

July 8, 2016

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

SUBJECT: PURDUE UNIVERSITY – NUCLEAR REGULATORY COMMISSION ROUTINE
INSPECTION REPORT NO. 50-182/2016-201

Dear Dr. Bean:

From June 6-9, 2016, the U.S. Nuclear Regulatory Commission (NRC, or the Commission) conducted an inspection at your Purdue University Reactor. The inspection included a review of activities authorized for your facility. The enclosed inspection report presents the areas examined and the results of that inspection, which was discussed with you and members of your staff on June 9, 2016.

During the inspection, the NRC staff examined activities conducted under your license as they relate to public health and safety to ensure compliance with the Commission's rules and regulations and with the conditions of your license. 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 non-compliances 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, 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 Mr. Gary Morlang at (301) 415-4092 or by electronic mail at 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

Purdue University

Docket No. 50-182

cc:

Leah Jamieson, Dean of Engineering
Purdue University
School of Nuclear Engineering
400 Central Drive
West Lafayette, IN 47907

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

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

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

Clive Townsend, Reactor Supervisor
Purdue University
School of Nuclear Engineering
400 Central Drive
West Lafayette, IN 47907

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

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

Docket No. 50-182

License No. R-87

Report No. 50-182/2016-201

Licensee: Purdue University

Facility: Purdue University Reactor

Location: West Lafayette, IN

Dates: June 6-9, 2016

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

EXECUTIVE SUMMARY

Purdue University
Purdue University Reactor
NRC Inspection Report No. 50-182/2016-201

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) organization and staffing, (2) procedures, (3) requalification training, (4) experiments, (5) design changes, (6) emergency preparedness, (7) maintenance logs and records, and (7) fuel handling logs and records. 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 (NRC) requirements.

Organization and Staffing

- The licensee's organization and staffing were in compliance with the requirements specified in the technical specification (TS).

Procedures

- The inspector found that appropriate procedures were in effect and new procedures had been prepared.
- A previously identified issue associated with Committee on Reactor Operations (CORO) review of procedure changes will be closed.

Requalification Training

- Because only one operator was licensed at the facility during the last inspection in this area, requirements in the facility's NRC-approved requalification plan could not be met. The inspector follow-up item (IFI) was written to ensure subsequent review in this area will be closed.
- New employees had qualified as licensed senior reactor operators and the requalification plan was being followed.

Experiments

- No new experiments were requested, but procedures existed to review them pursuant to TS requirements should one be requested.

Design Changes

- No new changes, tests, or experiments subject to evaluation under Title 10 of the *Code of Federal Regulations* Section 50.59 were performed.
- Two IFIs were identified during the last inspection in this area, one associated with the failure to conduct CORO meetings at the required periodicity and one with the failure to submit annual reports as required. These issues have been corrected and the IFI's will be closed.

Emergency Preparedness

- The emergency preparedness program was being conducted in accordance with the emergency plan (E-Plan).
- Three IFIs were identified during the last inspection in this area associated with the failure to conduct required periodic CORO reviews of the E-Plan, failure to conduct emergency drills at the required frequency, and failure to conduct an annual inventory of emergency supplies. These issues have been corrected and the IFIs will be closed.

Maintenance Logs and Records

- The licensee maintained records documenting principal maintenance activities.

Fuel Handling Logs and Records

- Fuel handling activities were completed and documented as required by TS and facility procedures.

REPORT DETAILS

Summary of Facility Status

Purdue University's (the licensee's) one kilowatt research reactor was shut down due to extensive building renovations in progress. During the inspection the reactor was not operated.

1. Organization and Staffing

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

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of the licensee's technical specification (TS) Section 6.1, "Organization," to Facility Operating License No. R-87, Amendment No. 12, dated August 9, 2007, were being met:

- Organizational structure
- Staffing requirements
- Reactor Logbook No. 57, September 3, 2014, to September 29, 2015
- Reactor Logbook No. 58, September 29, 2015, to April 29, 2016
- Reactor Logbook No. 59, April 29, 2016, to the present
- File of completed pre-start checklists, including those for 2015 and to date in 2016
- Committee on Reactor Operations (CORO) meeting minutes
- Purdue University Reactor 1 (PUR-1), Operating Principles and Core Characteristics Manual, Revision (Rev.) 0, dated August 27, 2015
- Annual Operating Report for January 1, 2014 to December 31, 2014, dated March 30, 2015
- Annual Operating Report for January 1, 2015 to December 31, 2015, dated March 30, 2016

b. Observations and Findings

Through discussions with licensee representatives, the inspector determined that the management structure at the facility had not changed since the previous U.S. Nuclear Regulatory Commission (NRC) inspection; however, there were non-managerial staff changes at the facility. There were three licensed senior reactor operators (SROs) at the facility. Staffing of the reactor shifts, including designated on-call individuals, met TS requirements as documented in the reactor logbook and pre-start checklists.

