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

October 30, 2019

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 SAFETY INSPECTION REPORT NO. 05000182/2019-202

Dear Dr. Bean:

From August 21-29, 2019, the U.S. Nuclear Regulatory Commission (NRC) conducted a non-routine, announced safety inspection at the Purdue University Reactor. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

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 selected examination of procedures and representative records, observations of activities, and interviews with personnel. Based on the results of this inspection, no findings of non-compliance 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 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).

Should you have any questions concerning this inspection, please contact Mr. William Schuster at 301-415-1590 or by electronic mail at William.Schuster@nrc.gov.

Sincerely,

***/RA/***

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

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

Enclosure:
As stated

cc: See next page

cc:

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Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
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SUBJECT: PURDUE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION SAFETY INSPECTION REPORT NO. 05000182/2019-202 DATE: OCTOBER 30, 2019

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

| | |
|---|---|
| Docket No.: | 50-182 |
| License No.: | R-87 |
| Report No.: | 05000182/2019-202 |
| Licensee: | Purdue University |
| Facility: | Purdue University Reactor |
| Location: | West Lafayette, Indiana |
| Dates: | August 21-29, 2019 |
| Inspector: | William Schuster |
| Accompanied by: | Michele DeSouza, Chief Examiner<br>Anthony Mendiola, Branch Chief |
| Approved by: | Anthony Mendiola, Chief<br>Research and Test Reactors Oversight Branch<br>Division of Licensing Projects<br>Office of Nuclear Reactor Regulation |

Enclosure

# EXECUTIVE SUMMARY

Purdue University
Purdue University Reactor
Inspection Report No. 05000182/2019-202

The primary focus of this announced inspection was the onsite review of selected aspects of the Purdue University (the licensee) research reactor facility safety program, including: (1) operating logs and records; (2) procedures; (3) requalification training; (4) surveillance and limiting conditions for operation; (5) committees, audits and reviews; and, (6) fuel handling logs and records. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with U.S. Nuclear Regulatory Commission (NRC) requirements.

Operations Logs and Records

- Records were found to be in conformance with the license, approved technical specification (TS), and administrative procedures.

Procedures

- Procedural review, revision, control, and implementation satisfied TS requirements.

Requalification Training

- Requalification activities satisfied regulatory and requalification program requirements.

Surveillance and Limiting Conditions for Operation

- Surveillance activities at the facility were completed within the TS-prescribed time frames.

Committees, Audits and Reviews

- The review functions performed by the Committee on Reactor Operations (CORO) satisfied TS requirements.

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**

The Purdue University Reactor (PUR-1) conducted restart, TS-required surveillances, and operator requalification activities following an extended facility shut down.

## 1. Operations Logs and Records

a. Inspection Scope (Inspection Procedure [IP] 69001, Section 02.02)

To verify compliance with the license, TS, and procedural requirements for records, the inspector reviewed select aspects of the licensee's program, including:

- Renewed Facility Operating License No. R-87, Docket No. 50-182
- "Technical Specifications for the Purdue University Reactor, PUR-1"
- Reactor Logbook No. 60, June 27, 2017, to present
- Select records, "Prestart Checklist and Reactor Operation Record"
- Select records, Factory Acceptance Tests
- Select records, Site Acceptance Tests
- Select records, Test Exception Reports, numbered 9000 through 9109

b. Observations and Findings

The inspector reviewed records from the digital instrumentation and control system replacement project. Specifically, the inspector examined acceptance testing for: physical inspection following installation; control algorithm; human machine interface function; and, rod drop timing. Changes to the project documentation was recorded and justified in test exception reports. The records reviewed indicated that the licensee performed the appropriate testing, received the appropriate level of CORO oversight, and received approval from the Facility Director prior to restart as required by License Condition 2.C.4.

c. Conclusion

Records were found to be in conformance with license, the approved TS, and administrative procedures.

## 2. Procedures

a. Inspection Scope (IP 69001, Section 02.03)

To verify compliance with the TS requirements for procedures, the inspector reviewed selected aspects of the licensee's program, including:

- "Technical Specifications for the Purdue University Reactor, PUR-1"
- "Purdue University Research Reactor Number One: Digital Instrumentation and Control Startup Plan and Checklist," August 2019
- Standard Operating Procedure, "Prestart Checklist"

- SOP, “Reactor Startup, Operation, Shutdown, and Securing Procedure”
- Select records, “Prestart Checklist & Reactor Operation Record,” dated from August 21-29, 2019

b. Observations and Findings

The inspector reviewed written procedures for core reloading, pre-start checklist, reactor startup, and TS-required surveillances. The inspector verified that procedures had been developed as required by TS 6.4, “Procedures.” The inspector also observed implementation of procedures during the PUR-1 restart. The procedures appeared to be appropriately detailed and effective guiding operators through licensed activities.

Additionally, the inspector discussed Inspector Follow-up Item (IFI) 50 182/ 2019-201-01, “Follow up on updates to TS required procedures,” with the licensee. Since this inspection focused on the procedures and activities required for restart, verification of the remaining TS-required procedures will occur during the next routine operations inspection. Therefore, this IFI will remain open.

c. Conclusion

Procedural review, revision, control, and implementation satisfied TS requirements.

