conditions were exceeded or was there a reasonable potential to exceed accident analysis conditions. This licensee-identified and corrected violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy.

Also with regard to the incorrect control rod calibration event, the inspector identified a minor discrepancy in the Reportable Occurrence Report dated July 7, 1995. Specifically in the section on "Consequences of the Incident," a value of \$3.40 rather than \$3.00 was quoted from the Safety Analysis Report as the reactivity insertion assumed for the basis of the limiting condition of operation for excess reactivity. The inspector reviewed a January 6, 1997, licensee submittal on this issue. This discrepancy would not effect the consequences of the incident, but may involve human performance issues in the safety analysis area. Therefore, this failure constitutes a violation of minor significance and is being treated as a Non-Cited Violation consistent with Section IV of the NRC Enforcement Policy.

Events were acceptably identified, reported and resolved in accordance with Technical Specification and associated licensee administrative requirements.

The inspector also verified, that selected operational parameters were in accordance with Technical Specification Limiting Conditions of Operation, by observation of instrumentation and facility conditions during low power operations.

c. Conclusions

Operational logs and records were acceptably maintained. Events were acceptably identified and resolved by the licensee. Operations were in accordance with Technical Specification Limiting Condition of Operation requirements.

02 Operational Status of Facilities and Equipment

02.1 Surveillance and Limiting Conditions of Operation

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed surveillance procedures, surveillance data, and Limiting Conditions of Operation.

b. Observations and Findings

The inspector reviewed the settings of selected safety systems and the conduct of safety system surveillances during the research reactor precritical startup procedure. The procedure was of acceptable detail, and was current and up to date. The conduct of this procedure acceptably demonstrated compliance with Technical Specification requirements for reactor startup.

c. Conclusions

Surveillances required by Technical Specification section 4.0 for startup were completed as required.

03 Operations Procedures and Documentation

03.1 Procedures

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed administrative controls, operating procedures and updates, and the performance of procedures.

b. Observations and Findings

The inspector verified that selected procedure and associated changes had been review and approved in accordance with Technical Specification 6.2.3. Changes were properly reflected in the procedure copies in use at the control room. The inspector observed that the conduct of startup and low power operations, as well as the setup for an experiment, was in accordance with current, approved procedures.

c. Conclusions

Procedures could and were effectively used by the operator. Changes to procedures were acceptably reviewed and approved.

05 Operator Training and Qualification

05.1 Regualification Training

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed active license status, training records, examinations, and corrective actions.



b. Observations and Findings

Associated records were maintained as required by Technical Specification 6.7.2. Records and discussions with operators showed that training was conducted on changes to the facility and procedures, and on events as required by the requalification plan. Records also showed that active duty status and requalification plan requirements were maintained.

The licensee developed the operating and procedure oral exams for the current cycle. The inspector reviewed these exams and determined that they demonstrated acceptable content and questions.

The licensee had also established in early 1996 a training committee to improve training and be more responsive to operator needs in response to a management requested Committee report. Indications from operators were that immediate needs had been addressed. The training committee was in the process of developing practical training demonstrations to accompany the training plans that have been developed. This effort received extensive management attention, up to the Nuclear Engineering Department Head, as well as Safeguards Committee review.

c. Conclusions

Requalification training and activities were focused on maintaining the research reactor safety and were in accordance with the requirements.

06 Operations Organization and Administration

06.1 Organization and Staffing

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed the organization and staffing, and research reactor operations, logs and procedures.

b. Observations and Findings

A new interim Facility Director was appointed in October 1996. This interim Facility Director met Technical Specification 6.1.4 requirements in that the experience and background exceeded the requirements of "the American National Standard for Selection and Training of Personnel for Research Reactors, ANSI/ANS 15.4-1977, Sections 4-6." This

was verified through review of an October 17, 1996, letter from licensee, "Notification of Change in Facility Management as Required by the Breazeale Nuclear Reactor Technical Specifications," and discussions with Dr. Witzig, the interim Facility Director. Dr. Witzig has been in nuclear engineering field since 1942 and is a retired professor of nuclear engineering. His qualifications exceeded the six years of experience and associated educational background required for the position. The licensee is currently in the search process to find a permanent Facility Director.

The inspector reviewed changes in the organization to place more facility personnel under the supervision of the Manager of Operations and Training. This change became effective on June 1, 1996. It satisfied Technical Specification requirements and was conducted to more accurately reflect working conditions (i.e., the personnel were already working with the Manager of Operations and Training in most regards). The change met Technical Specification organizational requirements and did not adversely effect facility safety.

The inspector also reviewed various committee reports related to the changes in personnel and organization. The licensee ensured that related safety considerations were acceptably resolved (e.g., training issues were promptly addressed as previously mentioned in the requalification area).