A new interim nuclear engineering department head had been appointed while the search for a permanent replacement was being conducted.

c. Conclusion

The licensee's organization and staffing were in compliance with the requirements specified in the TS.

Enclosure

2. Procedures

a. Inspection Scope (IP 69001)

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

- PUR-1 Procedures Manual
- PUR-1 07-01, "Partial or Complete Disassembly and Reassembly of the PUR-1 Core," dated September 7, 2007
- PUR-1 SMP-3, "Procedure for Checking Meter Contact Switches," dated November 11, 2015
- PUR-1 SMP-4, "Procedure for Checking the Source Missing Interlock," November 11, 2015
- PUR-1 SMP-5, "Procedure for Determining Magnet Current Settings and Checking the Fast Scrams," dated June 29, 1995
- PUR-1 SMP-6, "Procedure for Measuring Shim-Safety Rod Drop Times," November 11, 2015
- PUR-1 M-5A, "Calibration of Radiation Area Monitors (RAM) Model GA-6," dated April 25, 2001
- PUR-1 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. Procedures appeared 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 CORO.

During a previous inspection, the inspector identified that a number of pen and ink changes had been made to procedures, but that these changes had not been reviewed by the CORO as required. At that time this issue was identified as an unresolved item (URI) that would be reviewed during a future inspection. During this inspection, the inspector noted that all procedures had now been reviewed and rewritten as required. The procedures had been approved by the CORO. The licensee was informed that this issue will be closed (URI-50-182/2010-201-01).

Conclusion

The inspector found that appropriate procedures were in effect and new procedures had been written. The previously identified URI associated with CORO review of procedure changes will be closed.

3. **Requalification Training**

a. Inspection Scope (IP 69001 and IP 92701)

The inspector reviewed the following to verify that the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 55, "Operators Licenses," were being met:

- Operator Requalification Program for the PUR-1 Reactor Facility, dated February 12, 1988
- Operator's Requalification Program Performance Evaluation Form, dated April 9, 2009
- American National Standards Institute/American Nuclear Society, Section 15.4, "Certification of Medical Examinations," dated April 8, 2009
- Biennial Requalification Progress Records for the 2016/2017 cycle for each SRO (3)
- Individual data sheets for the 2016/2017 cycle for each SRO (3)
- Individual SRO operator medical records
- Reactor Logbook No. 57, September 3, 2014, to September 29, 2015
- Reactor Logbook No. 58, September 29, 2015, to April 29, 2016
- Reactor Logbook No. 59, April 29, 2016, to the present

b. Observations and Findings

The inspector reviewed the requalification records for the three licensed SRO's at the facility and noted that they were maintained as required by the requalification program. Two of the licensed SRO's received their license in March 2016. This allowed the licensee to follow the Requalification Plan as required. During the last inspection in this area, the licensee was informed that failure to conduct written and operating exams as required by the requalification plan is a minor violation and tracked as a follow-up item (IFI) (IFI 50-182/2013-201-01). This IFI will be closed

c. Conclusions

Current operator requalification was now being conducted with three SRO's currently at the facility. The IFI identified during the last inspection will be closed.

4. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with TS 3.5, "Limitations on Experiments":

- Requested irradiations forms
- CORO minutes for 2015 and 2016
- TS 4.5, "Experiments"
- PUR-1 Procedure 05-01, "Sample Irradiation," dated June 14, 2005
- PUR-1 Procedure 91-3, "Sample Irradiation in Drop Tubes," dated June 1991
- Reactor Logbook No. 57, September 3, 2014, to September 29, 2015
- Reactor Logbook No. 58, September 29, 2015, to April 29, 2016
- Reactor Logbook No. 59, April 29, 2016, to the present

b. Observations and Findings

The inspector reviewed the irradiations requests and through discussion with staff members determined that no new types of experiments were reviewed or approved during the past 2 years. Procedures were observed to be in effect to require an evaluation of new experiments by the staff and CORO for conformance to TS requirements at such time as an experiment of a new type is requested.

c. Conclusion

No new experiments were requested. Procedures existed to review them pursuant to TS requirements should one be requested.

