



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

July 29, 2021

Dr. Seungiin Kim, Reactor Director
Purdue University
The School of Nuclear Engineering
516 Northwestern Avenue
West Lafayette, IN 47906

SUBJECT: PURDUE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION SAFETY
INSPECTION REPORT NO. 05000182/2021203 AND NOTICE OF VIOLATION

Dear Dr. Kim:

From June 14 - 16 2021, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Purdue University Reactor facility. The enclosed report documents the inspection results, which were discussed on June 16, 2021, with you and 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 various activities, and interviewed personnel.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC regulatory requirements occurred. The violation was evaluated in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <https://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the enclosed inspection report. The violation is cited in the Notice because it constitutes a failure to meet regulatory requirements that has more than minor safety significance and the licensee failed to identify the violation.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC review of your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

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(s), 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). To the extent possible, your response should not include any personal privacy or proprietary information, so that it can be made available to the Public without redaction.

If you have any questions concerning this inspection, please contact Mr. Phil O'Bryan at 301-415-0266 or by electronic mail at Phil.OBryan@nrc.gov.

Sincerely,

Travis 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. 50-182
License No. R-87

Enclosures:
As stated

cc: w/enclosures: See next page

Purdue University

Docket No. 50-182

cc:

Mung Chiang, Dean of Engineering
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Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

SUBJECT: PURDUE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION SAFETY
INSPECTION REPORT NO. 05000182/2021203 DATED: JULY 29, 2021

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NOTICE OF VIOLATION

Purdue University
Purdue University Research Reactor

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

During a U.S. Nuclear Regulatory Commission (NRC) inspection conducted June 14 - 16, 2021, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Purdue University research reactor technical specifications (TS) Section 6.7.a, "Annual Operating Report," states in part, that "an annual report covering the operation of the reactor facility during the previous calendar year shall be submitted to the NRC." Paragraph 6 of TS 6.7.a states that the annual report to the NRC shall include "A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the licensee as measured at or before the point of such release or discharge." Section 6.b.i.I of TS 6.7.a states that "airborne waste (summarized on a monthly basis)" discharged for the reporting period shall be included in the annual report to the NRC. TS Section 6.7.a.6.b.i.I lists Argon-41 as a radioactive nuclide that shall be reported to the NRC in the Purdue University annual report.

Contrary to the above, Purdue does not measure or report to the NRC in its annual operating report the quantity of Argon-41 released from the Purdue University research reactor facility. Specifically, despite the fact that no Argon-41 measurement has been performed at the Purdue University research reactor, records dating to the 1980's indicate that Purdue has reported to the NRC in its annual operating reports that "no measurable amount of radioactive effluent was released to the environs beyond our effective control, as measured at or prior to the point of such release."

This is a Severity Level IV violation (Section 6.1).

Pursuant to the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) 2.201, "Notice of violation," Purdue University is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation," and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an Order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System), accessible from the NRC Web site at <https://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information.

If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

In accordance with 10 CFR 19.11, "Posting of notices to workers," you may be required to post this Notice within two working days of receipt.

Dated this 29th day of July, 2021.

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

Docket No.: 50-182

License No.: R-87

Report No.: 05000182/2021203

Licensee: Purdue University

Facility: Purdue University Reactor

Location: West Lafayette, Indiana

Dates: June 14 - 16, 2021

Inspector: Phil O'Bryan

Approved by: Travis 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

EXECUTIVE SUMMARY

Purdue University
Purdue University Reactor
Inspection Report No. 05000182/2021203

The focus of this routine, announced inspection was the onsite review of selected aspects of the Purdue University (the licensee) research reactor facility safety program, including: (1) organization and staffing; (2) procedures; (3) health physics; (4) emergency planning; and (5) transportation activities. The inspector found that 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, except where noted below.

Organization and Staffing

- The inspector found that the licensee's organization and staffing were consistent with the technical specification (TS) requirements.

Procedures

- The inspector found that written procedures were maintained in accordance with the TS and licensee administrative procedures.

Health Physics

- The inspector found that surveys, postings, and personnel dosimetry met regulatory requirements.
- The inspector found that radiation monitoring equipment was maintained and calibrated as required by TSs.
- The inspector found that calculations of effluents released from the facility did not satisfy license and regulatory requirements. See Section 4 of this report for details.

Emergency Planning

- The inspector found that the licensee maintained an effective emergency preparedness program through implementation of the emergency plan (EP) and the associated implementing procedures.

Transportation Activities

- The inspector found that radioactive material was transferred to the campus radioactive material license in accordance with the applicable regulations and licensee procedures.

REPORT DETAILS

Summary of Facility Status

The Purdue University research reactor was operated in support of training, experiments, and maintenance since the last routine inspection. During this inspection, the reactor was not operated.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69001, Section 02.01)

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

- TSs for the Purdue University reactor
- Purdue letter to the NRC dated May 7, 2021, "Update to Facility Personnel at Purdue University Reactor"
- Annual Reports for 2019 and 2020

b. Observations and Findings

The inspector found that the facility staffing changed since the previous inspection and was maintained as required by TS 6.1.c, "Staffing," for times that the reactor was not secured and when events required the presence of a senior reactor operator (SRO).

