September 30, 2016

Lei Cao, Director
Nuclear Reactor Laboratory
Ohio State University
1298 Kinnear Road
Columbus, OH 43212

SUBJECT: OHIO STATE UNIVERSITY – U.S. NUCLEAR REGULATORY COMMISSION SAFETY INSPECTION REPORT NO. 50-150/2016-201

Dear Mr. Cao:

From August 29 – September 1, 2016, the U.S. Nuclear Regulatory Commission (NRC, or the Commission) conducted an inspection at the Ohio State University Nuclear Reactor Laboratory facility. The enclosed report documents the inspection results, which were discussed on September 1, 2016, 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 inspectors reviewed selected procedures and records, observed activities, and interviewed personnel. Based on the results of this inspection, no findings of significance 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 Ossy Font at (301) 415-2490 or by electronic mail at Ossy.Font@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. 50-150
License No. R-75

Enclosure:
As stated

cc: See next page

cc:

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

Docket No.:	50-150
License No.:	R-75
Report No.:	50-150/2016-201
Licensee:	Ohio State University
Facility:	Nuclear Reactor Laboratory
Location:	Columbus, Ohio
Dates:	August 29 – September 1, 2016
Inspectors:	Ossy Font Xiaosong Yin (trainee)
Approved by:	Anthony Mendiola, Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Ohio State University
Nuclear Reactor Laboratory
Report No. 50-150/2016-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the Ohio State University's (the licensee's) Class II research and test reactor safety program including: (1) procedures; (2) experiments; (3) radiation protection program; (4) design changes; (5) committees, audits, and reviews; and (6) transportation since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements. No violations or deviations were identified.

Procedures

- The procedural control and implementation program satisfied Technical Specification (TS) requirements.

Experiments

- Experiments were being reviewed and approved as required.

Radiation Protection Program

- The inspectors determined that the Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.

Effluents and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements.

- Liquid and airborne releases were within the specified regulatory and TS limits.

Design Changes

- Changes to the facility were being evaluated using the criteria specified in Title 10 of the *Code of Federal Regulations* 50.59, "Changes, tests and experiments," and were reviewed and approved by the Reactor Operations Committee (ROC) as required.

Committees, Audits, and Reviews

- Review, audit, and oversight functions required by the TSs were acceptably completed by the ROC.

Transportation of Radioactive Materials

- Radioactive material was being shipped in accordance with the applicable regulations.

REPORT DETAILS

Summary of Plant Status

The Ohio State University's (OSU's or the licensee's) 500 kilowatt (kW) open pool-type reactor continued to be operated in support of undergraduate instruction, laboratory experiments, reactor operator training, and various types of irradiation projects. During the inspection, the reactor was started up, operated at varying power levels up to 50 kW, and shut down as required.

1. Procedures

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

To ensure that the requirements of Technical Specification (TS) Section 6.3, "Procedures," were being met, the inspectors reviewed the following:

- Ohio State University Research Reactor (OSURR) Operations Logbook; Pages 7891-7989
- Nuclear Reactor Laboratory (NRL) Administrative Procedures (AP) 02, "General Rules"
- NRL AP 06, "Format for Writing, Revising, and Approving Procedures"
- NRL AP 07, "Review of Procedures"
- NRL AP 08, "NRL Audit"
- NRL AP 14, "OSURR Modification Request"
- NRL AP 15, "Logging Unscheduled Shutdowns"
- NRL AP 16, "50.59 Screening and Evaluation"
- NRL radiation safety procedure (RS) 01, "Labeling and Storage of Radioactive Materials"
- NRL RS 02, "Radioactive Waste Disposal"
- NRL RS 08, "NRL Smear Survey"
- NRL RS 15, "Radiation Safety Instruction"
- NRL RS 11, "Routine Shipment of Radioactive Material"
- NRL RS 17, "Argon 41 Release Calculation"
- NRL RS 18, "Environmental Monitoring"
- Outage Procedures
- Biennial Review

b. Observations and Findings

The inspectors determined that written procedures were available for the activities delineated in TS Sections 6.3.1 and 6.3.2. New procedures or changes to existing procedures were reviewed and approved by the Reactor Operations Committee (ROC) as required. Procedures were

typically reviewed on a rotating basis such that all were reviewed biennially in accordance with procedure AP-06 and updated as needed. The ROC was kept abreast of the results of these reviews. The licensee used Attachment C to procedure AP-06, "Procedure Change Sheets," to document changes and the reason for the change. It was noted that the latest review conducted by NRL staff of the General Reactor Operations and Maintenance Procedures (OM), RS, and Instrumentation Use and Maintenance had been completed on May 16, 2016.