The inspector observed a facility staff meeting. The meeting was well attended and participated in by the staff. The inspector observed open and free communications to identify and resolve problems (e.g., problems with an experimental handling tool).

The number of licensed operators remained relatively unchanged. A reactor operator was in the control room, and a senior reactor operator was at the facility as required by licensee procedure when the research reactor was not secured. The staff size and supervisory oversight were acceptable to support the research reactor utilization schedule. These observations verified that the requirements of Technical Specification 6.1.3.a were being satisfied by the licensee.

In accordance with Technical Specification 6.1.3.b, a list of research reactor facility personnel was available in a procedure for the control room reactor operator to call personnel in an emergency.



The inspector verified through review of selected logs and procedures that a senior reactor operator directed activities related to movement of fuel, control rod, and >\$1 worth experiments, and to recovery from unplanned and unscheduled shutdowns as required by Technical Specification 6.1.3.c.

c. Conclusions

The assigned interim Facility Director was acceptably qualified to fulfill the requirements of the position. The changes to personnel and the organization met requirements and acceptably addressed associated safety issues. On-shift staffing and conduct of operations met or exceeded the requirements and ensured acceptable safe staffing levels. The facility staff meeting had an open and free exchange of information to identify and resolve problems.

07 Quality Assurance in Operations

07.1 Committees, Audits and Reviews

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed Safeguards Committee membership, management and meeting minutes, and the results of Safeguards Committee audits and reviews.

b. Observations and Findings

The Safeguards Committee minutes showed that activities were in accordance with Technical Specification 6.2.2 requirements for frequency, quorums, and minutes. The minutes, as prepared by the Manager of Operations and Training and the Staff Assistant VII, were very detailed so that the conduct of the meetings could readily be understood.

The inspector discussed review processes and communications of issues with the Chairman of the Safeguards Committee, and with the Associate Dean for Administrations and Planning and the Associate Dean for Graduate Studies and Research. These discussions were to ensure that the Safeguards Committee was effectively communicating issues to the College level (the Safeguards Committee is appointed by and reports to the College of Engineering). The Chairman of the Safeguards Committee plans to institute a policy of briefing college

level personnel after meetings. The Associate Deans for Graduate Studies and Research and for Administration and Planning plan to start attending Safeguards Committee meetings from time to time. These plans would provide significant communications to ensure that issues could be promptly considered by the College.

The inspector also discussed Safeguard Committee activities with several members of this Committee. Specifically, activities on the control rod calibration problem, and on the organization and personnel changes as previously mentioned in this report were discussed. The inspectors review of records and discussions found an effective, independent committee that evaluates and verifies safe implementation of research reactor activities in accordance with the requirements of Technical Specification 6.2.3.

The inspector reviewed the audits that were conducted in 1995 and 1996 for the Safeguards Committee. The inspector found the audits raised issues consistent with the charter of the Safeguards Committee and Technical Specification 6.2.4.

With regard to the resolution of review and audit findings by the licensee, the inspector was presented with a detailed process that addressed each related issue. The process established resolution plans and schedules for each issue. The inspector verified that the licensee had completed action on selected review and audit issues, and that the licensee was tracking those that had not yet been completed. This was a comprehensive and timely program for a research reactor licensee.

c. Conclusions

Review and audit functions required by Technical Specification were acceptable, and the licensee resolution program of the review and audit findings was thorough and well controlled. Safeguards Committee Chairman and College level personnel plan to increase direct communications provide additional assurance that Safeguards Committee issues are promptly addressed.

08 Miscellaneous Operations Issues

08.1 Experiments

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed experiment review and authorization records.

b. Observations and Findings

The Bettis Atomic Power Laboratory two phase flow experiment authorization form was reviewed and approved by the licensee in accordance with Technical Specification 6.4. The review provided an acceptable safety analysis of the experiment. The review also addressed potential hazards, reactivity and radiation levels, and experimental operational requirements. Implementation of some experimental protection features, radiation field posting, and control requirements, were observed by the inspector.

c. Conclusions

The experimental review, approval, and implementation program was effective and met regulatory requirements.

08.2 Fuel Handling Logs and Record

a. Scope (Inspection Procedure 40750)

The inspector reviewed fuel handling procedures and records.

b. Observations and Findings

Fuel elements in the pool were moved and examined in the May through June 1996, time frame. Records indicate that this activity had been reviewed and approved by the Safeguards Committee and that controls were established as required by Technical Specification and administrative procedure.

c. Conclusions

The fuel was acceptably handled in accordance with procedural and Technical Specification requirements.

## II. Maintenance

### M1 Conduct of Maintenance

#### M1.1 Maintenance Logs and Records

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed maintenance review and approval records, maintenance procedures, and maintenance authorizations.

b. Observations and Findings

The licensee replaced a control switch for fuel temperature channel selection (the licensee had instituted this change based on a previous inspection finding that the previous style of switch could confuse the operator). The replacement part was an equivalent replacement and did not involve any unreviewed safety questions. The maintenance was acceptably documented, tracked, and tested. Within the scope of this review, no safety concerns were identified.

c. Conclusions

Research reactor maintenance activities were documented and performed in accordance with approved procedures.

