

September 13, 2012

Mr. William E. Bonzer, Reactor Manager
Missouri University of Science and Technology
Nuclear Reactor Facility
1870 Miner Circle
Rolla, MO 65409-0630

SUBJECT: MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY - NRC ROUTINE
INSPECTION REPORT NO.: 50-123/2012-201

Dear Mr. Bonzer:

On August 13-16, 2012, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at your Nuclear Reactor Facility (Inspection Report No. 50-123/2012-201). The enclosed report documents the inspection results, which were discussed on August 16, 2012, with you and members of your staff.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concerns or non-compliances with NRC requirements were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public inspections, exemptions, and requests for withholding," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

If you have any questions concerning this inspection, please contact Mike Morlang at 301-415-4092 or Gary.Morlang@nrc.gov.

Sincerely,

/Plsaac for RA/
Gregory T. Bowman, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-123
License No.: R-79

Enclosure: NRC Inspection Report No.: 50-123/2012-201
cc w/encl: Please see next page

Missouri University of Science and Technology

Docket No.: 50-123

cc:

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

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

Docket No: 50-123

License No: R-79

Report No: 50-123/2012-201

Licensee: Missouri University of Science and Technology

Facility: Nuclear Reactor Facility

Location: Rolla, Missouri

Dates: August 13-16, 2012

Inspector: Mike Morlang

Approved by: Gregory T. Bowman. Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Missouri University of Science and Technology
Report No.: 50-123/2012-201

The primary focus of this routine, announced inspection of facility operations was the onsite review of selected aspects of the Missouri University of Science and Technology (MSTR, the licensee's) Class II research reactor facility safety programs including organization and staffing; procedures; experiments; health physics; effluents and environmental monitoring; design changes; committees, audits, and reviews; and transportation. 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.

Organization and Staffing

- The licensee's organization and staffing were in compliance with Technical Specifications.

Procedures

- Written procedures were being maintained in accordance with Technical Specification requirements.

Experiments

- Reactor experiments were being performed in accordance with the requirements of the Technical Specifications.

Health Physics

- The licensee maintained an effective radiation protection program in compliance with regulatory and Technical Specification requirements, resulting in low radiation exposures to facility workers and users.

Effluents and Environmental Monitoring

- The licensee evaluated annual environmental releases as required by Technical Specifications and reported results well below limits.

Design Changes

- The licensee maintained a procedure to process facility changes in accordance with regulatory requirements but had not made such a change since the previous inspection.

Committees, Audit and Reviews

- The Radiation Safety Committee continued to perform independent oversight in accordance with Technical Specification requirements.

Transportation

- The licensee did not ship any radioactive material under the R-79 license since the previous transportation inspection.

REPORT DETAILS

Summary of Plant Status

The Missouri University of Science and Technology (MSTR, the licensee's) 200 kW pool-type research reactor continues to be operated in support of graduate and undergraduate instruction, laboratory experiments, reactor operator training, and various forms of research. During the inspection, the reactor was not operated because of nuclear instrumentation detector problems.

1. Organization and Staffing

a. Inspection Scope (IP 69001)

The inspector reviewed the following reactor operations records to ensure compliance with the requirements of technical specification (TS) Section 6.3.1:

- Reactor Console Logbook #17, from October 3, 2011 to present
- Reactor Safety Committee (RSC) Meeting Minutes for 2011 and 2012
- MSTR Standard Operating Procedure (SOP) SOP-102, Pre-Startup Checklist, Revised (Rev.) January 21, 2011, April 2010 to present
- MSTR SOP-105, Reactor Shutdown Checklist, Rev. April 14, 1998
- MSTR SOP-107, Permanent Hourly Logs and Operational Data, Rev. January 3, 2008, January 9, 2009 to present
- MSTR Annual Progress Report for 2010/2011 and 2011/2012
- Hourly Log Sheets from April 2010 to present
- Contact Phone Number List dated February 6, 2012

b. Observations and Findings

There were 7 licensed senior reactor operators (SRO) and 4 reactor operators (RO) at the facility. A review of the logs and records indicated that TS shift staffing was as required. The inspector noted that each time the senior reactor operator or reactor operator changed an appropriate console log book entry was made. Additionally, the SRO on duty had his name written on a placard attached to the reactor console. A current contact list was posted as required by TS Section 6.3.1.2.

c. Conclusion

Shift staffing was being maintained in accordance with TS Section 6.3.1.

2. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that procedures were in accordance with TS Section 6.4 requirements:

- MSTR SOP-101, General Operations Procedure dated November 19, 2009
- MSTR SOP-102, Pre-Startup Checklist dated January 21, 2011
- MSTR SOP-103, Reactor Startup to Low Power dated December 30, 2009
- MSTR SOP-104 Reactor Power Changes and Stable Operations dated February 9, 2012
- MSTR SOP-105, Reactor Shutdown and Securing dated February 28, 1996
- MSTR SOP-100, Preamble dated September 10, 2009
- MSTR Annual Progress Report for 2010/2011 and 2011/2012
- Reactor Safety Committee (RSC) Meeting Minutes for 2011 and 2012

b. Observations and Findings

TS Section 6.4, Operating Procedures, required that operating procedures be maintained for specific topic areas. It also specified a means for making minor and substantive changes to procedures. The inspector found that all specified topics were addressed by existing procedures. Facility Annual Reports addressed the procedures that had been updated during the year and Reactor Safety Committee minutes reflected review and approval of procedure changes.