Outage procedures were developed for a maintenance outage which required draining the pool for entry and lowering of personnel. The radiation safety group was included and time limits were implemented to reduce exposure. These procedures were appropriate for the work performed.

c. Conclusion

The procedural control and implementation program satisfied TS requirements.

2. Experiments

a. Inspection Scope (IP 69001)

To ensure that the requirements of TS 6.4, "Experiment Review and Approval," were being met, the inspectors reviewed the following:

- Request for Reactor Operations forms for 2015 through 2016 to date
- "Annual Report for The Ohio State University Research Reactor, License R-75, Docket 50-150," for 2014 through 2015, dated September, 2015
- NRL AP 03, "Filing Requests for Reactor Operations"
- Form AP 03 Attachment D, "Request for Reactor Operation"
- NRL AP 04, "Approval of Request for Reactor Operations"
- NRL OM 03, "Experimental Facilities"
- Request for Reactor Operations Forms for 2014, 2015, and 2016

b. Observations and Findings

Experiments at the OSURR were initiated by the completion of a six-part form called a "Request for Reactor Operation." In most instances the requests were completed by a research consultant (i.e., a senior reactor operator (SRO)) at the NRL with input from the experimenter as needed. NRL AP-04, the procedure for approving reactor operations, listed ten items that were reviewed in order for the request to be approved. The procedure also provided a list of approved types of experiments, which were experiments that had previously been approved by the ROC. "Routine" or "standard" experiments (ones similar to those that were listed as approved experiments in AP-04) were generally reviewed and approved by a

SRO, typically the Associate Director of the facility. Any "new" experiments were reviewed and approved by the ROC.

c. Conclusion

Experiments were being reviewed and approved as required.

3. Radiation Protection Program

a. Inspection Scope (IP 69001)

To ensure that the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection against Radiation," and TS 3.3.5, "Primary and Secondary Coolant Activity Limits," and 3.6 and 4.6, "Radiation Monitoring Systems and Radioactive Effluents," were being met, the inspectors reviewed the following:

- Calibration of radiation monitoring instruments
- Environmental dosimetry results for 2015 to the present
- Personnel monthly dosimetry results for 2015 to the present
- Reactor Building Smear Survey Forms for 2015 to the present
- NRL Monthly Inspection Forms, dated January 2015 to the present
- Weekly Reactor Building Area Radiation Survey forms from January, 2015 to the present
- Effluent monitor calibration records for 2015 and 2016
- Particulate Air Sample Data Sheets for 2015 through the present
- Airborne release information documented in the OSU NRL Annual Reports for the period from July 1, 2014, through June 30, 2015
- NRL AP 02, "General Rules"
- NRL RS 03, "Calibrating Gaseous Effluent Monitor"
- NRL RS 04, "Particulate Air Monitoring"
- NRL RS 06, "Annual Radiation Monitor Calibration"
- NRL RS 08, "NRL Smear Survey"
- NRL RS 09, "Area Radiation Surveys"
- NRL RS 15, "Radiation Safety Instruction"
- NRL RS 16, "Dosimeter Calibration"
- NRL RS 17, "Ar-41 Release Calculations"
- NRL RS 18, "Environmental Monitoring"
- Argon-41 (Ar-41) Release Records (Daily) for 2015 and 2016

b. Observations and Findings

The licensee's radiation protection program was acceptably established in the OSU Radiation Safety Guidebook and Records Manual and in the Radiation Safety Standards for the OSU, as well as through the facility procedures. The inspectors verified that the OSU radiation protection program was being reviewed

annually as required. Part of the annual OSU NRL audit ensured that the radiation protection program at the facility was being conducted as required by the applicable procedures. No deficiencies related to the radiation protection program at the OSU NRL were identified during audits of the program.

