April 15, 2013

Mr. Ralph Butler, Director
Research Reactor Center
University of Missouri – Columbia
Research Park
Columbia, MO 65211

SUBJECT: UNIVERSITY OF MISSOURI – COLUMBIA RESEARCH REACTOR – NRC ROUTINE INSPECTION REPORT NO. 50-186/2013-201

Dear Mr. Butler:

From March 18–21, 2013, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection at the University of Missouri – Columbia Research Reactor (Inspection Report No. 50-186/2013-201). The enclosed report documents the inspection results, which were discussed on March 21, 2013, 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 selected procedures and records, observed of 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, and 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 Document 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 Craig Bassett at 301-466-4495 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Gregory T. Bowman, 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: NRC Inspection Report No. 50-186/2013-201
cc w/encl: See next page

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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Docket No. 50-186
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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No.:	50-186
License No.:	R-103
Report No.:	50-186/2013-201
Licensee:	Curators of the University of Missouri – Columbia
Facility:	University of Missouri – Columbia Research Reactor
Location:	Research Park Columbia, Missouri
Dates:	March 18–21, 2013
Inspector:	Craig Bassett
Approved by:	Gregory T. Bowman, Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Missouri – Columbia
University of Missouri – Columbia Research Reactor
Report No.: 50-186/2013-201

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 safety program, including: (1) organizational structure and staffing, (2) review and audit functions, (3) procedures, (4) staff communication and problem identification, (5) radiation protection, (6) environmental monitoring, and (7) transportation of radioactive material 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 the NRC requirements.

Organization and Staffing

- The licensee's organization and staffing were in compliance with the requirements specified in Technical Specification 6.1.

Review and Audit Functions

- The Reactor Advisory Committee acceptably completed the review, audit, and oversight functions required by Technical Specification 6.1.

Procedures

- The procedure review, revision, control, and implementation program satisfied Technical Specifications requirements.

Staff Communications and Problem Identification

- Various daily and weekly meetings were being held to ensure proper communication, planning, and preparation.

- The Corrective Action Program implemented by the licensee was functioning as designed.

Radiation Protection

- Surveys were completed and documented as specified by procedure and were outlined in the Annual Report.

- Postings and notices met regulatory requirements.

- Staff personnel were wearing dosimetry as required and recorded doses were within the regulatory limits.

- Radiation survey and monitoring equipment was being maintained and calibrated as required.

- The Radiation Protection and As Low As Reasonably Achievable Programs satisfied regulatory requirements.

- Annual reviews of the Radiation Protection Program were being completed by the licensee as required by Title 10 of the *Code of Federal Regulations* Part 20.

Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements.

- Releases were within the specified regulatory and Technical Specifications limits.

Transportation of Radioactive Materials

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

REPORT DETAILS

Summary of Plant Status

The University of Missouri – Columbia (the licensee) Research Reactor (MURR) continued to be operated in support of isotope production, silicon irradiation, reactor operator training, and various types of research. During the inspection, the reactor was operated continuously, following the weekly maintenance shutdown, to support laboratory experiments and product irradiation.

1. Organization and Staffing

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

To verify that the staffing and organizational structure requirements were being met as specified in Technical Specifications (TS) 6.1.a, Revision (Rev.) Number (No.) 15, which was implemented through Amendment No. 35 to Facility Operating License No. R-103, dated February 9, 2012, the inspector reviewed:

- Administrative controls and management responsibilities
- Current MURR organizational structure with respect to radiation protection
- Radiation protection (also referred to as health physics) staffing requirements for safe operation of the facility
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012
- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

b. Observations and Findings

The inspector noted that the organizational structure had not changed since the last inspection in the area of radiation protection (refer to NRC Inspection Report No. 50-186/2012-201). The Reactor Manager continued to report to the Facility Director through the Associate Director for Reactor and Facilities Operations while the Health Physics Manager reported to the Facility Director through the Associate Director for Regulatory Assurance.

