

September 4, 2013

Dr. Neil Sharkey, Vice President  
Research & Dean of the Graduate School  
The Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

SUBJECT: PENNSYLVANIA STATE UNIVERSITY – NRC ROUTINE INSPECTION REPORT  
NO. 50-5/2013-201

Dear Dr. Sharkey:

This refers to an inspection conducted from August 6–8, 2013, at the Pennsylvania State University facility (Inspection Report No. 05000005/2013-201, enclosed). The inspection included a review of activities authorized for your facility. The enclosed report presents the results of this inspection.

During this inspection, U.S. Nuclear Regulatory Commission staff examined activities conducted under your license as they relate to public health and safety to confirm compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred. The violation was evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it constitutes a failure to meet a regulatory requirement that has more than minor safety significance and it was identified through an event.

The NRC has concluded that information regarding the reason for the violation, the corrective actions taken and planned to correct the violation and prevent recurrence, and the date when full compliance was achieved is already adequately addressed on the docket in the subject inspection report. Therefore, you are not required to respond to this letter unless the description herein does not accurately reflect your corrective actions or your position. In that case, or if you choose to provide additional information, you should follow the instructions specified in the enclosed Notice.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Dr. N. Sharkey

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Should you have any questions concerning this inspection, please contact Taylor A. Lichatz at (301) 415-7128 or by electronic mail at [Taylor.Lichatz@nrc.gov](mailto:Taylor.Lichatz@nrc.gov).

Sincerely,

*/RA/*

Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No.: 50-5  
License No.: R-2

Enclosure:  
As Stated

Pennsylvania State University

Docket No. 50-5

cc:

Mr. Jeff Leavey, Manager of  
Radiation Protection  
The Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

Dr. Neil Sharkey  
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Dean of the Graduate School  
The Pennsylvania State University  
304 Old Main  
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University Park, PA 16802-1504

Dr. Kenan Ünlü, Director  
Radiation Science and Engineering Center  
Breazeale Nuclear Reactor Building  
Pennsylvania State University  
University Park, PA 16802-2301

Should you have any questions concerning this inspection, please contact Taylor A. Lichatz at (301) 415-7128 or by electronic mail at [Taylor.Lichatz@nrc.gov](mailto:Taylor.Lichatz@nrc.gov).

Sincerely,

*/RA/*

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Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
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Docket No.: 50-5  
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Enclosure:  
As Stated

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**NRC-002**

OFFICE	NRR/DPR/PROB	NRR/DPR/PROB
NAME	TLichatz	GBowman
DATE	9/ 4 /13	9/ 4 /13

**OFFICIAL RECORD COPY**

## NOTICE OF VIOLATION

Pennsylvania State University  
Penn State Breazeale Reactor

Docket No. 50-5  
License No. R-2

During an U.S. Nuclear Regulatory Commission (NRC) inspection conducted August 6–8, 2013, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Condition C.1, “Maximum Power Level,” of the Penn State Breazeale Reactor Renewed Facility Operating License states, in part, that the maximum power level shall not exceed 1.1 megawatts (thermal) when operated in the manual control mode, the automatic control mode, or the square wave mode.

Contrary to the above, on April 16, 2013, the licensee exceeded the maximum power level of 1.1 megawatts (thermal). Specifically, the licensee was irradiating an experiment in the reactor and pulled the sample while at 1 megawatt (thermal). This added \$0.80 of reactivity, increasing the reactor power to 1.32 megawatts. The reactor subsequently automatically scrammed, as designed.

This is a Severity Level IV violation (Section 6.1).

The NRC has concluded that information regarding the reason for the violation, the corrective actions taken and planned to correct the violation and prevent recurrence, and the date when full compliance was achieved is already adequately addressed on the docket in Inspection Report No. 05000005/2013-201. However, you are required to submit a written statement or explanation pursuant to Section 2.201 of Title 10 of the *Code of Federal Regulations* (10 CFR) if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a “Reply to a Notice of Violation” and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the NRC inspector of the facility that is the subject of this Notice of Violation (Notice), within 30 days of the date of the letter transmitting this Notice.

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC’s document system, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 4<sup>th</sup> day of September 2013.

