

July 27, 2017

Dr. Robert Bean, Director  
Purdue University Radiation Laboratory  
School of Nuclear Engineering  
400 Central Drive  
West Lafayette, IN 47904-2017

SUBJECT: PURDUE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION  
ROUTINE INSPECTION REPORT NO. 50-182/2017-201

Dear Dr. Bean:

From June 26-29, 2017, the U.S. Nuclear Regulatory Commission (NRC, or Commission) conducted an inspection at your Purdue University Research Reactor. The inspection included a review of activities authorized for your facility. The enclosed report documents the inspection results which were discussed on June 29, 2017, with members of your staff.

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 selected procedures and records, observed activities, and interviewed personnel. Based on the results of this inspection, no findings of noncompliance were identified. No response to this letter is required.

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 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).

R. Bean

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Should you have any questions concerning this inspection, please contact Gary Morlang at 301-415-4092 or by electronic mail at [Gary.Morlang@nrc.gov](mailto:Gary.Morlang@nrc.gov).

Sincerely,

*/RA/*

Anthony J. Mendiola, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-182  
License No. R-87

Enclosure:  
As stated

cc w/ enclosure: See next page

SUBJECT: PURDUE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION  
ROUTINE INSPECTION REPORT NO. 50-182/2017-201  
DATED: JULY 27, 2017

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**NRC-002**

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<b>DATE</b>	7/25/17	7/25/17	7/27/17

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Purdue University

Docket No. 50-182

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

Docket No. 50-182

License No. R-87

Report No. 50-182/2017-201

Licensee: Purdue University

Facility: Purdue University Research Reactor

Location: West Lafayette, IN

Dates: June 26 - 29, 2017

Inspector: Gary Morlang

Approved by: Anthony J. Mendiola, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Enclosure

## EXECUTIVE SUMMARY

Purdue University  
Purdue University Reactor  
NRC Inspection Report No. 50-182/2017-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Purdue University's (the licensee's) Class II research reactor facility safety programs including: (1) operations logs and records; (2) procedures; (3) surveillance and limiting conditions for operation; (4) health physics; (5) effluents and environmental monitoring; (6) committees, audits, and reviews; and (7) 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 in compliance with NRC requirements.

### Operations Logs and Records

- Within the scope of this review, the licensee's operations record keeping program conformed to technical specification (TS) requirements.

### Procedures

- The inspector found that appropriate procedures were in effect and new procedures were being prepared as needed.

### Surveillance and Limiting Conditions for Operation

- Surveillance testing was observed to be performed in accordance with requirements as stated in the TS.

### Health Physics

- The inspector verified that the licensee's health physics program was effective in minimizing radiation doses to individuals through training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

### Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory limits.

### Committees, Audits, and Reviews

- The Committee on Reactor Operations provided the oversight required by the TS.

### Transportation

- The licensee had not shipped any radioactive material since the last inspection.

## REPORT DETAILS

### Summary of Facility Status

The Purdue University's (the licensee's) one kilowatt research reactor was not operated during the inspection because of a major building renovation that was in progress. This included major electrical and service air system upgrades.

#### 1. Operations Logs and Records

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

The inspector reviewed selected parts of the following reactor operations records to verify that the requirements of technical specification (TS) Section 6.1, "Organization," were being met:

- Purdue University Reactor (PUR) Procedures Manual
- PUR Procedure Standard Operating Procedure (SOP)-2, "Reactor Startup, Operation and Shutdown," dated August 27, 2015
- Reactor Logbook No. 59, April 29, 2016 to June 16, 2017
- Reactor Logbook No. 58, September 29, 2015 to April 29, 2016
- Annual Report for January 1 to December 31, 2015, dated March 2016
- Annual Report for January 1 to December 31, 2016, dated March 2017
- File of completed pre-start checklists, including those for 2015, 2016 and to date in 2017

##### b. Observations and Findings

The PUR procedures specified a records system that was commensurate with TS requirements. Procedures called for operational data to be recorded in the reactor logbooks, startup checklists, and shutdown checklists. Data recorded indicated that the reactor was operated within reactor license and TS parameters. Good correlation was noted between reactor operations requests, startup checklists and console log books. Important items such as control rod and fuel inspection were well documented.