The health physics (HP) group was staffed with a Health Physics Manager, a Radioactive Waste Coordinator, a Special Projects Coordinator, and four HP technicians. The Radioactive Waste and Special Projects Coordinators were health physicists who worked mainly in the areas indicated by their respective titles. The HP technicians conducted routine project reviews, provided job coverage, and completed periodic assigned tasks and surveys.

The organizational structure remained in accordance with the requirements of the TS and staffing appeared to be adequate for the current level of operations. Qualifications of the staff members met program requirements. Review of records indicated that management responsibilities were discharged as required by applicable procedures.

c. Conclusion

The licensee's organization and staffing with respect to radiation protection were in compliance with the requirements specified in TS 6.1.a.

2. Review and Audit Functions

a. Inspection Scope (IP 69007)

In order to verify that the licensee had established and conducted reviews and audits as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 and TS 6.1, the inspector reviewed:

- 2011 and 2012 dose to target charts
- 2011 and 2012 as low as reasonably achievable (ALARA) reviews
- Radiation Protection Program/materials license audits for 2011 and 2012
- Other selected audits and reviews completed by management and HP personnel
- Selected subcommittee meeting minutes from September 2011 to the present, including the Isotope Use Subcommittee, the Reactor Safety Subcommittee, and the Reactor Procedure Review Subcommittee
- MURR Reactor Advisory Committee (RAC) meeting minutes and related documents, from January 2012 to the present
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 12, issued January 8, 2013
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012
- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

b. Observations and Findings

The inspector reviewed the meeting minutes of the RAC from January 2012 and the meeting minutes of various subcommittees from the September 2011 timeframe to the present. The minutes and associated documents indicated that the RAC met at the required frequency and that a quorum was present. The topics considered during the committee meetings and during the subcommittee meetings were appropriate and as stipulated in the TS.

The inspector reviewed the 2011 and 2012 audits of the licensee's Radiation Protection Program. It was noted that the Regulatory Assurance Group (RAG) had developed an internal audit program pertaining to the Radiation Protection Program, which consisted of three modules. Members of the RAG conducted audits and reviews of the program annually using one of the modules that had been developed. After a 3-year cycle, generally all aspects of the program were reviewed. Following each audit the full RAC reviewed the results. No significant issues were identified during the audits, but several areas for improvement were noted. The inspector also reviewed the Health Physics Manager's response to the audit findings to address each of the areas for improvement. The audits and

responses to the audits appeared to be acceptable.

The inspector also reviewed the dose to target charts and ALARA reviews for 2011 and 2012. These were prepared by the HP Manager and provided an annual review of the Radiation Protection Program and an overview of the dosimetry results and exposure goals for each separate group working at MURR. The data was also used to establish new exposure goals for the various groups. The charts and reviews illustrated and documented the licensee's continued efforts to reduce personnel dose and maintain doses ALARA.

c. Conclusion

Review, oversight, and audit functions required by the TS were acceptably completed by the RAC.

3. Procedures

a. Inspection Scope (IP 69008)

To verify compliance with TS 6.1.b and 6.1.c, the inspector reviewed selected portions of the following:

- MURR Procedure AP-HP-119, "High Radiation Area Access," Rev. 5, issued February 7, 2013
- MURR Procedure AP-RR-010, "Facility Access Criteria," Rev. 17, issued January 3, 2013
- MURR Procedure AP-RR-011, "Facility Access Process," Rev. 17, issued January 3, 2013
- MURR Procedure BP-SH-052, "Radioactive Material Shipment Package Documentation and Labeling," Rev. 10, issued February 6, 2013
- MURR Procedure OP-HP-356, "Operation – Lab Impex Stack Monitor – Filter Change and Source Checks," Rev. 3, issued October 15, 2012
- MURR Procedure OP-HP-400, "Gemstone Shipping Barrel Analysis," Rev. 9, issued October 15, 2012
- MURR Procedure WM-SH-105, "Radioactive Waste Processing," Rev. 8, issued February 6, 2013
- MURR Procedure WM-SH-300, "Exclusive Use Shipment of LSA or SCO Radioactive Waste," Rev. 10, issued September 19, 2012
- MURR Administrative Policy, POL-18, "Procedure Writer's Guide," Rev. 8, issued January 29, 2013
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012
- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

b. Observations and Findings

TS 6.1.c required that the RAC review safety significant procedure changes. The Reactor Procedure Review Subcommittee was established and chartered to act

on behalf of the RAC to fulfill this requirement. The inspector verified that the subcommittee was meeting as required to review current procedure revisions and changes. Following a review by the Reactor Procedure Review Subcommittee, the full RAC reviewed and approved the subcommittee's actions regarding the various procedural changes and reviews. The inspector noted that nearly all of the procedures at MURR had been through a full review and revision process since the Reactor Procedure Review Subcommittee was formed.

