



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

July 12, 2022

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

SUBJECT: PENNSYLVANIA STATE UNIVERSITY – U.S. NUCLEAR REGULATORY  
COMMISSION ROUTINE SAFETY INSPECTION REPORT  
NO. 05000005/2022202

Dear Dr. Unlu:

From May 16-18, 2022, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at your Pennsylvania State University Breazeale Reactor facility. The enclosed report presents the results of that inspection that were discussed on May 18, 2022, with you and members of your staff. The enclosed report documents the inspection results.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selective procedures and records, observed various activities, and interviewed personnel.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. However, since Pennsylvania State University has satisfied all of the criteria in paragraph 2.3.2.b. of the NRC Enforcement Policy, the violation is being treated as a non-cited violation (NCV). The NCV is described in the subject inspection report. If you contest the violation or significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with copies to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

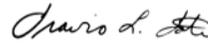
In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's document system (Agencywide Documents and Access 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).

K. Unlu

- 2 -

Should you have any questions concerning this inspection, please contact Mr. Michael Takacs at (301) 415-2042, or by electronic mail at [Michael.Takacs@nrc.gov](mailto:Michael.Takacs@nrc.gov).

Sincerely,



Signed by Tate, Travis  
on 07/12/22

Travis L. Tate, Chief  
Non-Power Production and Utilization  
Facility Oversight Branch  
Division of Advanced Reactors and Non-Power  
Production and Utilization Facilities  
Office of Nuclear Reactor Regulation

Docket No. 50-005  
License No. R-2

Enclosure:  
As stated

cc: See next page

The Pennsylvania State University

Docket No. 50-005

cc:

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Dr. Jeffrey Geuther  
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SUBJECT: PENNSYLVANIA STATE UNIVERSITY – U.S. NUCLEAR REGULATORY  
COMMISSION ROUTINE SAFETY INSPECTION REPORT  
NO. 05000005/2022202 DATED: JULY 12, 2022

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

Docket No.: 50-005

License No.: R-2

Report No.: 05000005/2022202

Licensee: Pennsylvania State University

Facility: Penn State Breazeale Reactor

Location: University Park, Pennsylvania

Dates: May 16-18, 2022

Inspector: Michael Takacs

Approved by: Travis L. Tate, Chief  
Non-Power Production and Utilization  
Facility Oversight Branch  
Division of Advanced Reactors and Non-Power  
Production and Utilization Facilities  
Office of Nuclear Reactor Regulation

Enclosure

## EXECUTIVE SUMMARY

Pennsylvania State University  
Penn State Breazeale Reactor  
Inspection Report No. 05000005/2022202

The primary focus of this routine safety inspection was the onsite review of selected aspects of the Pennsylvania State University (PSU, the licensee) Class II research reactor facility safety program, including: (1) organization and staffing, (2) operations logs and records, (3) requalification training, (4) surveillance and limiting conditions for operation (LCO), (5) emergency planning, (6) maintenance logs and records, and (7) fuel handling logs and records since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The NRC staff determined that the licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements. One Severity Level IV non-cited violation (NCV) was identified.

### Organization and Staffing

- The inspector determined that the licensee implemented and maintained an organization and staffing composition in compliance with the technical specifications (TS).

### Operations Logs and Records

- The inspector determined that the licensee implemented and maintained operations logs and records in compliance with facility procedures and TS.

### Requalification Training

- The inspector determined that the licensee implemented and maintained a requalification program in compliance with the facility procedures, regulations and TS.

### Surveillance and Limiting Conditions for Operation

- The inspector determined that the licensee implemented and maintained a surveillance program in compliance with TS. However, the inspector determined that, contrary to a TS LCO, one Severity Level IV violation occurred and is being treated as an NCV.

### Emergency Planning

- The inspector determined that the licensee implemented and maintained an emergency planning program in compliance with the facility emergency preparedness plan, emergency procedures and regulations.

### Maintenance Logs and Records

- The inspector determined that the licensee implemented and maintained a maintenance program and records in compliance with facility procedures and TS.

### Fuel Handling Logs and Records

- The inspector determined that the licensee implemented and maintained fuel handling logs and records in compliance facility procedures and TS.