The facility radiation protection program required that all personnel who had unescorted access to the reactor bay (a radiation area) were required to receive training in radiation protection, policies, procedures, requirements, and facilities prior to entry. An interactive computer-based short course, which consisted of six modules and was offered by the Radiation Safety Section of the OSU campus Office of Environmental Health and Safety (EH&S), provided the initial training. Completion of an annual lecture and short test given by OSURR personnel was required for continued access to the reactor bay. The training covered the topics required to be taught in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations.

The licensee received radiological support from the EH&S. They performed specific monthly and quarterly inspections and surveys of the reactor and the licensee's controlled areas conforming to the campus safety program. The inspectors also reviewed the weekly radiation surveys by NRL staff. The results were documented on the appropriate forms and evaluated as required. The number and location of survey points was adequate to characterize the radiological conditions at the facility.

The inspectors toured the reactor room and the accompanying laboratories. Control of radioactive material and control of access to radiation and high radiation areas was acceptable. The inspectors observed that caution signs, postings, and controls in the restricted or controlled areas were acceptable for the hazards involving radiation, high radiation, and contamination and were posted as required by 10 CFR Part 20, "Standards for Protection against Radiation," Subpart J. Additionally, copies of current notices to workers were posted in the facility including a copy of U.S. Nuclear Regulatory Commission (NRC) Form 3, "Notice to Employees," that was posted at the facility as required by 10 CFR 19.11, "Posting of notices to workers," was the current version.

The licensee used a National Voluntary Laboratory Accreditation Program accredited vendor, Mirion, to process personnel dosimetry. Through direct observation, the inspectors determined that dosimetry was acceptably used by facility personnel. An examination of the records for the inspection period showed that all exposures were within NRC limits and within licensee action levels.

Additionally, a Radiation Work Permit was issued for the reactor pool maintenance outage previously mentioned. Digital dosimetry was used and additional surveys were performed.

The calibration of portable survey meters and friskers was typically completed by the EH&S office while fixed radiation detectors and air monitoring instruments were calibrated by OSURR personnel at the facility. The calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Calibration frequency of the portable and fixed meters and monitors met the requirements established in the applicable procedures and records were being maintained as required.

All gaseous releases from the facility were measured with a gaseous effluent monitor. As indicated in the licensee's annual reports, the release of Ar-41 from the facility for the previous 2 years was less than the limit specified in 10 CFR Part 20. The licensee also used the Environmental Protection Agency computational code COMPLY to demonstrate that releases were in compliance with 10 CFR 20.1101, "Radiation protection programs," paragraph (d). There was no liquid release from the facility during the 2015-2016 2-year period reviewed. It was noted that the licensee's solid radioactive material continued to be transferred to the EH&S for storage and/or disposal.

TS 3.5, Specification (1) requires that "An exhaust fan with a capacity of at least 1000 cubic feet per minute shall be operable whenever the reactor is operating." However, for past decades there have been no records or knowledge of what the exhaust fan cubic feet per minute (CFM) rate actually is. There were no exhaust fan rates measured nor recorded for past memorable period of time. With this finding, NRC inspectors discussed the potential of this deficiency might lead to: (1) violations of TSs if the fan rate discovered is lower than 1,000 CFM; (2) administrative violation if the fan is operating at 1,000 CFM but no procedures in place to ensure this is true; (3) the fan is operating at a CFM greater than 1,000 which could lead to inaccurate off-site effluent release estimates since all off-site effluent releases were based (partially) on a 1,000 CFM release rate. The inspectors opened inspector follow-up item (IFI) 50-150/2016-201-01 to follow up on the measurement of the exhaust fan rate.

c. Conclusion

The inspectors determined that the radiation protection program being implemented by the licensee satisfied regulatory requirements.