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

Docket No: 50-5

License No: R-2

Report No: 50-5/2013-201

Licensee: Pennsylvania State University

Facility: Penn State Breazeale Reactor

Location: State College, PA

Dates: August 6–8, 2013

Inspector: Taylor A. Lichatz

Approved by: Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

The Pennsylvania State University  
Penn State Breazeale Reactor Facility  
NRC Inspection Report No. 50-5/2013-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Pennsylvania State University's (the licensee's) Class II research reactor facility safety program including: organization and staffing; experiments; health physics; design changes; committees, audits, and reviews; and transportation since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety and were generally in compliance with NRC requirements.

### Organization and Staffing

- Organizational structure and responsibilities were consistent with Technical Specification requirements.
- Shift staffing met the minimum requirements for current operations.

### Experiments

- Experiments were being reviewed and were generally performed in accordance with Technical Specification requirements and the licensee's written procedures. One cited violation was identified.

### Health Physics

- The radiation safety program was commensurate with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 requirements, Technical Specifications, and procedures.

### Design Changes

- The review and evaluation of changes to facilities and procedures satisfied NRC requirements specified in 10 CFR 50.59

### Committees, Audits, and Reviews

- The Reactor Safeguards Committee provided the oversight required by the Technical Specifications.
- The audit function was being performed annually as required by the Technical Specifications.

### Transportation

- Radioactive material shipments by the licensee were conducted in accordance with applicable procedures and regulatory requirements.

## REPORT DETAILS

### Summary of Facility Status

The Pennsylvania State University's (the licensee's) 1,000 kilowatt research reactor was operated in support of routine experiments, reactor operator training, and periodic equipment surveillances. During the performance based portion of this inspection, the reactor was operated in preparation for an upcoming reactor operator examination.

#### 1. **Organization and Staffing**

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

The inspector reviewed the following to verify compliance with the organizational and staffing requirements in Technical Specification (TS) 6.1:

- Penn State Breazeale Reactor (PSBR) organizational structure and staffing
- Annual Operating Report for the PSBR, FY 2011-2012, dated December 5, 2012
- Annual Operating Report for the PSBR, FY 2010-2011, dated December 9, 2011
- PSBR logbook entries from July 1, 2011, to present
- AP-1, "Personnel Requirements for Reactor Operations," Revision (Rev.) 2, dated December 23, 2003
- Letter dated August 8, 2013, to NRC, "Personnel Change License Number R-2; Docket Number 50-005"

##### b. Observations and Findings

Since the previous U.S. Nuclear Regulatory Commission (NRC) inspection (Inspection Report 50-5/2011-201), there have been two notable changes in the staffing at the PSBR. Specifically, the level 1 supervisor, the Vice President for Research and Dean of the Graduate School, changed, and there is a new Manager of Radiation Protection. Notices to the NRC were made as required.

There are several current PSBR licensed staff and their qualifications satisfied the training and experience requirements stipulated in the TS. The operations logs and associated records confirmed that shift staffing met the minimum requirements for duty personnel. Review of records and staffing procedures verified that management responsibilities were administered as required by TS.

##### c. Conclusion

The PSBR organization and staffing was consistent with TS requirements.

## 2. Experiments

### a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify that the requirements of TS Sections 3.7, "Limitations on Experiments," and 6.4, "Review and Approval of Experiments," were being met:

- Various active experiments for 2011 to present
- PSBR logbook entries from July 1, 2011 to present
- SOP-1, "Reactor Operating Procedure," Rev. 21, dated February 13, 2013
- SOP-5, "Experiment Evaluation and Authorization," Rev. 4, dated November 16, 2004
- SOP-6, "Experiment Encapsulation and Irradiation," Rev. 5, dated December 19, 2011
- SOP-7, "Qualification of Reactor Pool Reactor Operating Positions," Rev. 7, dated July 31, 2013
- SOP-8, "Release of Irradiated Experiments," Rev. 4, dated June 24, 2009
- SOP-9, "Pneumatic Transfer System (R1) Operation," Rev. 4, dated August 7, 2009
- SOP-10, "Reactor Operations at the Fast Neutron Irradiator (FNI) and the Fast Flux Tube (FFT)," Rev. 1, dated March 31, 2007
- SOP-11, "Reactor Operation at the Beam Ports," Rev. 0, dated March 19, 2007
- AP-4, "Identification, Evaluation and Documentation of Safety System Failures, Abnormal Events and Operational Events," Rev. 4, dated March 21, 2011
- AP-4 Event Evaluation #2013-02, "High Power SCRAM," event dated April 16, 2013
- SOP-5 Experiment Evaluation and Authorization # 2013-019, "Flux Measurement for Isotope Production Project"
- SOP-5 Experiment Evaluation and Authorization # 2013-020, "Flux Measurement for Isotope Production Project"