## REPORT DETAILS

### Summary of Facility Status

PSU operates a 1-megawatt TRIGA (Training, Research, Isotopes, General Atomics) nuclear reactor in support of education, research, and service. During the inspection, the reactor was operating.

#### 1. Organization and Staffing

##### a. Inspection Scope (Inspection Procedure (IP) 69001-03.01)

To ensure that the requirements of TS 6.1, "Organization," were met, the inspector reviewed the following:

- Facility Operating License No. R-2, Docket No. 50-5, Amendment No. 39
- Appendix A to Facility Operating License No. R-2, Amendment No. 40
- organization chart, Radiation Science and Engineering Center
- Penn State Breazeale Reactor (PSBR) staffing contact list, dated April 2022
- standard operating procedure (SOP)-1, "Reactor Operator Procedure," dated September 13, 2021
- annual operating reports, fiscal years (FY) 2019-2020, and FY 2020-2021.
- console logbooks 108, 109, and 110

##### b. Observations and Findings

The inspector found that since the previous NRC inspection (Inspection Report No. 05000005/2020201), no changes were made to the organization as outlined by TS 6.1.1, "Structure." The inspector observed that a list of facility personnel is posted in the control room in accordance with TS 6.1.3, "Staffing," item b. Additionally, the list is also posted in the PSBR emergency support center (ESC). The inspector found that the list contained the current names and contact information for management, operations, radiation safety, and other support personnel. The inspector determined that staffing satisfied the requirements of TS 6.1.3.a.

##### c. Conclusion

The inspector determined that the organization and staffing were consistent with the requirements in TS 6.1.1 and 6.1.3.

## 2. Operations Logs and Records

### a. Inspection Scope (IP 69001-03.02)

To ensure that the requirements of TS 6.7, "Records," were met, the inspector reviewed the following:

- SOP-1, "Reactor Operating Procedure, Section D. Logbook Protocol," dated September 13, 2021
- Administrative Procedure (AP)-3, "Operator and Senior Operator Requalification," dated October /10, 2005
- AP-4, "Identification, Evaluation and Documentation of Safety System Failures, Abnormal Events, and Operational Events, Appendix A - Event Documentation Forms"
- console logbooks 108, 109, and 110

### b. Observations and Findings

The inspector observed that logbook entries were maintained in accordance with approved procedures. The inspector found that specific items were routinely entered in the console logbook, including the names of licensed operators assigned to the console during reactor operations, system or equipment maintenance, core position within the pool, and reactor power. The inspector also observed that during reactor operation, the licensed operator recorded hourly TS LCO parameters electronically, including reactor power, core temperature, and verification of building confinement.

### c. Conclusion

The inspector determined that the licensee's logbook entries and records were maintained as required by facility procedures and TS.

## 3. Requalification Training

### a. Inspection Scope (IP 69001-03.04)

To ensure that the requalification training requirements of TS 6.1.4, TS 6.2.4, "Audit," TS 6.7.2, "Records to be Retained for at Least One Training Cycle," and, Title 10 of the *Code of Federal Regulations* (10 CFR) 55.53, "Conditions of licenses," paragraphs (e) and (h), were met, the inspector reviewed the following:

- AP-3, "Operator and Senior Operator Requalification," dated October 10, 2005
- operation and emergency procedures exam results, dated December 2021
- requalification training records and presentations, dated December 2021
- quarterly requalification tracker spreadsheet for 2021
- biennial medical exam results, "NRC Form 396"
- annual external audit report, dated December 2020
- console logbooks 108, 109, and 110

b. Observations and Findings

The requalification plan is captured in AP-3 and contains annual on the job training, oral tests, and operational test requirements. The inspector verified that the training lectures in the areas required by AP-3, were performed throughout the training cycle. The inspector verified that the operations and emergency preparedness exams were completed during the training cycle. The inspector selected a records sample of operators with an active license and verified that they performed the required quarterly hours of reactor operations. The inspector verified that the licensee conducted an independent audit of the requalification program as required by TS 6.2.4. In addition, the inspector verified that all active operators completed a biennial medical examination.

c. Conclusion

The inspector determined that the requalification program was implemented and maintained as required by regulations, TS, and procedures.