The inspector noted hand-written changes to procedures that dated as far back as 1995. Although editorial in nature, handwritten changes are to be reviewed by the RSC at a subsequent meeting as per TS 6.4. An Inspector Follow-up Item (IFI-50/123-2012/201-1) was opened and discussed with the licensee to ensure that this issue is reviewed during the next inspection.

c. Conclusion

Procedures were as required by TS 6.4 and being reviewed and updated as required.

3. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the requirements of TS Sections 3.7 and 4.7, Experiments, and Section 6.5, Experiment Review and Approval, were being met concerning experiments:

- File of Completed Irradiation Request Forms (IRF) for 2011 and 2012

- Permanent Reactor Logbook #17, October 3, 2011 to present
- SOP 702, Irradiation Request Forms (IRF), Rev. April 10, 1995
- SOP 710, Insertion and Removal of Experiments. Rev. March 30, 1994
- MSTR Annual Progress Report for 2010/2011 and 2011/2012
- Reactor Safety Committee (RSC) Meeting Minutes for 2011 and 2012

b. Observations and Findings

Pursuant to SOP 702, each IRF required review and approval by two individuals from among the following: a Senior Reactor Operator (SRO), the Director, and the Health Physicist (HP). If the IRF was determined to involve a new safety issue, review by the Radiation Safety Committee (RSC) was required. Once an experiment was authorized it could be repeated indefinitely as long as an SRO found the sample to be in compliance with the authorization.

During 2011, 33 IRF's were reviewed and approved, and to date in 2012, 2 IRF's had been reviewed and approved.

When conducting irradiations of experiments for the first time, the licensee used a graded approach to the irradiation. Experiments were initially conducted at low power levels and checked for expected radiation levels. Once levels were verified as expected, the power level was raised to the desired exposure.

c. Conclusion

The licensee was complying with the TS and procedural requirements pertaining to experiment authorization and irradiation.

4. Health Physics

a. Inspection Scope (IP 69001)

The following documents were reviewed to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Parts 19 and 20 and with TS Sections 3.6.1 and 4.6.1, Radiation Monitoring Systems, requirements regarding radiation protection:

- Handbook of Radiological Operations
- SOP 6, Radiation Work Permits, dated June 29, 1988
- 2011 and 2012 Monthly Reactor Audit file
- 2011 and 2012 Reactor Dosimetry file
- 2011 and 2012 Reactor Sump Water Analysis File
- 2011 and 2012 Monthly Contamination Survey file
- 2011 and 2012 Monthly Radiation Survey file
- 2011 and 2012 Quarterly As Low As Reasonably Achievable (ALARA) Reports
- 2011 and 2012 Reactor Pool Water Analysis file
- 2011 and 2012 Reactor Pool Water Tritium file

- 2011 and 2012 Monthly HP Audit Reports
- 2011 to present Radiation Work Permit file
- 2011 and 2012 Portable Survey Instrument Calibration Reports
- 2011 and 2012 Argon-41 Monthly Release Forms

b. Observations and Findings

Through the review of procedures and records, observations during facility tours, and discussion with staff personnel, the inspector assessed the licensee's radiation protection program, including radiation protection training given to individuals.

Dosimetry records indicated that the highest individual dose for 2011 was 109 mrem and the highest individual dose to date in 2012 was 29 mrem.

The licensee maintained and adhered to written procedures and instructions for all aspects of the radiation safety program. During tours through the facility the inspector verified that warning signs and postings for radiation workers were in accordance with regulations and procedures. Protective clothing was available if needed but areas were maintained in a clean condition such that it was very rarely required.

The inspector reviewed the radiation monitoring instrumentation calibration program. Most survey instruments were calibrated using an in-house calibration facility. Permanently mounted process monitors were calibrated in-situ. High range ion chambers and neutron detectors were sent offsite for calibration. In all cases calibration stickers were used to record the valid calibration interval; all devices inspected throughout the facility were found to be within their defined calibration interval.

Monthly reactor audits were very detailed and covered sealed sources, radiation area monitor (RAM) calibration, hand held instrument calibration, contamination surveys, air release calculations each time the reactor is operated, radiation surveys, and monthly pool water analysis.

c. Conclusion

The radiation protection program was effective and in compliance with Technical Specifications and regulatory requirements

5. Effluents and Environmental Monitoring

a. Inspection Scope (IP 69001-02.07.e, f, and g)

The following documents were reviewed to determine compliance with 10 CFR Part 20 and with TS Sections 3.6.2 and 4.6.2, Radioactive Effluents:

- Annual Progress Report, University of Missouri – Rolla Nuclear Reactor Facility, 2010/2011 and 2011/2012

- Argon-41 Release file
- Environmental Dosimetry files for 2011 and 2012
- 2011 and 2012 Air Release file
- 2011 and 2012 Byproduct Release file
- 2011 and 2012 Air Release Summary file
- Quarterly Environmental Dosimetry file for 2011 and to date in 2012

b. Observations and Findings

The licensee had 3 environmental dosimetry badges placed around the outside of the facility to monitor radiation levels. The maximum quarterly reading was for the period ending on September 30, 2011 at 53 mrem.