## 3. Requalification Training

a. Inspection Scope (IP 69001, Section 02.04)

To verify compliance with the regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 55, “Operators’ Licenses,” and approved requalification program, the inspector reviewed select aspects of the licensee’s program, including:

- Operator Requalification Program for the PUR-1 Reactor Facility
- “Biennial Requal Program Records,” for the 2018/2019 cycle
- Individual data sheets for the 2018/2019 cycle
- Select records, “PUR-1 Operator Proficiency Written Exam”
- Reactor Logbook No. 60, June 27, 2017 to present

b. Observations and Findings

The inspector reviewed requalification records for one of the licensed senior reactor operators (SROs) at the facility. The inspector verified the licensed operator was in compliance with license requirements as specified in 10 CFR 55.53, “Conditions of licenses,” and was participating in the NRC-approved facility requalification program. During the inspection, a licensed SRO completed an annual operating test proctored by an NRC operator license examiner in support of the PUR-1 restart. The results of that operating test will be forwarded to the facility separately in accordance with the established operator licensing process.

Additionally, the inspector discussed IFI 50-182/2019-201-02, "Follow up on annual operating test and literature review," with the licensee. At the time of this inspection, the 2018/2019 requalification cycle was still in progress. Since this inspection focused on the requalification activities of one licensed SRO as required for restart, verification of the remaining requalification records will occur during the next routine operations inspection. Therefore, this IFI will remain open.

c. Conclusion

Requalification activities satisfied regulatory and requalification program requirements.

## 4. Surveillance and Limiting Conditions for Operation

a. Inspection Scope (IP 69001, Section 02.05)

To verify compliance with the TS requirements for surveillances and limiting conditions for operation, the inspector reviewed select aspects of the licensee's program, including:

- "Technical Specifications for the Purdue University Reactor, PUR-1"
- "Purdue University Research Reactor Number One: Digital Instrumentation and Control Startup Plan and Checklist," August 2019
- PUR-1 Maintenance Log
- PUR-1 [Planned Maintenance System (PMS)] Records & Description
- Select records, "Cycle Schedule" datasheet
- Select records, "Quarter #___ Schedule" datasheet
- Select records, "Prestart Checklist and Reactor Operation Record"
- Reactor Logbook No. 60, June 27, 2017, to present

b. Observations and Findings

During the inspection, the inspector observed the performance of deferred TS surveillances that were required to be performed prior to startup or in conjunction with the next facility startup. These surveillances were performed by following the startup plan and checklist, which included two methods of control rod worth measurement, excess reactivity measurement, shutdown margin measurement, and power calibration using gold foil irradiations.

c. Conclusion

Surveillance activities at the facility were completed within the TS-prescribed time frames.

## 5. Committees, Audits and Review

a. Inspection Scope (IP 69001, Section 02.09)

To verify compliance with the TS requirements for review and audit, the inspector reviewed select aspects of the licensee's program, including:

- "Technical Specifications for the Purdue University Reactor, PUR-1"

b. Observations and Findings

The inspector discussed IFI 50-182/2019-201-03, "Follow up on CORO meeting periodicity and audits," with the licensee. During this inspection, the inspector verified some of the CORO functions have been performed as required. Specifically, the CORO held several meetings to review and approve PUR-1 restart plans and procedures. However, at the time of this inspection, the facility operations audit had not been completed. Therefore, this IFI will remain open.

c. Conclusion

The review functions performed by the CORO satisfied TS requirements.

## 6. Fuel Handling Logs and Records

a. Inspection Scope (IP 69001, Section 02.12)

To verify compliance with TS requirements for the PUR-1 fuel, the inspector reviewed select aspects of the licensee's program, including:

- "Technical Specifications for the Purdue University Reactor, PUR-1"
- "Purdue University Research Reactor Number One: Digital Instrumentation and Control Startup Plan and Checklist," August 2019
- Reactor Logbook No. 60, June 27, 2017, to present
- PUR-1 Core Status Board

b. Observations and Findings

The inspector observed reassembly of the PUR-1 core and reviewed the startup plan, logs, and records. The inspector verified that procedures in use were reviewed and approved as required. The inspector observed that an SRO was present during the fuel movement activities as required by TS 6.1.c.2. The inspector verified that fuel handling tools were adequately controlled/secured when not in use.

c. Conclusion

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

## 7. Exit Interview

The inspection scope and results were summarized on August 29, 2019, with members of licensee management and CORO. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

## PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

| | |
|---|---|
| R. Bean | Director, Radiation Laboratories |
| C. Townsend | Reactor Supervisor |
| D. Storz | Senior Reactor Operator |

Other Personnel

| | |
|---|---|
| S. Revankar | Professor, Nuclear Engineering |
| J. F. Schweitzer | Director, REM and Radiation Safety Officer |
| M. Tang | Health Physicist, REM |

## INSPECTION PROCEDURES USED

| | |
|---|---|
| IP 69001 | Class II Non-Power Reactors |

## ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Discussed

| | | |
|---|---|---|
| 50-182/2019-201-01 | IFI | Follow up on updates to TS required procedures. |
| 50-182/2019-201-02 | IFI | Follow up on annual operating test and literature review |
| 50-182/2019-201-03 | IFI | Follow up on CORO meeting periodicity and audits |

Closed

None

## LIST OF ACRONYMS USED

| | |
|---|---|
| 10 CFR | Title 10 of the *Code of Federal Regulations* |
| CORO | Committee on Reactor Operations |
| IFI | Inspector Follow-up Item |
| IP | Inspection Procedure |
| NRC | U.S. Nuclear Regulatory Commission |
| PUR-1 | Purdue University Reactor |
| SROs | Senior Reactor Operators |
| TSs | Technical Specifications |