

May 3, 2018

Mr. Matthew Sanford  
Interim Reactor Facility Director  
University of Missouri-Columbia  
Research Reactor Center  
1513 Research Park Drive  
Columbia, MO 65211

SUBJECT: UNIVERSITY OF MISSOURI-COLUMBIA – U.S. NUCLEAR REGULATORY  
COMMISSION ROUTINE INSPECTION REPORT NO. 50-186/2017-203

Dear Mr. Sanford:

From October 10-12, 2017, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your University of Missouri-Columbia Research Reactor. The enclosed report presents the results of that inspection, which were discussed on October 12, 2017, with 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 selective 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 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).

If you have any questions concerning this inspection, please contact Johnny Eads at 301-415-0136, or by electronic mail at [Johnny.Eads@nrc.gov](mailto:Johnny.Eads@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. 50-186  
License No. R-103

Enclosure:  
As stated

cc: See next page

University of Missouri-Columbia

Docket No. 50-186

cc:

Les Foyto, Associate Director  
Reactor and Facilities Operations  
University of Missouri – Columbia  
Research Reactor Center  
1513 Research Park Drive  
Columbia, MO 65211

Homeland Security Coordinator  
Missouri Office of Homeland Security  
P.O. Box 749  
Jefferson City, MO 65102

Planner, Dept of Health and Senior Services  
Section for Environmental Public Health  
P.O. Box 570  
Jefferson City, MO 65102

Deputy Director for Policy  
Department of Natural Resources  
1101 Riverside Drive  
Fourth Floor East  
Jefferson City, MO 65101

A-95 Coordinator  
Commissioner's Office  
Office of Administration  
P.O. Box 809  
State Capitol Building, Room 125  
Jefferson City, MO 65101

Planning Coordinator  
Missouri Department of Natural Resources  
1101 Riverside Drive  
Jefferson City, MO 65101

Test, Research and Training  
Reactor Newsletter  
P.O. Box 118300  
University of Florida  
Gainesville, FL 32611

SUBJECT: UNIVERSITY OF MISSOURI-COLUMBIA – U.S. NUCLEAR REGULATORY  
COMMISSION ROUTINE INSPECTION REPORT NO. 50-186/2017-203  
DATE: MAY 3, 2018

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

Docket No. 50-186

License No. R-103

Report No. 50-186/2017-203

Licensee: University of Missouri - Columbia

Facility: University of Missouri Research Reactor

Location: Research Park  
Columbia, Missouri

Dates: October 10-12, 2017

Inspector: Johnny Eads

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

Enclosure

## **EXECUTIVE SUMMARY**

University of Missouri-Columbia  
University of Missouri Research Reactor  
Inspection Report No. 50-186/2017-203

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Missouri-Columbia (the licensee's) 10 Megawatt Class I research reactor facility safety programs including: (1) organizational structure and staffing, (2) reactor operations, (3) operator requalification, (4) maintenance and surveillance, (5) fuel handling, and (6) emergency preparedness. The licensee's programs were acceptably directed toward the protection of public health and safety, and generally in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

### Organizational Structure and Staffing

- The organizational structure and staffing were consistent with technical specification (TS) requirements.
- Staffing was as required by the TSs and appeared to be adequate for safe operation of the reactor facility.

### Reactor Operations

- Reactor operations were conducted in accordance with written procedure and were acceptable.
- Operations shift turnovers and operator cognizance of facility conditions were acceptable.
- Various daily and weekly meetings were being held to ensure proper planning and preparation.
- The corrective action program implemented by the licensee was functioning as designed.

### Operator Requalification

- Operator requalification was being completed as required by the requalification program and the program was being maintained up-to-date.
- Operators were receiving their biennial physical examinations as required.

### Maintenance and Surveillance

- The work control program established and implemented by the licensee was being used to effectively complete maintenance activities at the facility.
- The surveillance program currently in use by the licensee satisfied TS requirements.

### Fuel Handling

- Fuel movements were conducted in accordance with TS and procedural requirements.
- Fuel inspections were being completed as required.