### b. Observations and Findings

The inspector observed the process for moving the reactor in the pool for an experiment on August 7, 2013, and determined that it was in accordance with established facility protocol and procedures. Additionally, from a random sampling of forms for experiments performed since the previous inspection, the inspector found that experiments were generally being reviewed, updated, and performed in accordance with TS requirements and the licensee's written procedures.

Condition C.1, "Maximum Power Level," of the Penn State Breazeale Reactor Renewed Facility Operating License states, in part, that the maximum power level shall not exceed 1.1 megawatts (thermal) when operated in the manual control mode, the automatic control mode, or the square wave mode.

Contrary to the above, on April 16, 2013, the licensee exceeded the maximum power level of 1.1 megawatts (thermal). Specifically, the licensee was irradiating an experiment in the reactor and pulled the sample while at 1 megawatt (thermal). This added \$0.80 of reactivity, increasing the reactor power to 1.32 megawatts. The reactor subsequently automatically scrammed, as designed.

Through interviews with the licensee and the review of records, the inspector determined that the licensee appropriately responded to the incident by documenting the event, contacting the NRC, and sufficiently developing and implementing corrective actions. The licensee completed the following corrective actions:

The experiment authorization for the specific sample capsule was revoked. This procedure was revised to include specific requirements regarding sample removal at power, and then reissued. Additionally, a review was completed of all the current 2013 experimental procedures to determine if there were similar weaknesses. If weaknesses were discovered, the procedures were either corrected or revoked.

The experiment authorization process and other sample handling procedures were then evaluated for the inclusion of lessons learned from the event.

The licensee conducted an operations stand-down and review of the event with all of the licensed operators with emphasis on human performance, questioning attitude, and reactivity effects. Additional operator training was conducted on prompt jump, reactivity limits, and reactivity events from the safety analysis of the PSBR.

The Director met with the Assistant Director for Operations and experimental staff to provide additional guidance on safety, independence, and oversight relative to experiment completion.

The licensee was informed that exceeding the maximum licensed power of 1.1 megawatts was a violation (VIO) of licensee condition C.1 (VIO 50-5/2013-201-01). As the licensee adequately responded to the event and completed all of the necessary corrective actions, this violation will not require a licensee response and is considered closed.

c. Conclusion

Experiments were being reviewed and were generally performed in accordance with TS requirements and the licensee's written procedures. One cited violation was identified.

### 3. Health Physics

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

The following items were reviewed to verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 and TS Sections 3.6 and 4.6 requirements:

- Annual Operating Report for the PSBR, FY 2011-2012, dated December 5, 2012
- Annual Operating Report for the PSBR, FY 2010-2011, dated December 9, 2011
- PSBR Radiation Dosimetry Records, from 1<sup>st</sup> quarter 2011 to present
- Environmental Dosimeter Data, from 1<sup>st</sup> quarter 2011 to present
- Radiation Training Records for 2011, 2012, and 2013
- Various Weekly and Quarterly Radiation Science and Engineering Center Radiation and Contamination Surveys for 2011, 2012, and 2013
- Portable Monitor Calibration Records for 2011, 2012, and 2013
- AP-8, "Radiation Protection Orientation Requirements," Rev. 7, dated July 23, 2013
- AP-16, "PSBR ALARA Procedure," Rev. 4, dated June 11, 2007
- AP-17, "RWP Procedure," Rev. 4, dated July 2, 2012
- AP-18, "Radiation Protection Program (RPP)," Rev. 4, dated September 1, 2008
- AOP-4, "Daily Contamination Check Procedure," Rev. 9, dated January 12, 2012
- AOP-5, "Water Collection and Analysis," Rev. 6, dated July 1, 2011
- CCP-8, "Calibration of Air Monitors," Rev. 6, dated March 18, 2013
- CCP-10, "Calibration of Area Radiation Monitors," Rev. 3, dated December 15, 2005
- CCP-12, "Calibration of Portable Survey Instruments and Pocket Dosimeters," Rev. 3, dated January 11, 2005