5. Design Changes

a. Inspection Scope (IP 69001)

The inspector reviewed the following materials to verify compliance with regulatory requirements:

- Annual Operating Report for January 1, 2014 to December 31, 2014, dated March 30, 2015
- Annual Operating Report for January 1, 2015 to December 31, 2015, dated March 30, 2016
- Requested irradiations forms
- CORO meeting minutes

b. Observations and Findings

The licensee reported that, since the previous inspection, there had been no changes made which constituted a change reportable to the NRC under 10 CFR 50.59. Changes to structures, systems, or components were typically reviewed and evaluated by the reactor staff and then reviewed and approved by the facility CORO during their quarterly meetings.

The inspector reviewed the CORO meeting minutes for the past 2 years during the last inspection in this area. No changes had been reviewed recently. However, it was also noted that no CORO meetings had been held since June 2012. TS 6.2.3, requires that the CORO meet semiannually, with no interval to exceed seven and a half months. The licensee was informed that the failure to hold CORO meetings at the proper frequency as required by TS 6.2.3, is a minor violation that will be followed by the NRC as an IFI to be reviewed during an upcoming inspection (IFI 50-182/2013-201-02). Now that the CORO meets on a quarterly basis, this IFI will be closed.

Information on changes to the facility was typically reported through the facility annual reports as required by TS 6.6.1. Through a review of the latest facility annual reports during the last inspection in this area, the inspector noted that no annual reports had been submitted to the NRC for the years 2011 and 2012. The licensee was informed that the failure to submit an annual report to the NRC each year as required in TS 6.6.1, is a minor violation that will be followed by the NRC as an IFI and reviewed during an upcoming inspection (IFI 50-182/2013-201-03). Now that annual reports are being submitted as required, this IFI will be closed.

c. Conclusion

No new changes, tests, or experiments subject to 10 CFR 50.59 reporting were performed. Two IFIs were reviewed, one associated with the failure to conduct CORO meetings at the required periodicity and one with the failure to submit annual reports as required. These IFI's will be closed.

6. Emergency Preparedness

a. Inspection Scope (IP 69001)

The inspector reviewed the implementation of selected portions of the emergency preparedness program including:

- E-Plan for the PUR, dated March 20, 2000
- Emergency Procedure No. 03-1-EP, approved March 25, 2003
- Summaries of Purdue Reactor emergency drills, held in 2014 and 2015
- Emergency Equipment Locker Inventory sheets

b. Observations and Findings

During the previous inspection in this area, the inspector noted that TS 6.2.6, requires that the facility's E-Plan be reviewed by the CORO biennially at intervals not to exceed two and a half years. While the current E-Plan was reviewed by the CORO when it was issued, no CORO review of the E-Plan had been completed since June 2010, a period in excess of that allowed by TS 6.2.6. The licensee was informed that the issue of not conducting a biennial review of the E-Plan as required by TS 6.2.6, is a minor violation that will be followed by the NRC as an IFI and reviewed during an upcoming inspection (IFI 50-182/2013-201-04). The CORO is now conducting biennial reviews of the E-Plan, this IFI will be closed.

The inspector determined that the licensee conducted training for emergency response personnel as required. This was accomplished through the operator requalification program at the facility.

The inspector noted that no drill had been conducted in 2012 and no drill had been conducted in 2013 as of the date of the last inspection in this area. The licensee was informed that the issue of not conducting an annual drill as required by Section 9.2 of the E-Plan is a minor violation that will be followed by the NRC as an IFI and reviewed during an upcoming inspection (IFI 50-182/2013-201-05). Drills were conducted in 2014 and 2015 and scheduled for 2016. This IFI will be closed.

