November 9, 2016

Mr. Ralph Butler, Executive 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. 50-186/2016-203

Dear Mr. Butler:

From October 17-20, 2016, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection of the University of Missouri-Columbia Research Reactor. The enclosed report documents the inspection results, which were discussed on October 20, 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 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 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 Mr. Johnny Eads at 301-415-0136, or by electronic mail at Johnny.Eads@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. 50-186
License No. R-103

Enclosure:
As stated

cc: See next page

cc:

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
930 Wildwood Drive, P.O. Box 570
Jefferson City, MO 65102-0570

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

A-95 Coordinator
Division of Planning
Office of Administration
P.O. Box 809, State Capitol Building
Jefferson City, MO 65101

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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

If you have any questions concerning this inspection, please contact Mr. Johnny Eads at 301-415-0136, or by electronic mail at Johnny.Eads@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. 50-186
License No. R-103

Enclosure:
As stated

cc: See next page

DISTRIBUTION:

PUBLIC	PROB r/f	RidsNrrDprPrta	RidsNrrDprPrtb
MNorris, NSIR	MCompton, NRR	AMendiola, NRR	NParker, NRR

ADAMS Accession No.: ML16307A200; *concurrence via email **NRC-002**

OFFICE	NRR/DPR/PROB	NRR/DPR/PROB/LA*	NRR/DPR/PROB/BC
NAME	(OFont for) JEads	NParker	AMendiola
DATE	11/3/16	11/2/16	11/9/16

OFFICIAL RECORD COPY

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

Docket No.	50-186
License No.	R-103
Report No.	50-186/2016-203
Licensee:	University of Missouri - Columbia
Facility:	University of Missouri Research Reactor
Location:	Research Park Columbia, Missouri
Dates:	October 17-20, 2016
Inspector:	Johnny Eads
Approved by:	Anthony J. Mendiola, Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

University of Missouri-Columbia
University of Missouri Research Reactor
Inspection Report No. 50-186/2016-203

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 and test reactor safety program including: (1) organizational structure and staffing, (2) reactor operations, (3) operator requalification, (4) maintenance and surveillance, (5) fuel handling, and (6) emergency preparedness. The review covered the period of time from the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas in January 2016 to the present. The licensee's program was acceptably directed toward the protection of public health and safety, and generally in compliance with the NRC requirements.

Organizational Structure and Staffing

- The organizational structure and staffing were consistent with Technical Specifications (TSs) 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.

- 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 emergency 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 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 Missouri University Research Reactor (MURR) Technical Specifications (TSs), Revision (Rev.) 17, authorized by License Amendment No. 37 to the renewed Facility Operating License No.R-103, dated March 11, 2016, 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 2016

b. Observations and Findings

The inspector noted that the organizational structure remained unchanged since the last inspection in the area of reactor operations. Since the last inspection, three of the managers within the operations line organization have changed. This included a new Reactor Manager, a new Assistant Reactor Manager Engineering and a new Assistant Reactor Manager. The inspector reviewed the qualifications of the new staff and found that they satisfied TS requirements.

Through a review of selected reactor operations logs for selected periods in 2016, 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 2 or 3 licensed individuals and one or more operator trainees. Operations shifts continued to be scheduled for a period of 12 hours.

TS Section 6.1.i., required that there be two facility staff personnel at the facility during reactor operation. 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 2016
- Selected MURR control room logbooks from 2016, 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, 2015 through December 31, 2015.

b. Observations and Findings

(1) Reactor Operation

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 reactor operators 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 2015 and 2016 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 2016," report for 2016
- "Written Examination Forms," for 2015 and 2016 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 six licensed reactor operators (ROs) on staff at the facility. The inspector noted that, of the 17 licensed operators at the facility, three were managers (two 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 tests 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 U.S. Nuclear Regulatory Commission 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
- "Maintenance Day List," forms for 2016
- 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 2016 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, 2015 through December 31, 2015

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 compliance procedures (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.

In addition, the inspector reviewed completed CP records related to the surveillance requirements for Iodine hot cell operations. Prior to the end of the inspection, the facility was unable to locate certain documentation related to TS surveillance 5.7.e for Iodine removal efficiency for the Iodine hot cell filter banks. As a result, Inspector Follow-up Item 50-186/2016-203-01 was opened. This information will be reviewed during the next inspection in this area.

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 TSs 3.8, 4.1, 4.3, and 5.5, the inspector reviewed selected aspects of the following:

- Selected Log Books from 2016
- 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 2016. 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.

Additionally, the inspector also noted that the facility has an administrative limit on fuel burnup of 150 MW-Days (MWD); below the 180 MWD calculated from TS 3.8. Through records review, the inspector verified that all fuel elements were removed from service before they reached the limit.

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 [E-Plan] for the University of Missouri Research Reactor Facility," latest revision issued September 15, 2016:

- MURR Emergency Procedures Manual, 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. 28
- 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 2016 emergency drill conducted on June 13, 2016 including the associated critiques
- Emergency Preparedness Training, EP-RO-003, Rev. 4, dated May 25. 2011

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 20, 2016. The inspectors discussed the findings for each area reviewed. The licensee acknowledged the findings. The inspectors 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

50-186/2016-203-01	IFI	Documentation related to TS surveillance 5.7.e for Iodine removal efficiency for the Iodine hot cell filter banks.

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
MWD	Megawatt-Days
NRC	U.S. Nuclear Regulatory Commission
Rev.	Revision
RO	Reactor Operator
SRO	Senior Reactor Operator
TS	Technical Specification