The inspector reviewed a letter from the Health Physics Manager to the Supervisor of Document Control dated March 22, 2012. The letter documented that the annual review of the radiation protection and shipping procedures had been completed for 2011 as required by the TS 6.1.b. The annual procedure review for 2012 was in the process of being completed during the week of the inspection.

The inspector made the observation that there was no procedure detailing how to conduct and document a radiation/contamination survey. Because of some minor issues noted by the inspector during a review of selected survey maps, the licensee determined that such a procedure was needed. The licensee was informed that the issue of developing a procedure concerning the conduct and documentation of radiation and contamination surveys would be followed by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-186/2013-201-01).

c. Conclusion

The procedure review, revision, control, and implementation program satisfied TS requirements.

4. Staff Communications and Problem Identification

a. Inspection Scope (IP 69006)

To verify that the licensee was communicating plant information, as well as implementing the Corrective Action Program (CAP), in accordance with TS Sections 3.0, 4.0, and 5.0, and procedural requirements, the inspector reviewed selected portions of the following:

- Quarterly CAP summaries for 2012 and to date in 2013
- Selected CAP detail reports for 2012 and to date in 2013
- MURR Procedure AP-RO-110, "Conduct of Operations," Rev. 18, issued November 16, 2012
- MURR Administrative Procedure AP-RR-001, "Corrective Action Program," Rev. 11, issued April 26, 2010
- MURR Administrative Procedure AP-RR-026, "Event Review," Rev. 4, issued April 11, 2011
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012

- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

b. Observations and Findings

(1) Staff Communication

During the inspection, the inspector attended the plan of the day (POD) meeting on Tuesday, Wednesday, and Thursday morning. The meeting, chaired by the Reactor Manager, was held daily and representatives from all organizations at the facility were in attendance. Safety-significant issues, if any, were discussed and maintenance or operating needs were presented. Any concerns or schedule conflicts were resolved during the meeting. The inspector noted that the POD meeting provided the opportunity for everyone to be made aware of current facility conditions and the scheduled activities for that day.

(2) 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. The program was designed so that anyone could identify a discrepancy, concern, or improvement opportunity and enter the issue into the CAP system via the MURR intranet. 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. The status of each CAP issue was tracked and staff members could check on the issue of their concern whenever they wanted.

On Tuesday morning, the inspector attended the weekly CAP meeting. Various items which had been received during the previous week were reviewed. Each issue was discussed, corrective actions were reviewed, and each item was classified according to the license's criteria, which were outlined in the governing procedure. It was noted that the events were classified into one of five categories: reactor/radiation safety issue, personnel safety/regulatory issue, current good manufacturing practice, improvement opportunity issue, and trending issue. Following the discussion each issue was assigned to a responsible manager so that the needed actions could be taken and the issues could be resolved. The CAP appeared to be an effective tool used by the licensee to identify and correct facility problems.

c. Conclusion

Various daily and weekly meetings were being held to ensure proper planning and preparation for the various facility activities. The CAP was functioning as described in the MURR's procedures.