The inspector noted that there is currently no Reactor Supervisor (Level 3) meeting the qualification requirements of the Purdue TS due to the departure of the former Reactor Supervisor. The Purdue Reactor is currently shutdown and the person designated to become the Reactor Supervisor is in training. The inspector also noted that the Reactor Director (Level 2) performed the duties of the Reactor Supervisor, as allowed by TS.

c. Conclusion

The inspector found that TS requirements for organization and staffing were met.

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:

- TSs for the Purdue University reactor
- Purdue University Radiation Safety Manual
- Standard Operating Guideline (SOG)-W08, "Radioactive Waste Removal"
- Standard Operating Procedure (SOP)-201, "Reactor Room Survey"
- Committee on Reactor Operations (CORO) Minutes from 2019 to the present

b. Observations and Findings

The inspector verified that procedures were developed, reviewed, and approved in accordance with TS 6.4, "Procedures."

c. Conclusion

The inspector found that procedural review, revision, control, and implementation satisfied TS requirements.

3. Health Physics

a. Inspection Scope (IP 69001, Section 02.07)

To verify compliance with TS Section 6.3, TS Section 6.7, Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection against Radiation," the inspector reviewed selected aspects of:

- personnel dosimetry records for 2019, 2020, and to date in 2021
- environmental dosimetry records for 2019, 2020, and to date in 2021
- radiological signs and postings at the facility
- Purdue University Radiation Safety Manual
- SOG-W08, "Radioactive Waste Removal"
- SOP-201, "Reactor Room Survey"
- Purdue University reactor annual reports for 2018, 2019 and 2020
- CORO meeting minutes for 2019 to the present
- annual as low as reasonably achievable (ALARA) audit for 2020
- radiation and radioactive contamination surveys for 2019 to the present

b. Observations and Findings

(1) Surveys

The inspector reviewed radiation and contamination surveys of licensee-controlled areas for the past 2 years. The inspector determined that the results of these surveys were documented, reviewed, and evaluated, and corrective actions were taken when readings or contamination results exceeded set action levels.

(2) Postings and Notices

During tours of the facility, the inspector observed that postings and controls established for radiation, high radiation, contamination, and radioactive storage areas met the requirements of 10 CFR Part 20, Subpart J, "Precautionary Procedures." The inspector confirmed that personnel complied with the signs, postings, and controls.

Notice of Violation (NOV) 50-182/2020201-03, "Failure to Post a Radiation Area (10 CFR 20.1902(a))" was issued in December 2020 for not posting the reactor room a radiation area despite meeting the requirements for doing so. During the current inspection, the inspector found that all areas of the facility were posted correctly. This NOV is closed.

(3) Dosimetry

The inspector determined that the licensee used appropriate dosimetry for monitoring personnel radiation dose. Through direct observation the inspector determined that dosimetry use by facility personnel was in accordance with the university radiation protection requirements. Examination of the dosimetry results, indicating radiological exposures at the facility for the past 2 years, showed that all occupational doses were within 10 CFR Part 20 limits.

(4) Radiation Monitoring Equipment Use and Calibration

The inspector reviewed the use and calibration of radiation monitoring equipment. The inspector reviewed calibration records and determined that records were maintained as required, and that calibration frequencies met the requirements established in the applicable surveillance procedures. Through observations of activities at the facility, the inspector determined that monitoring equipment was used in accordance with facility procedures.

(5) Radiation Worker Training

The inspector determined that licensed operators at Purdue were tested annually on principles of health physics, and that personnel authorized to work with radioactive material under the campus material license received annual refresher training.

The inspector reviewed documentation of the training provided to Purdue staff members and the documents indicated that all current staff members received the required training. The inspector determined that the personnel training program satisfied requirements in 10 CFR 19.12, "Instruction to workers."

(6) Environmental and Effluent Monitoring

i. Observations

The inspector reviewed the area radiation monitors (ARMs) and the continuous air monitor (CAM) calibration records. The inspector verified that the ARMs and CAM were calibrated by licensee staff in accordance with procedures.

The inspector verified that there were no liquid releases from the facility to the sanitary sewer within the past 2 years. It was noted by

the inspector, that solid waste was transferred from the facility to the campus Radiological and Environmental Management department.

The inspector noted that onsite and off-site gamma radiation monitoring was completed using environmental dosimetry in accordance with the applicable university procedures. The data indicated that there were no unusual dose rates in the areas surrounding the Purdue reactor facility and that there were no measurable doses above any regulatory limits. These results were also appropriately reported in the facility annual reports

- ii. Unresolved Item (URI) 50-182/2019-201-01, Follow Up on Environmental Monitoring Thermoluminescent Dosimeter (TLD) Cycles.

