



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

August 2, 2023

Mr. Ethan Taber, Reactor Manager
Missouri University of Science
and Technology
Nuclear Reactor Facility
250 West 13th Street
Rolla, MO 65409-0630

SUBJECT: BOARD OF CURATORS OF THE UNIVERSITY OF MISSOURI – U.S. NUCLEAR
REGULATORY COMMISSION SAFETY INSPECTION REPORT
NO. 05000123/2023201

Dear Mr. Taber:

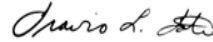
From May 16-18, 2023, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Missouri University of Science and Technology Research Reactor. The enclosed report presents the results of that inspection, which were discussed on May 18, 2023, with you and members of your staff.

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, 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 Publicly Available Records component of the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

If you have any questions concerning this inspection, please contact Juan Arellano at (301) 415-0477, or by email at Juan.Arellano@nrc.gov.

Sincerely,



Signed by Tate, Travis
on 08/02/23

Travis L. 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. 50-123
License No. R-79

Enclosure:
As stated

cc: GovDelivery Subscribers

SUBJECT: BOARD OF CURATORS OF THE UNIVERSITY OF MISSOURI – U.S. NUCLEAR
REGULATORY COMMISSION SAFETY INSPECTION REPORT
NO. 05000123/2023201 DATED: AUGUST 2, 2023

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

Docket No.: 50-123

License No.: R-79

Report No: 05000123/2023201

Licensee: Board of Curators of the University of Missouri

Facility: Missouri University of Science and Technology Research Reactor

Location: Rolla. MO

Dates: May 16-18, 2023

Inspector: Juan Arellano

Approved by: Travis L. 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

Enclosure

EXECUTIVE SUMMARY

Board of Curators of the University of Missouri
Missouri University of Science and Technology Research Reactor
Inspection Report No. 05000123/2023201

The primary focus of this routine announced inspection was the onsite review of selected aspects of the Board of Curators of the University of Missouri's (the licensee) safety program, including: (1) organization and staffing; (2) procedures; (3) experiments; (4) health physics (HP); (5) committees, audits and review; and (6) transportation of radioactive materials. The U.S. Nuclear Regulatory Commission (NRC) staff determined that the licensee's program was acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

Organization and Staffing

- The inspector determined that the licensee's organization and staffing complied with the technical specifications (TSs).

Procedures

- The inspector determined that procedures were controlled, maintained current, implemented, and followed in compliance with TS and license requirements.

Experiments

- The inspector determined that experiments were reviewed, approved, and conducted in accordance with TS, procedural, and regulatory requirements.

Health Physics

- The inspector determined that the licensee's HP program was conducted in accordance with TS, procedural, and regulatory requirements.

Committees, Audits and Reviews

- The inspector determined that the licensee's oversight programs were conducted in accordance with TS and procedural requirements.

Transportation Activities

- The inspector determined that the licensee's radioactive material was transferred to the campus radioactive material license in accordance with licensee procedures and applicable regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The licensee's 200-kilowatt research reactor continues to be operated in support of education, experiments, training, and surveillance. During this inspection, the reactor was operated for demonstration purposes.

1. Organization and Staffing

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

The inspector observed a reactor startup and reviewed the following to verify compliance with the TS requirements for organization and staffing:

- facility email, "LEVEL 1 PERSONNEL CHANGE AT THE MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY REACTOR," dated October 17, 2022
- Radiation Safety Committee (RSC) minutes dated September 14, 2022
- "Missouri Science & Technology" reactor logbook 19
- Missouri University of Science and Technology Nuclear Reactor (MSTR) Facility annual report 2021 - 2022
- standard operating procedure (SOP) 102, "Pre-Startup Checklist Procedure," dated September 26, 2022
- SOP 103, "Reactor Startup to Low Power," dated December 9, 2022
- select pre-startup checklists performed from 2023 - present

b. Observations and Findings

The inspector found that the facility staffing changed since the previous inspection and was maintained as required by TS 6.1.3 for times that the reactor was not secured and when events required the presence of a senior reactor operator.