5. Radiation Protection

a. Inspection Scope (IP 69012)

The inspector reviewed the following to verify compliance with 10 CFR Parts 19 and 20 and the applicable licensee TS requirements and procedures:

- Radiation protection (radiation worker) training records for 2012
- MURR dosimetry records for 2011, 2012, and 2013 to date
- Dose report review forms for October 2010–February 2013
- Selected radiation and contamination survey records for the past year
- Radiological signs and posting in various facility laboratories and in the beam port floor area
- Calibration and periodic check records for selected radiation survey and monitoring instruments for the past 2 years
- MURR Procedure AP-HP-105, "Radiation Work Permit," Rev. 10, issued November 23, 2010, and the associated form, Form FM-17, "Radiation Work Permit"
- MURR Procedure AP-HP-117, "MURR Initial Radiation Worker Training Program," Rev. 10, issued January 11, 2011, and the associated forms, Form FM-26, "MURR Training Questionnaire," and Form FM-29, "Initial Training Packet"
- MURR Procedure AP-HP-130, "Reactor License Projects Annual Review," Rev. 4, issued September 30, 2010
- MURR Procedure IC-HP-300, "Calibration – Radiation Survey Instruments," Rev. 6, issued March 7, 2012, and the associated form, Form FM-62, "Radiation Instrument Certificate of Calibration"
- MURR Procedure OP-HP-220, "Tritium Bioassay," Rev. 8, issued August 2, 2012
- MURR Procedure RP-HP-120, "Personnel Radioactive Contamination," Rev. 6, issued April 29, 2009, and the associated forms, Form FM-54, "Report of Personnel Contamination," and Form FM-76, "Personnel Contamination Log"
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 12, issued January 8, 2013
- MURR Administrative Policy, POL-17, "MURR Training Booklet (Security, Emergency, and Health Physics)," Rev. 1, issued July 14, 2010
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012
- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

The inspector also toured the MURR facility and observed the use of dosimetry and survey meters.

b. Observations and Findings

(1) Surveys

Daily, monthly, and other periodic contamination and radiation surveys, outlined in the licensee's Reactor Operations Annual Report for 2012, were completed by HP staff members. Any contamination detected in concentrations above established action levels was noted and the area or item was decontaminated. Results of the surveys were typically documented on survey maps and posted at the entrances to the various areas surveyed so that facility workers and visitors would be aware of the radiological conditions that existed therein.

The inspector accompanied an HP technician during completion of a radiation and contamination survey of several of the beam ports in the basement of the containment. The survey was conducted appropriately. The inspector conducted a radiation survey of the ports and the general area as well and no problems or anomalies were noted.

(2) Postings and Notices

Copies of current notices to workers were posted in appropriate areas in the facility. The copies of NRC Form 3 noted at the facility were the latest issue, as required by 10 CFR Part 19, and were posted in various areas throughout the facility such as the main bulletin board, the main hallways, and at the entrance to the beam port floor area. The inspector determined that appropriate radiological signs, as well as current copies of the survey maps (as noted above), were typically posted at the entrances to controlled areas. Other postings also showed the industrial hygiene hazards that were present in the areas.

(3) Dosimetry Use and Results

Through direct observation the inspector determined that dosimetry was acceptably used by facility and contractor personnel. The inspector determined that, last year, the licensee used optically stimulated luminescent (OSL) dosimetry for whole body monitoring and thermoluminescent dosimeters (TLDs) in the form of finger rings and wrist badges for extremity monitoring. Because a new dosimetry vendor had been selected, the licensee was now using TLDs for all monitoring applications. The dosimetry was supplied and processed by Mirion Technologies, Inc., a National Voluntary Laboratory Accreditation Program accredited vendor. An examination of the OSL and TLD results indicating radiological exposures at the facility for the past 2 years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limits.

(4) Radiation Monitoring Equipment

Examination of selected radiation monitoring equipment indicated that the instruments had the acceptable up-to-date calibration sticker attached. A review of selected instrument calibration records indicated that the calibration of swipe counters and portal monitors was typically completed by licensee staff personnel. Other instruments, such as portable survey meters, friskers, and neutron detectors were shipped to vendors for calibration. Calibration frequency met procedural requirements and records were maintained as required. The inspector noted that area radiation monitors, as well as air monitors and stack monitors, were also being calibrated as required. These monitors were also typically calibrated by licensee staff personnel.