The inspector reviewed the emergency supplies that were maintained at the facility for use in responding to various situations during the last inspection in this area. The supplies were being maintained properly. It was noted that Section 9.5 of the E-Plan requires that these supplies be verified and checked annually by the PUR-1 staff. The last check was completed on January 19, 2012, a period in excess of that allowed by the E-Plan. The licensee was informed that the issue of not completing an annual check of the emergency supplies as required by the E-Plan is a minor violation that will be followed by the NRC as an IFI and reviewed during an upcoming inspection (IFI 50-182/2013-201-06). Inventories of emergency equipment are now being conducted on an annual basis, this IFI will be closed.

c. Conclusion

The emergency preparedness program was conducted in accordance with the E-Plan. However, three IFIs were identified during a previous inspection associated with the failure to conduct required periodic CORO reviews of the E-Plan, failure to conduct emergency drills at the required frequency, and failure to conduct an annual inventory of emergency supplies. These IFI's will be closed.

7. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

The inspector reviewed the following selected maintenance logs and records to verify compliance with the requirements of TS 6.5.1.a:

- Maintenance Logbook from January 8, 2015, to the present
- Reactor Logbook No. 54, February 29, 2011, to November 30, 2011
- Reactor Logbook No. 55, November 30, 2011, to June 26, 2012
- Reactor Logbook No. 56, June 26, 2012, to the present
- Annual Operating Report for January 1, 2014 to December 31, 2014, dated March 30, 2015
- Annual Operating Report for January 1, 2015 to December 31, 2015, dated March 30, 2016

b. Observations and Findings

The inspector reviewed selected portions of the reactor and maintenance logbooks covering the interval of time since the previous inspection. Major maintenance activities were found documented with detail commensurate with the safety significance of the activity. The inspector noted corresponding entries in the reactor and maintenance logs allowing detail tracking of events. It was also noted that preventive maintenance was typically performed every 6 months.

The licensee had hired an outside contractor to assist with the restoration of all electronic equipment and procedures for effective maintenance. The new maintenance procedures were in depth and very detailed.

c. Conclusion

The licensee maintained records documenting all maintenance activities as required by TS.

8. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with requirements of TS 6.5.2.d:

- PUR-1 Procedures Manual
- PUR-1 Standard Operating Procedure 07-04, "Initial Fuel Assembly Loading Procedure," reviewed by CORO August 31, 2007
- Reactor Logbook No. 57, September 3, 2014, to September 29, 2015
- Reactor Logbook No. 58, September 29, 2015, to April 29, 2016

- Reactor Logbook No. 59, April 29, 2016, to the present
- PUR-1 Standard Operating Procedure 07-05, "Core Loading Procedure," reviewed by CORO September 7, 2007
- PUR-1 Standard Operating Procedure 07-01, "Partial or Complete Disassembly and Reassembly of the Core," reviewed by CORO September 1, 2007

b. Observations and Findings

Procedures for refueling, fuel movement, and TS-required fuel inspections and surveillances were reviewed and approved as required.

Fuel Inspection was conducted on May 5, 2015 and fuel inventory was conducted on June 11, 2015. Log entries clearly identified that a licensed SRO was present for all fuel movement activities.

c. Conclusion

Fuel handling activities were completed and documented as required by TS and facility procedures.

9. Exit Meeting Summary

The inspector reviewed the inspection results with members of licensee management and staff at the conclusion of the inspection on June 9, 2016. 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 Laboratory
D. Storz	Electronic Technician and Senior Reactor Operator
C. Townsend	Reactor Supervisor and Senior Reactor Operator

INSPECTION PROCEDURES USED

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

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-182/2013-201-01	IFI	Follow-up on the issue of conducting requalification written and operating tests.
50-182/2013-201-02	IFI	Follow-up on the issue of holding semiannual CORO meetings at the proper frequency as required by TS 6.2.3.
50-182/2013-201-03	IFI	Follow-up on the issue of submitting an annual report to the NRC each year as required TS 6.6.1.
50-182/2013-201-04	IFI	Follow-up on the issue of conducting a biennial review of the E-Plan as required by TS 6.2.6.
50-182/2013-201-05	IFI	Follow-up on the issue of conducting an annual drill as required by Section 9.2 of the E-Plan.
50-182/2013-201-06	IFI	Follow-up on issue of the completion of an annual check and verification of the emergency supplies as required Section 9.5 of the E-Plan.
50-182/2010-201-01	URI	Failure to have pen and ink temporary changes to procedures reviewed by the CORO.

Discussed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
CORO	Committee on Reactor Operations
E-Plan	Emergency Plan
IFI	Inspector Follow-up Item
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
PUR-1	Purdue University Reactor 1
Rev.	Revision
SRO	Senior Reactor Operator
TS	Technical Specifications
URI	Unresolved Item