c. Conclusion

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

2. Procedures

a. Inspection Scope (IP 69001, Section 02.03)

The inspector reviewed various procedures and observed their implementation, including a reactor startup and reactor shutdown. The inspector also reviewed the following regarding the licensee's procedures to ensure that the requirements of the licensee's administrative procedures and TS 6.4 were met:

- licensed operator procedure changes form
- SOP 104, "Reactor Power Changes and Stable Operations," dated September 27, 2022
- SOP 105, "Reactor Shutdown and Shutdown Checklist," dated September 26, 2022

- SOP 106, "Restart of Reactor," dated September 26, 2022
- SOP 150, "Response to Alarms," dated February 28, 2022
- SOP 207, "Fuel Handling," dated September 30, 2022
- SOP 507, "Emergency Procedures - Administrative Responsibilities," dated March 8, 2022
- SOP 806, "Temperature Channel," dated November 5, 2021
- SOP 812, "Confinement and Ventilation System Check," dated May 25, 2022
- SOP 818, "Function Test of the Building Security System," dated March 29, 2022
- SOP 819, "Spectroscopy Detector Calibration," dated September 17, 2021

b. Observations and Findings

The inspector observed that the licensee maintained written procedures covering the areas specified in TS 6.4. The inspector found that the procedures in use by the licensee were current, reviewed and approved as required by TS 6.4, able to be implemented as intended, and adhered to by reactor personnel.

c. Conclusion

The inspector determined that procedures were controlled, maintained current, implemented, and followed in compliance with TS and license requirements.

3. Experiments

a. Inspection Scope (IP 69001, Section 02.06)

The inspector reviewed the following to ensure that experiments were reviewed and conducted as required by TS 3.7 and 6.5:

- "Missouri Science & Technology" reactor logbook 19
- "Missouri Science & Technology" reactor logbook 20
- irradiation request forms performed from 2021 - present
- SOP 702, "Irradiation Request Forms," dated August 9, 2016
- SOP 710, "Insertion and Removal of Experiments," dated March 30, 1994
- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests and experiments," screening and evaluation documentation 23-05

b. Observations and Findings

The inspector found that experiments were reviewed and approved as required by TS 6.5 and 10 CFR 50.59. The inspector also found that experiments were conducted in accordance with the licensee's procedures and TS 3.7.

c. Conclusion

The inspector determined that experiments were reviewed, approved, and conducted in accordance with TS, procedural, and regulatory requirements.

4. Health Physics

a. Inspection Scope (IP 69001, Section 02.07)

The inspector toured the facility and observed radiological signs and postings. The inspector also reviewed the following to ensure the licensee's HP program adheres to the requirements of 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," 10 CFR Part 20, "Standards for Protection against Radiation," and TS 3.6 and 4.6:

- safety analysis report for the MSTR
- SOP 654, "Measurement of ⁴¹Ar Concentration in the Reactor Building Air," dated October 23, 2013
- SOP 654, "Measurement of ⁴¹Ar Concentration in the Reactor Building Air," dated September 17, 2021
- SOP 814, "AMS-4 Calibrations," dated May 25, 2022
- SOP 655, "Radiation Area Monitor (RAM) Calibrations," dated November 18, 2014
- argon (Ar)-41 analysis performed September 22, 2021
- MSTR Ar-41 analysis/report review
- certificate of calibration for standard reference source Na-22
- Ar-41 measurement log sheet performed 2021
- select, "Missouri University of Science and Technology Reactor Building Area Contamination Survey," performed from 2021 - present
- select, "Missouri University of Science and Technology Reactor Building Area Radiation Survey," performed from 2021 - present
- survey instrument calibration sheets performed from 2021 - present
- radiation area monitor calibration forms performed from 2021 - present
- select personnel dosimetry records from 2021 - present
- select environmental dosimetry records from 2021 - present
- select Ar-41 release monthly air reports performed from 2021 - present
- annual radiation training material
- liquid effluent releases from 2021 - present
- AMS-4 calibration log sheet performed 2022
- annual checklist sheets performed 2021 - present

b. Observations and Findings

The inspector found that practices regarding the use of dosimetry, radiation monitoring equipment, placement of radiological postings, posting of notices, use of protective clothing, and the handling and storing of radioactive material or contaminated equipment was in accordance with regulations and the licensee's radiation protection program. The inspector found that the licensee met the regulatory requirements concerning radiological effluent releases and radiation survey, sampling, and monitoring. The inspector also found that training was conducted for radiation workers and as low as reasonably achievable (ALARA) principles were implemented as required by licensee procedures.