### III. Engineering

#### E1 Conduct of Engineering

##### E1.1 Design Changes

a. Inspection Scope (Inspection Procedure 40750)

The inspector reviewed a design change package, and associated procedures and drawings.

b. Observations and Findings

A design change for the reactor bridge was reviewed and approved by the license in accordance with the requirements of 10 CFR 50.59 and licensee administrative procedures. The change was reviewed by the Safeguards Committee. The changes were tested to verify performance consistent with safety analysis assumptions. Procedure and drawing changes were made as required by administrative procedures and were consistent with the changes as observed by the inspector.

The licensee also instituted a Systems Expert program to monitor systems and ensure that systems are in satisfactory operating condition. This program is relatively new, and the licensee is continuing to develop the program. The inspector verified that the program had been instituted and did not adversely impact safety nor violate requirements.

c. Conclusions

The design change was acceptably reviewed, approved, implemented, tested, and controlled. The new Systems Expert program is an ongoing improvement in engineering for the facility.

IV. Plant Support

R8 Miscellaneous Radiation Protection and Control Issues

R8.1 Health Physics

a. Scope (Inspection Procedure 40750)

The inspector reviewed coordination between the health physics and research reactor facility staff, and equipment condition.

b. Observations and Findings

The inspector discussed training and reactor safety issues with the University Health Physicist and the reactor staff. Cooperation and work coordination were generally considered to be adequate. For example, in the research reactor staff meeting a member of the University Health Physicists staff was in attendance and related work activities were discussed and planned. However, the University Health Physicist indicated that there were some training courses (e.g., on the rabbit system) at the facility that would be useful for his personnel to attend. The reactor staff was planning to address this issue.

The inspector also noted from observations during tours of the facility and from attendance at a licensee staff meeting, that the licensee is currently working on more stringent controls for laboratory access (e.g., individual lab doors closed and locked), and radiation monitor calibration sticker control.

c. Conclusions

The radiation protection personnel and reactor staff have an effective working relationship, and the licensee is working to improve laboratory access and radiation monitor calibration sticker controls.

## **P1 Conduct of Emergency Preparedness Activities**

### **P1.1 Emergency Planning**

#### **a. Scope (Inspection Procedure 40750)**

The inspector reviewed changes to the emergency plan, changes to implementing procedures, facilities, equipment and supplies, exercises and drills, and training.

#### **b. Observations and Findings**

The Emergency Plan and implementing procedures were kept up to date and copies were readily available in response locations. The inspector verified that emergency call lists were accurate and available in the required places.

The 1995 exercise, drills, and training were in accordance with Emergency Plan requirements and provided an acceptable challenge to the participants. Licensee key emergency response personnel demonstrated that they could respond to emergency situations as required. The 1996 emergency preparedness activities had been completed but the licensee review was not complete, so that the inspector did not examine these activities which included offsite response agencies participation.

Facilities, equipment and supplies were maintained in working order as required by the Emergency Plan.

#### **c. Conclusions**

The emergency plan was acceptably implemented and emergency preparedness continues to receive management support. Acceptable training was provided to licensee personnel.

## **V. Management Meetings**

### **X1 Exit Meeting Summary**

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on December 12, 1996. The licensee acknowledged the findings presented.



## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

P. G. Boyle, Reactor Supervisor/Nuclear Education Specialist, Penn State Breazeale Reactor (PSBR)  
M. E. Bryan, Reactor Supervisor/Engineer, PSBR  
C. C. Davison, Reactor Supervisor/Nuclear Education Specialist, PSBR  
T. L. Flinchbaugh, Manager of Operations and Training, PSBR  
R. Gould, Research Assistant, PSBR  
R. W. Granlund, University Health Physicists  
D. E. Hughes, Manager of Engineering Services, PSBR  
E. H. Klevans, Department Head, Nuclear Engineering  
J. H. Mahaffy, Chairman, Safeguards Committee  
G. J. McMurtry, Associate Dean for Administration and Planning  
M. Morlang, Reactor Operator Intern, PSBR  
M. M. Reischman, Associate Dean for Graduate Studies and Research  
F. J. Remick, Member, Safeguards Committee  
K. E. Rudy, Supervisor of Facility Services, PSBR  
P. J. Staufer, Staff Assistant VII, PSBR  
M. Voth, Associate Professor, Nuclear Engineering  
W. F. Witzig, interim Director, Radiation Science and Engineering Center

## INSPECTION PROCEDURE (IP) USED

IP 40750: CLASS II NON-POWER REACTORS

## ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

None

### Closed

None