(5) Radiation Protection Program

The licensee's Radiation Protection and ALARA Programs continued to be established and described in the MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," and implemented through the various HP procedures that had been reviewed and approved. The programs contained instructions concerning organization, training, monitoring, personnel responsibilities, and audits. The programs, as outlined and established, appeared to be acceptable. The inspector verified that annual reviews of the Radiation Protection Program were being completed by the licensee as required by 10 CFR Part 20. The ALARA Program provided instructions and guidance for keeping doses as low as reasonably achievable and was consistent with the guidance in 10 CFR Part 20.

(6) Radiation Work Permit Program

The inspector reviewed selected radiation work permits that had been written, used, and closed out during 2012 and those issued to date in 2013. It was noted that the instructions specified in MURR Procedure AP-HP-105, Attachment 7.1, and those on the associated forms (e.g., Form FM-17, "Radiation Work Permit Instructions") had been followed. Appropriate review by management and health physics personnel had been completed. The controls specified in the radiation work permits were acceptable and applicable for the type of work being done.

(7) Radiation Protection Training

The inspector reviewed the licensee's Radiation Worker Training Program. It was required that all staff members complete this training on an annual basis. The inspector verified that the training records were being kept up to date and that all badged employees had completed the training within the previous year. In addition, new employees were required to complete the training immediately after being hired. The

training material appeared to be adequate and included the information required by 10 CFR Part 19.

Radiation worker training was divided into two portions. Part 1 training was general in nature and given to all facility personnel. Part 2 training was more detailed and specifically tailored to those individuals who routinely handled radioactive material or who routinely worked in a radiologically controlled area. The inspector attended a portion of the Part 2 training being offered during the course of the inspection. The training was adequate and provided the type of information needed by radiation workers.

(8) MURR ALARA Program

In 2000, the licensee's total cumulative facility dose was 46.7 rem. The Manager of Health Physics and the HP staff, along with other MURR managers and group leaders, recognized that improvements could be made in this area. Consequently, each group established an ALARA goal for the next year and the facility dose was then tracked by group, as well as for each individual. With emphasis placed on achieving the various groups' ALARA goals, the facility dose began to decrease. Due to the establishment of aggressive ALARA goals, continued efforts on dose reduction, worker awareness, and engineered improvements, the total cumulative facility dose was further reduced. In 2005, the facility dose was 30.7 rem. During that year the licensee began extensive planning and preparation for two major projects that were planned for 2006.

In 2006, the licensee successfully completed two major tasks including the replacement of the beryllium reflector and the removal and replacement of two primary reactor heat exchangers. Even though the facility dose increased, the total cumulative dose was held to 33.8 rem. Since 2006, MURR management and staff have continued their efforts to maintain personal doses ALARA. In 2010, the cumulative facility dose increased somewhat due, in part, to an increase in the amount of product irradiation work performed during the year. In 2011, there was a marked increase in the cumulative dose. The licensee indicated that two factors contributed to the increase. First, approximately twenty-five new people had been hired at the facility and they started working and receiving dose. Second, new projects and research, along with an increase in routine work, had increased the dose received by various groups at the facility. In 2012, the cumulative facility dose was reduced to 29.0 rem.

(9) Facility Tours

On various occasions during the inspection, the inspector toured the hot cell area, beam port floor area, and selected support laboratories with licensee representatives. No unmarked radioactive material and no other anomalies were noted. The inspector noted that facility radioactive material storage areas were properly posted. Radiation and high

radiation areas were posted and properly controlled as required.

c. Conclusion

The inspector determined that the Radiation Protection and ALARA Programs, as implemented by the licensee, satisfied regulatory requirements because: (1) surveys were completed and documented acceptably to permit evaluation of the radiation hazards present, (2) postings met regulatory requirements, (3) personnel dosimetry was being worn as required and recorded doses were within the NRC's regulatory limits, (4) radiation survey and monitoring equipment was being maintained and calibrated as required, (5) the Radiation Protection Program was acceptable and was being reviewed annually as required, and (6) personnel were receiving the required radiation worker training.

6. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Part 20, TS 3.7, and the environmental monitoring program outlined in various procedures:

- Quarterly reports of environmental TLD results
- Results of the analyses of environmental vegetation, soil, and water samples
- Selected monthly effluent ALARA environmental review summaries for 2012 and to date in 2013
- Liquid batch release review forms for 2012 associated with the monthly effluent ALARA environmental review summaries
- MURR Procedure IC-HP-310, "Calibration - Eberline Model PING 1A Stack Monitor - Particulate Channel," Rev. 6, issued December 9, 2011
- MURR Procedure OP-HP-200, "Air Sampling - Containment Building Tritium," Rev. 5, issued January 13, 2012
- MURR Procedure OP-HP-221, "Environmental Sample - Analysis," Rev. 5, issued June 6, 2007
- MURR Procedure OP-HP-222, "Air Sampling - Containment Building Ar-41," Rev. 6, issued February 7, 2013
- MURR Procedure OP-HP-353, "Waste Tank Sample - Analysis," Rev.7, issued June 22, 2011
- MURR Procedure SV-HP-110, "Environmental Sampling," Rev. 4, issued February 15, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2011, through December 31, 2011, issued February 27, 2012
- MURR Reactor Operations Annual Report for the period from January 1, 2012, through December 31, 2012, issued February 26, 2013

b. Observations and Findings

(1) Gaseous and Liquid Releases

The inspector determined that gaseous releases continued to be monitored as required, were acceptably analyzed, and were documented in the annual operating reports. Airborne concentrations of gaseous releases were noted to be within the concentrations stipulated in 10 CFR Part 20, Appendix B, Table 2 and the limits stipulated in the TS. The dose rate to the public, as a result of the gaseous releases, was below the dose constraint specified in 10 CFR 20.1101(d).

The liquid releases from the facility to the sanitary sewer also continued to be monitored as required, were acceptably analyzed, and were documented in the annual reports. The inspector reviewed the analyses of the liquid that had been released and noted that the results indicated that the releases were within the limits specified in 10 CFR Part 20, Appendix B, Table 3.

(2) Environmental Soil, Water, and Vegetation Samples

The inspector reviewed the results of the environmental soil, water, and vegetation samples that were collected, prepared, and analyzed during 2012. These samples had all been collected and analyzed as required and within the time frame established by procedure. No problems were noted.

(3) Environmental Monitoring using TLDs

On-site and off-site gamma radiation monitoring was completed using the reactor facility stack effluent monitor and various environmental TLDs in accordance with the applicable procedures. Review of the data indicated that there were no measurable doses above any regulatory limits.

c. Conclusion

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits.

7. Transportation

a. Inspection Scope (IP 86740)

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

- Selected records of various types of radioactive material shipments for 2012 and to date in 2013
- Selected training records for staff personnel authorized to ship radioactive

material

- MURR Policy POL-14, "Shipping Quality Assurance Program for Type B Shipping Casks," Rev. 5, issued January 29, 2013
- MURR Procedure AP-SH-001, "Administrative Procedure, Radioactive Materials Shipping," Rev. 7, issued March 11, 2011
- MURR Procedure BPB-SH-002, "20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 11, issued July 25, 2012
- MURR Procedure BPB-SH-005, "DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 10, issued March 29, 2012
- MURR Procedure BP-SH-011, "Shipment of Non-Waste DOT 7A Type A (Gemstone) Radioactive Material Package," Rev. 5, issued December 5, 2011
- MURR Procedure BP-SH-013, "Packaging and Shipment of Radioactive Material Using MURR Reusable Type A Package," Rev. 5, issued May 11, 2011
- MURR Procedure QAB-SH-003, "Material Control for Type B Shipping Program," Rev. 2, issued September 29, 2011

b. Observations and Findings

During the inspection, the inspector observed the preparations for three shipments; one involving a domestic shipment of barium, one involving a domestic shipment of iridium, and one involving an international shipment of iridium. Each shipment was made in a Type B shipping container. Throughout the process the inspector noted adherence to procedures and attention to maintaining radiation doses ALARA. Shipping personnel reviewed the irradiation records and the contents of the packages were verified using gamma spectroscopy. Shipping papers were prepared by one person and reviewed for accuracy and completeness by a second staff member. The licensee verified consignee information (i.e., possession of a license to receive radioactive materials, address, and contact information). Also, appropriate labels were completed and applied to the shipping containers. The inspector verified that the shipping papers contained all required information and that the appropriate labels were correct and applied to the packaging. An HP technician was also involved to review the shipment paperwork. Other quality assurance checks were also adequate and completed as required. Throughout the shipping process it was noted that MURR staff members where knowledgeable of their duties and conducted a thorough review of all documentation.

