

June 25, 2015

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

SUBJECT: PURDUE UNIVERSITY - NRC ROUTINE INSPECTION REPORT NO.  
50-182/2015-201

Dear Dr. Bean:

From June 8-11, 2015, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your Purdue University Reactor. 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 enclosed 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 noncompliances with requirements 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, and requests for withholding," 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 (PARS) component of NRC's document system (Agencywide Document Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

R. Bean

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

Sincerely,

***/RA by MDeSouza for/***

Kevin Hsueh, 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/ encl: See next page

R. Bean

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**TEMPLATE #: NRC-002**

OFFICE	PROB:RI		PROB:BC
NAME	GMorlang		KHsueh
DATE	6/25/2015		6/25/2015

**OFFICIAL RECORD COPY**

Purdue University

Docket No. 50-182

cc:

Leah Jamieson, Dean  
College of Engineering  
Purdue University  
West Lafayette, IN 47907

Mayor  
City of West Lafayette  
609 W. Navajo  
West Lafayette, IN 47906

Manager  
Epidemiology Res Center/Indoor & Radiological Health  
Indiana Department of Health  
2525 N. Shadeland Ave., E3  
Indianapolis, IN 46219

P.E., Director  
Consumer Protection  
Indiana State Department of Health  
2 North Meridian Street, 5D  
Indianapolis, IN 46204

Mr. Ed Merritt  
Reactor Supervisor  
Department of Nuclear Engineering  
Purdue University  
West Lafayette, IN 47907

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

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

Docket No: 50-182

License No: R-87

Report No: 50-182/2015-201

Licensee: Purdue University

Facility: Purdue University Reactor

Location: West Lafayette, IN

Dates: June 8 to 11, 2015

Inspectors: Gary "Mike" Morlang

Approved by: Kevin Hsueh, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Purdue University  
Purdue University Reactor  
NRC Inspection Report No. 50-182/2015-201

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 operations logs and records; procedures; surveillance and limiting conditions for operation; health physics; effluents and environmental monitoring; committees, audits, and reviews; and transportation. The licensee's programs were acceptably directed toward the protection of public health and safety and were in compliance with U.S. Nuclear Regulatory Commission requirements.

### Operations Logs and Records

- Within the scope of this review, the licensee's operations record keeping program conformed to Technical Specification 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 Technical Specifications.

### 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 Technical Specifications.

### 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 had not operated since April 2013 because of electronic equipment problems and lack of licensed staff personnel. The electronic equipment problems have been repaired and new licensed staff personnel were in place.

#### 1. Operations Logs and Records

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

The inspector reviewed selected parts of the following reactor operations records to verify that the requirements of Technical Specifications Section 6.5, "Operating Records," were being met:

- Purdue University Reactor (PUR) Procedures Manual
- PUR Procedure 91-1, "Reactor Startup, Operation and Shutdown," dated June 1991
- Reactor Logbook No. 57, September 4, 2014 to present
- Reactor Logbook No. 53, June 26, 2012 to September 3, 2014
- Annual Report for January 1 to December 31, 2013, dated May 2014
- Annual Report for January 1 to December 31, 2014, dated March 2015
- File of completed Pre-start Checklists, including those for 2012 to 2015

##### b. Observations and Findings

The PUR procedures specified a records system that was commensurate with Technical Specification 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 Technical Specification parameters prior to the shutdown in 2013. Records indicated the electronic repairs were completed and the reactor deemed operation on March 20, 2015.

##### c. Conclusion

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

## 2. Procedures

### a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the requirements of Technical Specifications Section 6.3, "Operating Procedures," were being met:

- PUR Procedures Manual
- PUR 91-1, "Reactor Startup, Operation and Shutdown," dated June 1991
- 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 M-1, "Procedure for Checking Meter Contact Switches," dated June 16, 1995
- PUR M-2, "Procedure for checking the Source Missing Interlock," dated June 8, 1995
- PUR M-3, "Procedure for determining magnet current settings and checking the fast scrams," dated June 29, 1995
- PUR M-4, "Procedure for measuring Shim-safety rod drop times," dated July 28, 1995
- PUR M-5A, "Calibration of Radiation Area Monitors," dated April 25, 2011
- 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 for Reactor Operations (CORO). The inspector noted that Technical Specifications Section 6.4.8 requires all temporary pen and ink procedure changes initiated by the reactor supervisor to be "subsequently" reviewed by the CORO. A number of temporary changes had been made to several maintenance procedures over many years. These maintenance procedures had been rewritten and were being reviewed by the CORO at the time of the inspection. The licensee was informed that failure to have the pen and ink procedure changes reviewed by the CORO was identified as an Unresolved Item<sup>1</sup> (URI) pending corrective actions and implementation of controls to prevent recurrence. This issue was reviewed during the inspection and will remain open until the CORO has approved the new procedures (URI-50-182/2010-201-01).