#### b. Observations and Findings

Licensee personnel were interviewed and observed by the NRC inspector. Specifically, the inspector observed practices regarding the use of dosimetry and the handling and storage of radioactive material and equipment, radiation monitoring equipment, placement of radiological postings and barriers, and the use of protective clothing. The inspector also observed the licensee perform various sample surveys to ensure the appropriate procedures and techniques were followed and that there were proper postings of radiation signs and barriers. The inspector determined that the licensee used appropriate survey techniques and that there were appropriate signs and postings.

The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor, Landauer, to process personnel dosimetry. The inspector reviewed dosimetry from 1<sup>st</sup> quarter 2011 to present and noted that doses were well within the regulatory limits and consistent with the operations of the PSBR. Through direct observation, the inspector determined that dosimetry was

acceptably used by facility personnel. Copies of current notices to workers were posted in the facility. Other notices were also posted which characterized the industrial hygiene hazards that were present in the areas. The inspector noted that the copy of NRC Form 3, "Notice to Employees," that was posted at the facility as required by 10 CFR Part 19.11 was the current version.

The calibration of portable survey meters and friskers was completed by radiation protection personnel at the Environmental Health and Safety office while fixed radiation detectors and air monitoring instruments were calibrated by PSBR personnel at the facility. The calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Calibration frequency of the portable and fixed meters and monitors met the requirements established in the applicable procedures and records were being maintained as required.

Current emission records, environmental monitoring (including dosimetry and tritium release records), and the two most recent annual operating reports were reviewed. There were no liquid radioactive effluent releases during this period outside of 10 CFR Part 20 limits.

c. Conclusion

The radiation safety program was commensurate with 10 CFR Part 20 requirements, TS, and procedures.

**4. Design Changes**

a. Inspection Scope (IP 69001)

To ensure that facility changes were reviewed and approved as required by TS Section 6.2 and 10 CFR 50.59, the inspector reviewed selected aspects of:

- AP-12, "Change", Rev. 6, dated June 17, 2011
- AP-12 Work Package #2011-01, "Fuel Temperature SCRAM Setpoint Change," dated June 22, 2011
- AP-12 Work Package #2011-02, "SOP-1 50.59 Screen," dated August 1, 2011
- AP-12 Work Package #2011-03, "City Water through Demineralizer Modification," dated August 1, 2011
- AP-12 Work Package #2011-04, "Relocation of Small Building Air Compressor to Pump Room," dated August 22, 2011
- AP-12 Work Package #2011-05, "48k Storage Tank Transfer System Piping Modification," undated
- AP-12 Work Package #2011-07, "Evaluation of Pulse Mode Operation at the Fast Neutron Irradiator and Fast Flux Tube," dated September 9, 2011
- AP-12 Work Package #2011-08, "Installation of Argon Air Monitor in Reactor Bay," dated September 21, 2011

- AP-12 Work Package #2012-01, "PSBR TRIGA Core Loading #54," Rev. 2, dated June 4, 2012
- AP-12 Work Package #2012-01A, "Test and Balance Operation – Reactor Bay HVAC and Facility Exhaust," dated August 16, 2012
- AP-12 Work Package #2012-02, "Facility Exhaust System – Hand; Off; Auto Control and Revision of SOP-2, SOP-4A," dated July 5, 2012
- AP-12 Work Package #2012-03, "Evacuation Alarm and Channel Check," dated June 19, 2012
- AP-12 Work Package #2012-04, "Liquid Waste Evaporator," dated July 22, 2012
- AP-12 Work Package #2013-01, "Fast Neutron Irradiations in the Central Thimble," dated April 15, 2013
- AP-12 Work Package #2013-02, "PSBR TRIGA Core Loading #55," dated May 31, 2013
- Special Procedure, "Core 55 Loading – 2013 Fuel Movement," Rev. 0, dated June 6, 2013
- SOP-3, "Core Loading and Fuel Handling," Rev. 7, dated October 15, 2012
- Annual Operating Report for the PSBR, FY 2011-2012, dated December 5, 2012
- Annual Operating Report for the PSBR, FY 2010-2011, dated December 9, 2011
- Penn State Reactor Safeguards Committee (RSC) Meeting Minutes from January 18, 2011 to April 16, 2013