**4. Surveillance and Limiting Conditions for Operation**

a. Inspection Scope (IP 69001-03.05)

To ensure that the requirements of TS 3.0, "Limiting Conditions for Operation," and TS 4.0, "Surveillance Requirements," were met, the inspector reviewed the following:

- Checks and Calibration Procedure (CCP)-1, "Control Rod Speed and Scram Time Checks," and completed data sheet, dated June 2, 2021
- CCP-11, "Core Reactivity Evaluation," and completed data sheet, dated June 4, 2021
- CCP-15, "Control Rod Reactivity Worth," and completed data sheet, dated June 4, 2021
- console logbooks 108, 109, and 110
- Appendix A to Facility Operating License No. R-2, Amendment No. 40
- NRC Headquarters Operations Center (HOC) records
- SOP-1, "Reactor Operating Procedure," dated December 8, 2021

b. Observations and Findings

The inspector selected a sample of the TS-required surveillances to verify implementation and determined that the frequency and outcome met the TS requirements. The inspector found that the TS LCO regarding confinement of the building was verified on an hourly basis during reactor operations by the console operator (i.e., the reactor bay truck door is closed and the reactor bay personnel doors are not blocked open and left unattended). The inspector verified that surveillance results were retained as required by TS 6.7.1, "Records to be Retained for at Least Five Years," and licensee's procedural requirements.

On December 8, 2021, the licensee reported to the NRC HOC (Event Notification 55632), that an overpower event occurred during performance of a square wave

rapid power excursion on December 7, 2021. During this inspection, the inspector conducted a follow-up review of the event and determined that a violation occurred on December 7, 2021, under TS LCO 3.1.1, "Non-Pulse Mode Operation," Specification b, "The maximum power level SHALL be no greater than 1.1 MW (thermal)." The inspector found that contrary to TS 3.1.1.b, the reactor power had reached 1.38 MW, as indicated on the control room digital recorder. The inspector also determined that during this event: (1) the reactor operator attempted to perform a 0.75 square-wave operation with a setpoint of 500 kW, however, the operator had not entered the setpoint into the system which defaulted to a setting of 100 W, (2), after the square-wave operation was executed, the operator recognized the incorrect setting and quickly changed the setting to 500 kW, an action outside of the approved procedure, and (3) this resulted in a reactor power transient which caused the reactor to scram on an overpower trip, which is set at 1.08 MW. The inspector determined that the operator failed to follow best practices by checking that the setpoint was entered correctly and then acted outside of SOP-1 in an attempt to correct the setpoint. The inspector verified that as a result of this event, the reactor fuel TS safety limit (i.e., 1150°C) and the TS limiting safety system setting (i.e., 650°C) were not exceeded. The inspector also determined that as a result of this event, SOP-1 has been revised to include an additional verification step for setting the reactor power setpoint, and that all licensed reactor operators and senior reactor operators have been trained on this event and the revision to SOP-1, and that modifications were made to the control console user interface to prevent recurrence.

The inspector determined that this violation to be a Severity Level IV violation consistent with Section 6.1. d. 1 of the NRC Enforcement Policy. The inspector also determined that since this violation was non-willful, non-repetitive, licensee-identified and appropriately corrected, it will be treated as a non-cited violation (NCV), consistent with Section 2.3.2 of the NRC Enforcement Policy. This violation is dispositioned as NCV 05000005/2022202-01.

c. Conclusion

The inspector determined that the surveillance program was in compliance with TS. However, the inspector determined that, contrary to TS LCO 3.1.1.b, a violation occurred which has resulted in one Severity Level IV violation and is being treated as an NCV. The inspector has determined that this NCV (i.e., NCV 05000005/2022202-01) is resolved and closed.