The inspector verified that the licensee maintained on file copies of consignees' licenses to possess radioactive material as required. As noted above, the license of each specific consignee was verified to be current prior to initiating a shipment and the amount of radioactive material was compared to that amount authorized by the license. The inspector also verified that the licensee staff members who were designated as "shippers" had received training within the last 3 years with the most recent training provided to those individuals in May 2012.

The records of various types of shipments were reviewed, including the records

of a shipment of radioactive waste. Through records review and discussions with licensee personnel, the inspector determined that, in addition to medical isotopes and radioactive waste, the licensee had shipped spent fuel and other types of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation and NRC regulations.

c. Conclusion

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

8. Exit Interview

The inspection scope and results were summarized on March 21, 2013, with members of licensee management and staff. The inspector described the areas inspected and discussed in detail the inspection findings. The licensee did not identify any of the material provided to or reviewed by the inspector during the inspection as proprietary. The licensee acknowledged the results of the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. Butler	MURR Facility Director
R. Dobey	Health Physics Manager
J. Ernst	Associate Director, Regulatory Assurance Group
L. Foyto	Associate Director, Reactor and Facilities Operations
J. Fruits	Reactor Manager
A. Gaddy	Compliance Specialist
E. Graham	Health Physics Technician
J. Hemphill	Health Physicist, Special Projects Coordinator
C. Herbold	Assistant Reactor Manager – Engineering
N. Hogue	Health Physicist, Radioactive Waste Coordinator
M. Hudson	Health Physics Technician Specialist (Shipping)
B. Jacobi	Assistant Reactor Manager, Operations
L. Juengermann	Shipping Manager
M. Kraus	Safety Associate and CAP Coordinator
K. Kutikkad	Asst. Reactor Manager, Physics; SNM Coordinator; and Security Director
R. Maxey	Health Physics Technician (Shipping)
J. Mitchell	Health Physics Technician II
M. Nichols	Health Physics Technician (Shipping)
D. Nickolaus	Health Physics Technician II
D. Rathke	Access Control Coordinator
B. Richardson	Non-Radioactive Shipping/Receiving Technician
M. Sanford	Associate Director, Products and Services
C. Schnieders	Health Physics Technician
S. Wood	Health Physics Technician (Shipping)

INSPECTION PROCEDURES USED

IP 69004	Class 1 Research and Test Reactor Effluent and Environmental Monitoring
IP 69006	Class 1 Research and Test Reactor Organization, Operations, and Maintenance Activities
IP 69007	Class 1 Research and Test Reactor Review and Audit and Design Change Functions
IP 69012	Class 1 Research and Test Reactor Radiation Protection
IP 86740	Inspection of Transportation Activities

ITEMS OPENED, CLOSED, AND/OR DISCUSSED

Opened

50-186/2013-201-01	IFI	Follow-up on the issue of developing a procedure concerning the proper conduct and documentation of radiation and contamination surveys at MURR.

Closed

None.

LIST OF ACRONYMS USED

ALARA	As low as reasonably achievable
CAP	Corrective Action Program
10 CFR	Title 10 of the *Code of Federal Regulations*
DDE	Deep dose equivalent
HP	Health physics
IFI	Inspector Follow-up Item
IP	Inspection Procedure
MURR	University of Missouri – Columbia Research Reactor
No.	Number
NRC	U. S. Nuclear Regulatory Commission
OSL	Optically stimulated luminescent (dosimeter)
POD	Plan of the Day
RAC	Reactor Advisory Committee
RAG	Regulatory Assurance Group
Rev.	Revision
SDE	Shallow dose equivalent
TLD	Thermoluminescent dosimeter
TS	Technical Specifications