4. Design Changes

a. Inspection Scope (IP 69001)

To ensure that the requirements of 10 CFR 50.59, "Changes, tests and experiments," and TS 6.2, "Review and Audit," were being met, the inspectors reviewed the following:

- NRL AP-14, "OSURR Modification Requests,"
- NRL AP-14, "OSURR Modification 10 CFR 50.59 Evaluation (Attachment B)
- "Annual Report for The Ohio State University Research Reactor, License R-75, Docket 50-150," for 2014/2015, dated September, 2015
- Facility configuration and associated records
- Facility design change records for the past two years
- Completed "OSURR Modification Request" forms Nos. 66, 68, and 77

b. Observations and Findings

Facility design changes were controlled and implemented through NRL AP-14. The inspectors reviewed "OSURR Modification Request" forms since the last inspection in this area, the associated 10 CFR 50.59 evaluations, and the corresponding design change packages concerning the latest facility changes. From these reviews, the inspectors determined that the facility design change evaluations contained adequate supporting documentation and information. Additionally, the inspectors found that the 10 CFR 50.59 reviews conducted by the ROC were focused on safety and met Technical Specification and OSURR procedural requirements. Post-installation verification testing of the changes made to systems or equipment was adequately documented. Procedure and drawing changes were included in the change packages and were consistent with the requirements for facility changes.

c. Conclusion

Changes to the facility were being evaluated using the 10 CFR 50.59 criteria and were reviewed and approved by the ROC as required.

5. Committees, Audits and Review

a. Inspection Scope (IP 69001)

To ensure that the requirements of TS Section 6.2, "Review and Audit," were being met, the inspectors reviewed the following:

- ROC membership and qualifications
- ROC meeting minutes for the past two years
- Audit of the NRL Operations for calendar year 2014 and 2015
- "Annual Report for The Ohio State University Research Reactor, License R-75, Docket 50-150," for 2014/2015, dated September, 2015
- NRL AP-08, "NRL Audit"

b. Observations and Findings

The composition of the ROC and the meeting frequency satisfied the requirements of TS 6.2.1 and 6.2.2. The minutes of these meetings demonstrated that the ROC provided the review and conducted the audits required by the TS 6.2.3 and 6.2.4.

Issues brought up by the ROC were resolved in an appropriate time frame and were noted in ROC meeting minutes. The ROC provided adequate oversight and direction for the safe operation of the facility.

c. Conclusion

Review and oversight functions required by the TSs were acceptably completed by the ROC.

6. Transportation

a. Inspection Scope (IP 69001)

To ensure compliance with regulatory and procedural requirements for transferring or shipping licensed radioactive material, the inspectors reviewed the following:

- Selected records of radioactive material shipments
- State and NRC licenses for receivers of shipments
- NRL RS-11, "Routine Shipment of Radioactive Material"
- "White and Herminhuysen Radiation Shipment Training Records"

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspectors determined that the licensee had shipped various types of radioactive material since the last previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. All radioactive material shipment records reviewed by the inspectors had been completed in accordance with Department of Transportation (DOT) and NRC regulatory requirements.

The inspectors verified that the licensee maintained a copy of the license to possess radioactive material of each recipient as required and that the license was verified to be current prior to initiating a shipment to that entity. EH&S training of the staff members responsible for shipping the material was also reviewed. The inspectors verified that the shipper's training met DOT requirements.

c. Conclusion

Radioactive material was shipped in accordance with the applicable regulations and licensee procedures.

8. Exit Interview

The inspection scope and results were summarized on September 1, 2016, with members of licensee management. The inspectors described the areas inspected and discussed in detail the inspection findings.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

L. Cao	Director, Nuclear Reactor Laboratory
A. Kauffman	Associate Director, Nuclear Reactor Laboratory and SRO
K. Herminghuysen	SRO
S. White	SRO

Other Personnel

D. Konate	RSO, Facilities Operation and Development, EH&S
J. McGuire	Assistant RSO, Facilities Operation and Development, EH&S

INSPECTION PROCEDURES USED

IP 69001	Class II Non-Power Reactors
IP 86740	Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

IFI 50-150/2016-201-01	Follow up on the measurement of the exhaust fan rate required in TS 3.5, Specification (1).

Closed

None

Discussed

LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
AP	Administrative Procedure
Ar-41	Argon-41
EH&S	Office of Environmental Health and Safety
IP	Inspection Procedure
kW	Kilowatt
NRC	U.S. Nuclear Regulatory Commission
NRL	Nuclear Reactor Laboratory
OM	Operations and Maintenance Procedure
OSU	Ohio State University
OSURR	Ohio State University Research Reactor
RS	Radiation Safety Procedure
ROC	Reactor Operations Committee
SRO	Senior Reactor Operator