The licensee analyzed air samples collected over the reactor pool surface to evaluate exposure to personnel in the reactor bay from Argon-41 and also samples collected at 1 of 3 exhaust fans to evaluate exposure to the public. Results showed compliance with 10 CFR Part 20 limits.

The licensee maintained good reactor water quality through pre-processing potable campus water used to make up for evaporative losses and continuous clean-up of circulating reactor pool water. Filters and resins from the pool clean-up system were collected as radioactive waste but activity levels were minimal. Likewise, a small quantity of laboratory waste (vials, absorbent paper, gloves, etc.) was collected in the reactor building consisting of very little activity.

c. Conclusion

The licensee evaluated annual environmental releases as required by TS and reported results well below 10 CFR 20 limits.

6. Design Changes

a. Inspection Scope (IP 69001-02.08)

The inspector reviewed the following to ensure that the requirements of 10 CFR 50.59 were being implemented effectively:

- RSC Meeting Minutes file for 2010, 2011 and 2012
- Annual Progress Report, University of Missouri – Rolla Nuclear Reactor Facility, 2010-2011
- Annual Progress Report, University of Missouri – Rolla Nuclear Reactor Facility, 2011-2012
- SOP 310, Facility Modifications, Rev. April 28, 1997

b. Observations and Findings

The licensee reported that 2 changes were made since the previous inspection that required a 10 CFR 50.59 review. The licensee had constructed a second pneumatic transfer system for sample irradiations and had installed a new

reactor pool cooling system. The license was in the process of conducting a review of a potential new control rod drive position indicating system. All of the reviews were clearly documented in the RSC minutes.

c. Conclusion

The licensee maintained a procedure to process facility changes in accordance with regulatory requirements.

7. Committees, Audits and Reviews

a. Inspection Scope (IP 69001-02.09)

The inspector reviewed the following to ensure that the requirements of TS Section 6.2, Review and Audit, were being implemented effectively:

- RSC Meeting Minutes file for 2010, 2011 and 2012
- Monthly Health Physics Audits for 2011 and 2012
- Annual Procedural Audits for 2011 by the Reactor Director

b. Observations and Findings

The licensee used a single independent oversight safety committee to fill requirements for both the reactor license and the campus byproduct material license. The committee consisted of a minimum of 5 members, one of which must be the Radiation Safety Officer, two of which must be reactor staff and at least 2 members from related academic fields. Currently there are 7 members on the committee. The committee members were appointed by the Vice Chancellor - Administrative Services, providing a reporting chain to the Chancellor that was fully independent of the reactor operations line of reporting. Meetings were conducted quarterly but only required annually by TS Section 6.2.2. The Reactor Manager briefed the committee each quarter on matters relating to reactor safety.

c. Conclusion

The RSC continued to perform independent oversight in accordance with Technical Specification requirements.

8. Transportation

a. Inspection Scope (IP 86740)

- Health Physics Radioactive Waste Pick-up Form
- 2010 and 2011 Radioactive Shipment File

b. Observations and Findings

The inspector reviewed the file for radioactive shipments made under the reactor license (R-79) and found that there were no shipments made since the previous transportation inspection. The licensee did transfer radioactive waste to the University Materials License and allow the Health Physics Department personnel to remove the waste from the reactor facility.

c. Conclusion

The licensee did not ship any radioactive material under the R-79 license since the previous transportation inspection.

9. Exit Interview

The inspector met with members of licensee staff and management in an exit briefing on August 16, 2012. The inspector summarized the areas inspected and presented preliminary inspection findings.

PARTIAL LIST OF PERSONS CONTACTED

W. Bonzer	Reactor Manager
C. Reisner	Senior Reactor Operator
M. Henry	Senior Administrative Assistant Missouri University of Science and Technology
F. Ahmed	Health Physicist
K. Freedline	Health Physics Technician
A. Baker	Health Physics Technician

INSPECTION PROCEDURE (IP) USED

IP 69001	Class II Non-Power Reactors
IP 86740	Inspection of Transportation Activities
IP 92701	Follow Up Items

ITEMS OPENED, CLOSED, AND DISCUSSED

Open

50-123/2012-201-1	IFI	Follow-up item to ensure procedure pen and ink changes are reviewed and approved by the RSC
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Closed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ALARA	As Low As Reasonably Achievable
HP	Health Physics
IFI	Inspector Follow-up Item
IP	Inspection Procedure
IRF	Irradiation Request Form
MSTR	Missouri University of Science and Technology Reactor
NRC	U. S. Nuclear Regulatory Commission
Rev	Revision
RSC	Radiation Safety Committee
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TS	Technical Specification