The NRC staff issued a notice of violation (NOV) 05000123/2021201-01 on June 28, 2021 (Agencywide Documents Access and Management System Accession

No. ML21160A042). This was due to errors in experimental verification methodology which led the licensee to fail to conduct a valid experimental verification of airborne radioactive effluent values. During this inspection, the inspector reviewed the licensee's implementation of corrective actions associated with the violation. The inspector noted that the licensee corrected Ar-41 experimental verification deficiencies with an updated procedure, created an administrative frequency of the experiment to be performed every 3 years, and created a corrective actions program to manage issues at the facility. The experimental verification of airborne effluents was performed September 22, 2021. The inspector verified that the RSC reviewed and approved the corrective actions. Based upon this follow-up, the inspector found the corrective action adequate; therefore, the NOV is closed.

c. Conclusion

The inspector determined that the licensee's HP program was conducted in accordance with TS, procedural, and regulatory requirements.

5. Committees, Audits and Reviews

a. Inspection Scope (IP 69001, Section 02.09)

The inspector reviewed the following to ensure that committees, audits, and reviews were conducted as required by the licensee's procedures and TS 6.2:

- RSC minutes dated May 12, 2021
- RSC minutes dated September 16, 2021
- RSC minutes dated December 14, 2021
- RSC minutes dated March 15, 2022
- RSC minutes dated June 13, 2022
- RSC minutes dated September 14, 2022
- RSC minutes dated December 7, 2022
- RSC minutes dated March 22, 2023
- 2022 radiation protection and ALARA program audit for the MSTR
- 2021 radiation protection and ALARA program audit for the MSTR
- select "Missouri S&T Monthly Reactor Health Physics Audit," performed from 2021 -present
- annual TS audit dated November 30, 2022
- annual TS audit dated November 30, 2021

b. Observations and Findings

The inspector found that the licensee's reactor oversight committee met and provided reviews as required by the TS. The inspector also found that problems identified from the licensee's required reviews and audits were resolved in accordance with the licensee's procedures and TS.

c. Conclusion

The inspector determined that the licensee's oversight programs were conducted in accordance with TS and procedural requirements.

6. Transportation Activities

a. Inspection Scope (IP 86740)

The inspector reviewed the following to ensure the licensee's program for transporting radioactive materials met NRC and Department of Transportation requirements:

- reactor material transfer forms performed from 2021 - present
- SOP 603, "Release of By-Product Materials on Campus," dated April 24, 1995
- SOP 604, "Radioactive waste handling," dated October 13, 2014

b. Observations and Findings

The inspector found that the licensee's radioactive material was transferred to the Missouri University of Science and Technology campus material license. The inspector found that these transfers were performed in accordance with Environmental Health and Safety and facility procedures.

c. Conclusion

The inspector determined that radioactive material transfers were made in accordance with applicable procedures and regulatory requirements.

7. Exit Interview

The inspection scope and results were summarized on May 18, 2023, with members of licensee management and staff. The inspector described the areas inspected and discussed the inspection results. The licensee acknowledged the results of the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

| | |
|--------------|---|
| J. Graham | Facility Director |
| E. Taber | Reactor Manager |
| M. Bresnahan | Director of Environmental Health and Safety |
| A. Skye | Reactor Operator |

INSPECTION PROCEDURES USED

| | |
|----------|---|
| IP 69001 | Class II Research and Test Reactors |
| IP 86740 | Inspection of Transportation Activities |

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

| | |
|---------------------|--|
| 05000123/2021201-01 | NOV TS 4.6.2, "Radioactive Effluents," Due to Testing and Calculation Errors |
|---------------------|--|

Discussed

None