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<sup>1</sup>An Unresolved Item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.



c. Conclusion

The inspector found that appropriate procedures were in effect and new procedures were being prepared as needed. A URI was noted for failure to have temporary pen and ink changes to maintenance procedures reviewed by the CORO.

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

a. Inspection Scope (IP 69001 and IP 92701)

The inspectors reviewed the following to determine if the periodic surveillance tests on safety systems were performed as stipulated in TECHNICAL SPECIFICATION Section 4.0, Surveillance Requirements:

- PUR-1 Maintenance Log
- File of completed Pre-start Checklists including those for 2014 and 2015
- Procedure 91-1, "Reactor Startup, Operations and Shutdown," dated June 1991
- 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. 57, September 4, 2014 to present
- Reactor Logbook No. 56, June 26, 2012 to September 3, 2014

b. Observations and Findings

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 Technical Specifications.

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

c. Conclusion

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

#### 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, 2013, dated May 2014
- Annual Report for January 1 to December 31, 2014, dated March 2015
- Personnel dosimetry records
- Radiation Monitor Calibration Logbook, March 2013 to present
- 2013 and 2014 Audit of Radiation Safety Program Content and Implementation
- Reactor Air and Water Reports for 2013, 2014 and to date in 2015

##### 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 inspectors and PUR-1 facilities' associated exposures were in conformance with 10 CFR Part 20 and administrative limits. The maximum whole body exposure during 2014 was 28 millirem and the maximum exposure to extremities was 15 millirem. The maximum whole body exposure for year-to-date 2015 was 44 millirem and the maximum exposure to extremities was 29 millirem. All results were below 10 CFR Part 20 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, 2013, dated May 2014
- Annual Report for January 1 to December 31, 2014, dated March 2015
- Reactor Air and Water Annual Report for 2013 and 2014
- Reactor Continuous Air Monitor Filter Data Worksheets for 2013 and 2014
- Reactor Water Data Worksheets for 2013 and 2014

### **b. Observation and Findings**

The inspectors 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 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 inspectors 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, 2013, dated May 2014
- Annual Report for January 1 to December 31, 2014, dated March 2015
- CORO Meeting Minutes from October 17, 2013, February 14, 2014, September 26, 2014, January 20, 2015, April 1, 2015 and May 20, 2015
- 2013 and 2014 Audit of Radiation Safety Program Content and Implementation

b. Observations and Findings

The CORO was short one member with the retirement of the Reactor Supervisor. The job has been posted and interviews were in progress. A quorum as defined in Technical Specifications Section 6.2.4 was present at each of the meeting minutes reviewed. Meetings were held at the required frequency as specified in Technical Specifications Section 6.2.3.

Through review of CORO meeting minutes from the recent past, the inspectors verified that the committee was performing the review responsibilities defined in Technical Specifications Section 6.2.5.

c. Conclusion

The Committee on Reactor Operations provided the oversight required by the Technical Specifications.

**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 since the last inspection.

**8. Exit Meeting Summary**

The inspector reviewed the inspection results with members or the licensee management at the conclusion of the inspection on June 11, 2015. 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. The licensee acknowledged the results of the inspection.

### **PARTIAL LIST OF PERSONS CONTACTED**

#### **Licensee**

R. Bean	Director of Radiation Laboratories
E. C. Merritt	Reactor Supervisor
J. F. Schweitzer	Director/Radiation Safety Officer
Z. Tribbett	Health Physics Staff

### **INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
IP 92701	Follow-up

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

#### **Opened**

None

#### **Closed**

None

#### **Discussed**

50-182/2010-201-01	URI	Failure to have pen and ink temporary changes to procedures reviewed by the CORO.
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### **PARTIAL LIST OF ACRONYMS USED**

ADAMS	Agencywide Document Access Management System
10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
CORO	Committee on Reactor Operations
IP	Inspection Procedure
No.	Number
NRC	U.S. Nuclear Regulatory Commission
NRF	Nuclear Reactor Facility
PARS	Publicly Available Records
PUR	Purdue University Reactor
REM	Radiological and Environmental Management
Rev.	Revision
URI	Unresolved Item