### Emergency Preparedness

- The emergency preparedness program was conducted in accordance with the emergency plan (E-Plan).
- Training for all facility personnel was being conducted annually as required.
- Emergency response equipment was available and was being maintained and inventoried as required.
- Emergency drills were being conducted annually as required by the E-Plan and critiques were held following the drills.
- Support organizations were actively participating biennially in the emergency drills.

## REPORT DETAILS

### **Summary of Plant Status**

The University of Missouri-Columbia (the licensee) continued to operate the 10 Megawatt research and test reactor in support of isotope production, silicon irradiation, reactor operator (RO) training, and various types of research. During the inspection, the reactor was operated following the weekly maintenance shutdown, to support laboratory experiments and product irradiation.

#### **1. Organizational Structure and Staffing**

##### **a. Inspection Scope (Inspection Procedure (IP) 69006)**

To verify that the licensee was complying with the requirements specified in Section 6.1 of the University of Missouri-Columbia Research Reactor (MURR) TSs, issued January 4, 2017, the inspector reviewed selected aspects of the following:

- MURR organization and staffing
- Management and staff responsibilities outlined in the TS
- MURR control room logbooks for selected periods in 2017

##### **b. Observations and Findings**

The inspector noted that the organizational structure remained unchanged since the last inspection in the area of reactor operations. The inspector reviewed the qualifications of the staff and found that they satisfied TS requirements.

Through a review of selected reactor operation logs for selected periods in 2017, and through interviews with operations personnel, the inspector determined that the licensee continued to operate with five crews on a four-shift rotation. This allowed time for the "extra" crew to have additional training and procedure review on a rotating basis. Each operating crew on shift was staffed with two or three licensed individuals and one or more operator trainees. Operations shifts continued to be scheduled for a period of 12 hours.

TS Section 6.1.c., required that there be two facility staff personnel at the facility during reactor operations. The inspector verified that staffing during reactor operations satisfied this requirement.

##### **c. Conclusion**

The MURR organizational structure and staffing were consistent with the requirements of TS 6.1.

## **2. Reactor Operations**

### **a. Inspection Scope (IP 69006)**

To verify that the licensee was operating the reactor, communicating plant information, and implementing the corrective action program (CAP) in accordance with TS Section 3, and procedural requirements, the inspector reviewed selected portions of the following:

- Selected MURR console watch logbooks from 2017
- Selected MURR control room logbooks from 2017, and the associated forms including: FM-43, "Nuclear and Process Data," FM-55, "Startup Nuclear Data;" and FM-56, "Reactor Routine Patrol,"
- MURR Reactor Operations Annual Report for the period from January 1, 2016 through December 31, 2016.

### **b. Observations and Findings**

#### **(1) Reactor Operations**

The inspector observed facility activities on various occasions during the week including a reactor start-up, routine reactor operations, and the handling of samples and sample manipulating tools. Written procedures and checklists were used for each activity as required. It was noted that the ROs followed the procedures and were knowledgeable and professional in the conduct of their duties. Health physics personnel provided coverage as needed/required.

#### **(2) Staff Communication**

During the inspection, the inspector attended operations crew shift turnover meetings. These turnover briefings were held at 6:30 a.m. and 6:30 p.m. each day. The status of the reactor and the facility were discussed on each occasion as required. All operators of the relief crews reviewed the appropriate logs and records and were briefed on the upcoming shift activities and scheduled events before assuming the operations duty. Through direct observation and records review, the inspector verified that the content of shift turnover briefings held during each shift change was appropriate and noted that shift activities and plant conditions were discussed in detail.

#### **(3) Corrective Action Program**

The inspector reviewed the licensee's CAP, which had been developed to provide staff members with a formal process to identify deficiencies and bring safety issues, as well as other issues of concern, to management's attention for resolution. When issues were identified, each one was screened for safety significance, evaluated to determine the cause and its contributing factors, and assigned to a responsible manager for resolution. Corrective actions were developed and implemented

consistent with the significance of the issue and according to an established schedule.

Based on a review of a sample of CAP documents the inspector found that the licensee had taken corrective actions as necessary or had assigned a responsible manager to take the needed actions.

c. Conclusion

MURR reactor operations, as well as shift turnovers and operator cognizance of facility conditions during startup and routine operation, were acceptable. Various daily and weekly meetings were being held to ensure proper planning and preparation for operations activities. The CAP was functioning as required by procedure.