b. Observations and Findings

The inspector reviewed several changes to the facility during the past two years that were reviewed and approved under the 10 CFR 50.59 screening process. The procedure in use was noted as being comprehensive and all of the changes to the facility were well documented with a thorough evaluation. The modifications had no safety implications for the public or the facility. It was noted that the RSC reviewed the series of documents listed above as required in the facility TS.

c. Conclusion

Records indicated that changes at the facility were acceptably being reviewed and approved in accordance with 10 CFR 50.59 and applicable licensee administrative controls.

**5. Committees, Audits, and Reviews**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 6.2 were being implemented as required:

- Penn State RSC Meeting Minutes from January 18, 2011 to April 16, 2013

- External Audit Report for the PSBR, dated December 2012
- External Audit Report for the PSBR, dated December 2011
- SOP-18, "Review of Procedures," Rev. 6, dated July 22, 2013
- AP-6, "Penn State Reactor Safeguards Committee Charter and Operating Procedure," Rev. 4, dated April 20, 2006
- AP-4 Event Evaluation #2013-02, "High Power SCRAM," event dated April 16, 2013

b. Observations and Findings

The inspector verified that the RSC was composed of at least five members and met at least once per calendar year as required by Section 6.2 of the facility TS. The inspector reviewed the RSC meeting minutes for the past two years. Review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations, and ensured acceptable use and oversight of the reactor. Additionally, comprehensive audits were being performed annually by non-reactor staff.

c. Conclusion

RSC review functions required by the TS were being implemented and documented; the annually required audit was thorough and complete.

## 6. **Transportation**

a. Inspection Scope (IP 86740)

To verify compliance with 10 CFR Part 71 and 49 CFR Parts 100–185 and procedural compliance for transporting or shipping licensed radioactive material, the inspector reviewed the following:

- Selected records of various types of radioactive material shipments
- Environmental Health and Safety Training Records for Limited Quantity Shipments
- Radiation Protection Procedure RP-Shipping-10, "Radioactive Receipt and Shipping Procedure"

b. Observations and Findings

The inspector observed the licensee process a shipment on August 7, 2013, and noted that the appropriate protocol was followed. Through records reviewed and discussions with licensee personnel, the inspector determined that the licensee had shipped various packages of radioactive material since the previous inspection. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The radioactive material records reviewed by the inspector had been completed in accordance with the Department of Transportation (DOT) and NRC regulations.

The inspector verified that the licensee maintained copies of shipment recipients' licenses to possess radioactive material as required and that the licensees were

verified prior to shipment. The training of staff members responsible for shipping material was also reviewed and noted to be up-to-date. The shippers' training met NRC and DOT requirements.

c. Conclusion

Radioactive material shipments by the licensee were conducted in accordance with applicable procedures and regulatory requirements.

**7. Exit Interview**

The inspector reviewed the inspection results with members of licensee management and PSBR staff at the conclusion of the inspection on August 8, 2013. The licensee acknowledged the items presented.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

K. Ünlü	Director, Radiation Science & Engineering Center
M. Trump	Associate Director for Operations
J. Leavy	Radiation Safety Officer
D. Bertocchi	Health Physics Technician

## **INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
IP 86740	Inspection of Transportation Activities

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

50-005/2013-201-01 VIO Exceeding the licensed maximum power level.

### Closed

50-005/2013-201-01 VIO Exceeding the licensed maximum power level.

## **PARTIAL LIST OF ACRONYMS USED**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Document Access Management System
ALARA	As Low As Reasonably Achievable
DOT	Department of Transportation
IP	Inspection Procedure
NRC	U. S. Nuclear Regulatory Commission
PSBR	Penn State Breazeale Reactor
PSU	Penn State University
Rev.	Revision
RSC	Reactor Safeguards Committee
TS	Technical Specifications
VIO	Violation