URI 50-182/2019201-01 was opened in 2019 because, contrary to Purdue TS 4.7, Purdue monitored environmental TLDs less frequently than personnel TLDs. During the current inspection, the inspector found that Purdue corrected the issue and the issue was not greater than minor in significance. This URI is closed.

- iii. Notice of Violation 50-182/2021203-01, Violation of TS 6.7.a, "Annual Operating Report" Due to Failure to Measure and Report Argon-41 Effluents.

Purdue University research reactor TS Section 6.7.a, "Annual Operating Report," states in part, that "an annual report covering the operation of the reactor facility during the previous calendar year shall be submitted to the NRC." Paragraph 6 of TS 6.7.a states that the annual report to the NRC shall include "A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the licensee as measured at or before the point of such release or discharge." Section 6.b.i.I of TS 6.7.a states that "airborne waste (summarized on a monthly basis)" discharged for the reporting period shall be included in the annual report to the NRC. TS section 6.7.a.6.b.i.I lists Argon-41 as a radioactive nuclide that shall be reported to the NRC in the Purdue University annual report.

Contrary to the above, Purdue does not measure or report to the NRC in its annual operating report the quantity of Argon-41 released from the Purdue University research reactor facility. Specifically, despite the fact that no Argon-41 measurement has been performed at the Purdue University research reactor, records dating to the 1980's indicate that Purdue has reported to the NRC in its annual operating reports that "no measurable amount of radioactive effluent was released to the environs beyond our effective control, as measured at or prior to the point of such release."

The inspector found that Purdue relied on two pieces of information to conclude that they did not release measurable quantities of

Argon-41. The first is a calculation in the Purdue Safety Analysis Report (SAR) that concludes that Purdue would not exceed Argon-41 release limits if it operated continuously at up to 18 kilowatts. The inspector found that this calculation does not satisfy the TS requirement to measure radioactive effluents at or prior to the point of release.

The second piece of information Purdue relied on for not reporting Argon-41 release quantities was exposure data from TLDs used to satisfy TS 4.7, "Effluents." TS 4.7 requires Purdue to place TLDs inside of the reactor room and "at the exhaust location of the reactor facility which is representative of effluent release from the reactor facility." However, the inspector found that these TLDs were placed in locations that were exposed to direct radiation from the Purdue reactor (e.g. the reactor room walls), making their exposure readings meaningless for Argon-41 measurement. The inspector noted that, in early 2021, one TLD was moved to the exhaust stack outside of the reactor room, but Purdue has not correlated the exposure of this TLD to Argon-41 radioactivity quantities released.

(7) Facility Tours

The inspector toured the facility and found that control of radioactive material and control of access to radiation and high radiation areas were acceptable and in accordance with the regulations. As noted earlier, the postings and signs for these areas were appropriate. No problems were noted.

c. Conclusion

With the exception noted above, the inspector determined that the licensee's radiation protection program satisfied regulatory requirements.

4. Emergency Planning

a. Inspection Scope (IP 69001, Section 02.10)

The inspector reviewed selected aspects of the following to verify compliance with the Purdue University Reactor EP:

- EP for the Purdue University Reactor
- EP equipment storage
- EP training records
- Annual Reports for 2019 and 2020

b. Observations and Findings

The inspector found that EP training was conducted, drills were performed, emergency response call lists were maintained and posted, and emergency equipment was maintained and available as required by the EP and licensee procedures.

c. Conclusion

The inspector determined the emergency preparedness program was conducted in accordance with the EP.

5. Transportation Activities

a. Inspection Scope (IP 86740)

The inspector interviewed personnel and reviewed the following to verify compliance with regulatory and procedural requirements for transferred licensed material:

- Records of radioactive material shipments and transfer for 2019 and 2020
- SOG-W08, "Radioactive Waste Removal"

b. Observations and Findings

The inspector verified that radioactive material waste generated at the Purdue University reactor was transferred to the Purdue University campus material license. The inspector found that these transfers were performed in accordance with facility guidelines.

c. Conclusion

The inspector found that radioactive material transfers were completed in accordance with procedural requirements.

3. Exit Interview

The inspection scope and results were summarized on June 16, 2021, with members of licensee management. The inspector described the areas inspected and discussed the inspection findings.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

S. Kim	Reactor Director
T. Miller	Reactor Supervisor (in training)
D. Storz	Senior Reactor Operator

Other Personnel

J. Schweitzer	Radiation Safety Officer
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INSPECTION PROCEDURE USED

IP 69001	Class II Non-Power Reactors
IP 86740	Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-182/2021203-01	NOV	Violation of TS 6.7.a, "Annual Operating Report" Due to Failure to Measure and Report Argon-41 Effluents.
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Closed/Discussed

50-182/2019201-01	URI	Follow Up on Environmental Monitoring Thermoluminescent Dosimeter (TLD) Cycles.
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50-182/2020201-03	NOV	Failure to Post a Radiation Area (10 CFR 20.1902(a))
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