### 3. **Operator Requalification**

a. Inspection Scope (IP 69003)

The inspector reviewed selected aspects of the following to ensure compliance with the "Operator Requalification Program - University of Missouri Research Reactor (MURR)," dated January 7, 1997, and clarified by a memorandum dated March 30, 2001:

- Current status of operator licenses
- Medical examination records for the past 2 years
- MURR operator requalification program training and examination records for 2016 and 2017 including:
  - "Annual Operating Test Records"
  - "MURR Operator Active Status Log"
  - "Annual On-The-Job Training Requirement/Checklists"
  - MURR operational task forms documenting five different evaluated tasks completed by each operator every year
- "Annual On-The-Job Checklist – OJT Progress Report 2017," report for 2017
- "Written Examination Forms," for 2016 and 2017 documenting the facility-administered biennial exam completed by each operator

b. Observations and Findings

There were a total of 11 licensed senior reactor operators (SROs) and eight licensed ROs on staff at the facility. The inspector noted that, of the 19 licensed operators at the facility, five were managers (four SROs and one RO). The inspector verified that the requalification program was being maintained up-to-date and RO and SRO licenses were current. MURR operator active status logs and records also showed that operators maintained active duty status as required.

A review of the logs and records showed that training was being conducted in accordance with the licensee's requalification and training program. Procedure reviews and examinations had been documented as required. Information regarding facility changes and other relevant information had been routed under the crew review process and licensed operators acknowledged their review of this information. The inspector verified that quarterly reactor operations, reactivity manipulations, other required operations activities, and Reactor Supervisor activities were being completed as required and the appropriate records were being maintained. Records indicating the completion of the annual operations test and supervisory observations were also maintained.

Biennial written examinations were being completed by the operators as required. The inspector reviewed the last biennial requalification examination, which had been administered in 2015. It was noted that the examination was similar in its level of difficulty as compared to NRC administered examinations.

The inspector also noted that all operators were receiving biennial medical examinations within the allowed time frame as required.

c. Conclusion

Operator requalification was being conducted in accordance with the operator requalification program requirements. Operators were receiving their biennial physical examinations as required.

**4. Maintenance and Surveillance**

a. Inspection Scope (IP 69006, 69010)

To verify that the licensee was meeting the requirements of their preventive maintenance program and complying with TS requirements concerning the surveillance program, the inspector reviewed selected aspects of:

- Selected MURR compliance procedures (CPs)
- "Maintenance Day List," forms for 2017
- Entries in the "Completed CP's and Datasheets," notebook
- Selected "Compliance Check Procedure," data sheets and records
- Various "Worklist for Maintenance Shutdown," forms used in 2017 and developed prior to each weekly maintenance shutdown and kept in the "Maintenance Day Book"
- MURR Reactor Operations Annual Report for the period from January 1, 2016 through December 31, 2016

b. Observations and Findings

(1) Maintenance

The inspector reviewed the work control program, which was organized through the computer program known as "Maximo." The program was designed to ensure that all maintenance activities (including periodic

surveillance activities), were screened, planned, and completed as scheduled; that post maintenance testing was conducted; and, that the entire process was documented appropriately. The inspector attended the weekly maintenance meeting where these activities are discussed and coordinated each week. The program appeared to be effective.

(2) Surveillance

Various periodic surveillance items including verifications, calibrations, and testing of various reactor systems, instrumentation, auxiliary systems, and security systems and alarms, were reviewed by the inspector. The licensee used CPs to conduct these surveillances and followed the same established schedule each year. Maintaining a set schedule from year to year helped the licensee ensure that all surveillance items were completed as required. The data recorded in the logbooks and on the CP records indicated that the verifications and calibrations had been completed on schedule and in accordance with licensee procedures. Tracking and scheduling of the surveillance activities was done using the "Maximo" database. The results reviewed by the inspector were noted to be within the TS and procedurally prescribed parameters.

c. Conclusion

The work control program established and implemented by the licensee was being used effectively to complete maintenance activities at the facility. The surveillance program currently in use by the licensee satisfied TS requirements.