##### c. Conclusion

The licensee's operations record keeping program conformed to TS requirements.

## 2. Procedures

### a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the requirements of TS Section 6.4, "Procedures," were being met:

- PUR Procedures Manual
- PUR SOP - 1, "Prestart Checklist," dated August 27, 2015
- PUR SOP - 2, "Reactor Startup, Operation and Shutdown," dated August 27, 2015
- PUR 07-01, "Partial or complete disassembly and reassembly of the PUR core," dated September 7, 2007
- PUR-03-01-EP, "Emergency Procedure," dated March 25, 2003
- PUR-05-01, "Sample Irradiation," dated June 14, 2005
- PUR 07-05, "Procedure for core loading," dated September 1, 2007
- PUR SMP - 3, "Procedure for Checking Meter Contact Switches," dated November 11, 2015
- PUR M-2, "Procedure for checking the Source Missing Interlock," dated June 8, 1995
- PUR SMP - 5, "Procedure for determining magnet current settings and checking the fast scrams," dated November 11, 2015
- PUR SMP - 6, "Procedure for measuring Rod Drop Times," dated November 11, 2015
- PUR M-6, "Determining Excess Reactivity," dated July 27, 1995

### b. Observations and Findings

The inspector reviewed the licensee's written procedures and revisions to procedures. The procedures reviewed were thorough and of the appropriate level of detail. The Procedures Manual included lists of "Approved Procedures," "Maintenance Procedures," and "Emergency Procedures," all of which were reviewed and approved by the Committee on Reactor Operations (CORO). All of the maintenance procedures had been rewritten and approved by the CORO within the last 18 months.

### c. Conclusion

The inspector found that appropriate procedures were in effect and new maintenance and operating procedures had been issued.

### 3. Surveillance and Limiting Conditions for Operation

#### a. Inspection Scope (IP 69001 and IP 92701)

The inspector reviewed the following to determine if the periodic surveillance tests on safety systems were performed as stipulated in TS Section 4, "Surveillance Requirements":

- PUR-1 Maintenance Log
- File of completed pre-start checklists including those for 2015, 2016 and to date in 2017
- Procedure SOP - 2, "Reactor Startup, Operations and Shutdown," dated August 27, 2015
- Procedure 95-7-RR, "Calibration of Regulating Rod," dated July 25, 1995
- Procedure 95-7-SS, "Calibration of Shim Safety Rod," dated July 28, 1995
- PUR 07-01, "Partial or complete disassembly and reassembly of the PUR core," dated September 7, 2007
- PUR 07-05, "Procedure for core loading," dated September 1, 2007
- Reactor Logbook No. 59, April 29, 2016 to June 16, 2017
- Reactor Logbook No. 58, September 29, 2015 to April 29, 2016

#### b. Observations and Findings

The surveillance check lists were updated in October 2016 to reflect the new TS issued on October 31, 2016. Surveillance requirements were primarily done as part of the pre-start checkout; surveillance such as control rod drop time tests and water chemistry tests were documented with individual procedures or in the Console Log Books. Checks and calibrations were completed as required by TS.

The licensee had developed a new tracking system to ensure the required annual, semiannual, quarterly, monthly and weekly administrative and TS items were completed in a timely manner. TS requirements were annotated in red.

#### c. Conclusion

Surveillance test were observed to be performed in accordance with requirements as stated in the TS.