## 5. **Emergency Planning**

a. Inspection Scope (IP 69001-03.10)

To ensure that the emergency preparedness requirements of 10 CFR 50.47, Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," and the licensee's emergency plan, the inspector reviewed the following:

- “Penn State Breazeale Reactor (PSBR) Emergency Preparedness Plan,” dated April 23, 2021
- Emergency Procedure (EP)-2, “Fire or Explosion,” dated July 25, 2008
- EP-6, “Medical Emergencies,” dated November 14, 2014
- EP-13, “Building Evacuation,” dated December 5, 2016
- CCP-21, “Emergency Support Center Supplies Check,” dated December 13, 2021, and June 3, 2021
- Memorandum of understanding (MOU) with PSU Police Department, dated September 24, 2021
- MOU with Alpha Fire Company, dated September 7, 2021
- MOU with Mount Nittany Medical Center, dated September 1, 2021
- emergency contact list, dated April 18, 2022
- annual review of the PSBR emergency preparedness plan, performed on December 9, 2020, and December 2, 2021
- completed equipment check semi-annual surveillance forms
- training records for the reactor staff and the PSU Police

b. Observations and Findings

The inspector verified that emergency planning implementing procedures are current and approved by management. The inspector confirmed that the licensee arranged for an independent biennial audit of the emergency preparedness plan and implementing procedures, which was performed in December 2020, as required by TS 6.2.4.d. The inspector ensured the availability and operability of emergency equipment in the emergency supply cabinets located in the ESC. The inspector confirmed that the licensee continued to maintain current MOUs with the University Police, the Alpha Fire Company, and the Mount Nittany Medical Center to support both onsite and offsite emergency response. The inspector verified that training for reactor staff and the PSU Police was completed annually as required. The inspector verified that emergency drills for calendar year 2020 and 2021, were conducted as required by the emergency preparedness plan.

c. Conclusion

The inspector determined that the licensee implemented and maintained its emergency planning program in compliance with the facility emergency preparedness plan, emergency procedures and regulations.

**6. Maintenance Logs and Records**

a. Inspection Scope (IP 69001-03.11)

To ensure that the maintenance requirements of TS 6.7.1.c., and 6.7.1.g. were met, the inspector reviewed the following:

- AP-4, “Identification, Evaluation and Documentation of Safety System Failures, Abnormal Events, and Operational Events”
- annual operating reports, FY 2019 - 2020, and FY 2020 - 2021
- electronic maintenance log
- tagout logbook

- console logbooks 108, 109, and 110

b. Observations and Findings

The inspector determined that maintenance is documented and resolved as required by the licensee's procedures. Additionally, the inspector verified that maintenance records were retained for at least five years as required by TS 6.7.1.

c. Conclusion

The inspector determined that the licensee implemented and maintained maintenance activities and records in compliance with facility procedures and TS.

## 7. **Fuel Handling Logs and Records**

a. Inspection Scope (IP 69001-03.12)

To ensure that the requirements of TS 3.1.6 and TS 4.1.3, "TRIGA Fuel Elements," were met, the inspector reviewed the following:

- current fuel element storage location map
- fuel inspection spreadsheet database for 2020
- console logbooks 108, 109, and 110
- annual operating reports, fiscal years (FY) 2019 - 2020 and FY 2020 - 2021

b. Observations and Findings

The inspector determined that no fuel movement or fuel inspection activities have occurred since this module was previously inspected in July 2020. The inspector verified that the next TS required biennial fuel inspection is due in July 2022.

c. Conclusion

The inspector determined that the licensee implemented and maintained fuel handling logs and records in compliance facility procedures and TS.

## 8. **Exit Interview**

The inspection scope and results were summarized on May 18, 2022, with members of the licensee management and staff. The inspector described the areas inspected and discussed the inspection observations. The licensee did not identify any of the material provided to or reviewed by the inspector during the inspection, as proprietary. The licensee acknowledged the results of the inspection.

**LIST OF PERSONS CONTACTED**

Licensee

K. Unlu,	Director of the PSBR Facility
J. Geuther	Associate Director for Operations
S. Herrmann	Reactor Operations Coordinator
A. Tong	Senior Research Engineer
T Daubenspeck	Activation and Irradiation Specialist
Z. Van Horn	Reactor Operator
D. Beck	Engineering Program Manager

**INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
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**ITEMS OPENED, CLOSED, AND DISCUSSED**

Opened

NCV 05000005/2022202-01	The licensee exceeded the TS LCO for the reactor fuel thermal power limit of 1.1 MW due to failure to follow reactor operating procedure.
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Closed

NCV 05000005/2022202-01	The licensee exceeded the TS LCO for the reactor fuel thermal power limit of 1.1 MW due to failure to follow reactor operating procedure.
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Discussed

None