## 5. Fuel Handling

a. Inspection Scope (IP 69009)

To ensure that the licensee was handling and moving fuel appropriately and completing fuel inspections as required by TS Sections 4.1, 5.3, and 5.4, the inspector reviewed selected aspects of the following:

- Selected Log Books from 2017
- Fuel Location Map
- MURR form FM-8, "Fuel Movement Sheet,"

b. Observations and Findings

The inspector reviewed the fuel movement procedures and selected fuel movement sheets for each core loading in 2017. They were prepared by the Assistant Reactor Manager - Physics for core refueling, partial core refueling, fuel storage rearrangement, loading of spent fuel into a shipping container, performing end-of-life inspections of fuel elements, and transferring new unirradiated fuel from storage to the pool. Through records review, the inspector verified that fuel was moved as planned.

For new fuel, the inspector verified that the licensee implemented its security controls before, during, and after the fuel was placed in the pool. Overall, the inspector noted that fuel movement logs and sheets were well maintained.

c. Conclusion

Fuel movements and inspections were conducted in accordance with TS and procedural requirements.

## 6. Emergency Preparedness

a. Inspection Scope (IP 69011)

The inspector reviewed selected aspects of the following to verify compliance with the "Emergency Plan for the University of Missouri Research Reactor Facility," latest revision issued September 15, 2016:

- MURR Emergency Procedures Manual, Revision (Rev.) 81, updated November 2, 2015, containing MURR emergency procedures, EP-RO-001 through EP-RO-020
- Emergency Equipment Maintenance, EP-RO-20 Attachment 2.1, Rev. 5, dated May 25, 2011
- MURR emergency call list, FM-104, Rev. 32
- Memorandum of Understanding with the Fire Department dated September 7, 2016
- MURR operator requalification program training and examination records documenting emergency preparedness training of operators
- Documentation of the 2017 emergency drill including the associated critique

b. Observations and Findings

The inspector reviewed the facility's E-Plan and implementing procedures and verified they were being audited annually as required. The inspector also verified that emergency equipment lockers (lobby and the secondary location at the health physics office) were properly maintained and inventoried on a quarterly basis as required. Emergency call lists were updated and accessible in the control room, the front lobby, and in the various controlled copies of MURR emergency procedures manuals as required.

Through records review of annual training and drills and interviews with facility emergency organization personnel (i.e., MURR emergency responders), the inspector determined that they were knowledgeable of the proper actions to take in case of an emergency. Emergency training for operators was completed and tracked through the operator requalification program. Emergency preparedness and response training for emergency support organizations was completed biennially, as required, during the pre-drill meetings.

c. Conclusion

The emergency preparedness program was conducted in accordance with the E-Plan. Training was being conducted annually as required. Emergency response equipment was available and being maintained and inventoried as required. Emergency drills were being conducted annually as required by the E-Plan with support organizations participating biennially.

**7. Exit Interview**

The inspection scope and results were reviewed with the licensee on October 12, 2017. The inspector discussed the findings for each area reviewed. The licensee acknowledged the findings. The inspector noted that proprietary material was reviewed during the inspection but none is included in this inspection report.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee Personnel

R. Butler	Director
J. Ernst	Senior Advisor
L. Foyto	Associate Director, Reactor and Facilities Operations
R. Hudson	Reactor Training
D. Kutikkad	Assistant Reactor Manager – Physics
B. Meffert	Reactor Manager

## **INSPECTION PROCEDURES USED**

IP 69003	Class I Research and Test Reactor Operator Licenses, Requalification, and Medical Activities
IP 69006	Class I Research and Test Reactor Organization, Operations, and Maintenance Activities
IP 69009	Class I Research and Test Reactor Fuel Movement
IP 69010	Class I Research and Test Reactor Surveillance
IP 69011	Class I Research and Test Reactor Emergency Preparedness

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

None

### Closed

None

## **LIST OF ACRONYMS USED**

CAP	Corrective Action Program
CP	Compliance Procedure
E-Plan	Emergency Plan
IP	Inspection Procedure
MURR	University of Missouri-Columbia Research Reactor
NRC	U.S. Nuclear Regulatory Commission
Rev.	Revision
RO	Reactor Operator
SRO	Senior Reactor Operator
TS	Technical Specification