#### 4. Health Physics

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

The inspector reviewed the following to verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 requirements:

- Radiation Safety Manual
- Annual Report for January 1 to December 31, 2015, dated March 2016
- Annual Report for January 1 to December 31, 2016, dated March 2017
- Personnel dosimetry records
- Radiation Monitor Calibration Logbook, March 2015 to present
- 2015 and 2016 Audit of Radiation Safety Program Content and Implementation
- Reactor Air and Water Reports for 2015, 2016 and to date in 2017

##### b. Observations and Findings

The inspector reviewed records of radiation surveys performed by a Radiological and Emergency Management (REM) health physics specialist, and found activity levels to be generally consistent with background radiation. A copy of the current NRC Form 3 notice to radiation workers required by 10 CFR Part 19 was posted at the entrance to the reactor bay.

Dosimetry results were reviewed by the inspector and PUR-1 facilities' associated exposures were in conformance with 10 CFR Part 20 and administrative limits.

The calibration records of selected devices were reviewed. Calibration tags on devices found throughout the facility were verified to be current and in accordance with the calibration records that were reviewed. REM calibrated the PUR-1 facility portable radiological monitoring equipment onsite.

The inspector reviewed Radiation Safety Training records given every 2 years to permanent reactor staff and found them to be up-to-date.

##### c. Conclusion

The inspector verified that the licensee's health physics program was effective in minimizing radiation doses to individuals through training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

## 5. Effluent and Environmental Monitoring

### a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20:

- Annual Report for January 1 to December 31, 2015, dated March 2016
- Annual Report for January 1 to December 31, 2016, dated March 2017
- Reactor Air and Water Annual Report for 2015 and 2016
- Reactor Continuous Air Monitor Filter Data Worksheets for 2015 and 2016
- Reactor Water Data Worksheets for 2015, 2016 and to date in 2017

### b. Observation and Findings

The inspector reviewed air and water data collected by REM staff that would indicate if fuel integrity had been compromised or breached. There were no indications of nuclear fuel or its byproducts having been detected in the water or air samples. Licensee air samples showed that all samples were below minimum detectable activity.

The licensee also reported the results of several thermoluminescent dosimeters (TLD) placed around the PUR-1 facility as environmental radiation monitors, including the Electrical Engineering classroom above the reactor bay. In all cases the TLDs indicated no significant difference from background radiation levels.

### c. Conclusion

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory limits.

## 6. Committees, Audits, and Reviews

### a. Inspection Scope (IP 69001 and IP 92701)

The inspector reviewed the following to verify compliance with the requirements of TS Section 6.2, "Review and Audit":

- Annual Report for January 1 to December 31, 2015, dated March 2016
- Annual Report for January 1 to December 31, 2016, dated March 2017
- Quarterly CORO Meeting Minutes from April 1, 2015 to May 9, 2017
- 2015 and 2016 Audit of Radiation Safety Program Content and Implementation

b. Observations and Findings

A quorum as defined in TS Section 6.2.b was present at each of the meeting minutes reviewed. Meetings were held at the required frequency as specified in TS Section 6.2.b.

Through review of CORO meeting minutes from the recent past, the inspector verified that the committee was performing the review responsibilities defined in TS Section 6.2.d.

c. Conclusion

The CORO provided the oversight required by the TS.

**7. Transportation**

a. Inspection Scope (IP 86740)

The inspector interviewed personnel to verify compliance with regulatory and procedural requirements for transferring licensed material.

b. Observations and Findings

None.

c. Conclusion

The licensee had not shipped any radioactive material under the reactor license since the last inspection.

**8. Exit Meeting Summary**

The inspector reviewed the inspection results with members of the licensee management at the conclusion of the inspection on June 29, 2017. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

R. Bean	Director of Radiation Laboratories
C. Townsend	Reactor Supervisor
J. F. Schweitzer	Director REM/Radiation Safety Officer
M. Tang	Health Physics Staff
J. Young	Health Physics Staff

## **INSPECTION PROCEDURES USED**

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

### Opened

None

### Closed

None

### Discussed

None

## **PARTIAL LIST OF ACRONYMS USED**

CFR	<i>Code of Federal Regulations</i>
CORO	Committee on Reactor Operations
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
PUR	Purdue University Research Reactor
REM	Radiological and Emergency Management
SOP	Standard Operating Procedure
TS	Technical Specification