May 26, 2009

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. 50-186/2009-201

Dear Mr. Butler:

On May 4–7, 2009, the U.S. Nuclear Regulatory Commission (NRC, the Commission) completed an inspection at the University of Missouri - Columbia Research Reactor (Inspection Report No. 50-186/2009-201). The enclosed report documents the inspection results, which were discussed on May 7, 2009, 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, observation of activities, and interviews with 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 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).

Should you have any questions concerning this inspection, please contact Craig Bassett at 404-358-6515 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

cc:

University of Missouri
Associate Director
Research Reactor Facility
Columbia, MO 65201

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

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Research Reactor Center
University of Missouri - Columbia
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Johnny H. Eads, Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-186
License No. R-103

Enclosure: NRC Inspection Report No. 50-186/2009-201
cc w/enclosure: Please see next page

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ACCESSION NO.: ML091460002 *** via e-mail** **TEMPLATE #: NRR-106**

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

Docket No.:	50-186
License No.:	R-103
Report No.:	50-186/2009-201
Licensee:	Curators of the University of Missouri - Columbia
Facility:	University of Missouri - Columbia Research Reactor
Location:	Research Park Columbia, Missouri
Dates:	May 4–7, 2009
Inspectors:	Craig Bassett Jack Donohue
Accompanied by:	Mike Morlang
Approved by:	Johnny H. Eads, Chief Research and Test Reactors Branch B Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Missouri - Columbia
University of Missouri - Columbia Research Reactor
Report No.: 50-186/2009-201

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 (10MW) Class I research and test reactor safety program including: 1) organizational structure and staffing; 2) review and audit and design change functions; 3) procedures, 4) radiation protection, 5) environmental monitoring; and 6) transportation of radioactive material since the last 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 U.S. Nuclear Regulatory Commission (NRC) requirements. No violations or deviations were identified.

Organization and Staffing

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

Review and Audit and Design Change Functions

- Review and oversight functions required by Technical Specifications Section 6.1 were acceptably completed by the Reactor Advisory Committee.

- The design change program and procedures, which outlined the review and evaluation of changes to structures, systems, and components, and procedures and other documentation at the facility, satisfied NRC requirements.

Procedures

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

Radiation Protection

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

- Postings and notices met regulatory requirements.

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

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

- The Radiation Protection and ALARA Programs satisfied regulatory requirements.

- Annual reviews of the Radiation Protection Program were being completed by the licensee as required by 10 CFR Part 20.

- Radiation protection training was being conducted and was acceptable.

Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements and 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 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), Section 6.1, Revision (Rev.) Number (No.) 13, dated January 29, 2004, the inspectors reviewed:

- Administrative controls and management responsibilities
- Current MURR organizational structure with respect to radiation protection
- Operations and 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, 2007 through December 31, 2007, issued February 27, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2008 through December 31, 2008, issued February 23, 2009

b. Observations and Findings

The inspectors noted that the organizational structure had not changed since the last inspection in the area of radiation protection (refer to NRC Inspection Report No. 50-186/2008-201). The Health Physics (HP) Group was staffed with a Health Physics Manager, a Radioactive Waste Coordinator and a Project Manager (who were both Health Physicists), and three HP technicians. At the time of the inspection, one HP technician position was open but an offer had been made and accepted, and the individual was expected to start work within two weeks.

The organizational structure was 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. Conclusions

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

2. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69007)

In order to verify that the licensee had established and conducted reviews and audits as required by 10 CFR Part 20 and TS Section 6.1 and to ensure that facility changes were reviewed and approved in accordance with 10 CFR 50.59, the inspectors reviewed:

- Radiation Protection Plan Audit for 2007 and 2008
- Selected audits and reviews completed by management and HP personnel
- Selected Subcommittee meeting minutes from January 2008 to the present including the Isotope Use Subcommittee, the Reactor Safety Subcommittee, and the Reactor Procedure Review Subcommittee
- MURR Reactor Advisory Committee meeting minutes, and related documents, from January 2008 to the present
- MURR Radiation Safety Committee meeting minutes from January 2008 to the present
- Selected Modification Records and 50.59 Screen Forms processed during 2008
- MURR Procedure AP-RO-115, "Modification Records," Rev. 4, issued October 29, 2008
- MURR Procedure AP-RR-003, "10 CFR 50.59 Evaluations," Rev. 4, issued July 6, 2006
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 8, issued September 16, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2007 through December 31, 2007, issued February 27, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2008 through December 31, 2008, issued February 23, 2009

b. Observations and Findings

(1) Review and Audit Functions

The inspectors reviewed the meeting minutes of the Reactor Advisory Committee (RAC) and the meeting minutes of various subcommittees from January 2008 to the present. The minutes, and associated documents, indicated that the committee met at the required frequency and that a quorum was present. The topics considered during the RAC meetings and during the subcommittee meetings were appropriate and as stipulated in the TS.

The inspectors reviewed the latest audits of the licensee's Radiation Protection (RP) program. It was noted that a member of one of the subcommittees of the RAC or other designated persons, including management and HP personnel, conducted audits and reviews of the RP

program and the full RAC reviewed the results. No significant issues were identified during the audits but several areas for improvement were noted. The inspectors also noted that a new format for the audit and review of the RP program had been developed since the last inspection. This was done to facilitate completion of the review and audit by someone in either the Health Physics Group or the Regulatory Assurance Group, or by a member of the RAC. The new format appeared to be effective and adequate.

(2) Design Change Functions

The regulatory requirements stipulated in 10 CFR 50.59 were implemented at the facility through MURR Procedures AP-RR-003 and AR-RO-115. The procedures were developed to address activities that affected changes to the facility Hazards Summary Report (HSR), modifications to the facility, changes to MURR procedures, new tests or experiments not described in the HSR, revisions to NRC approved analysis methodology, and/or proposed compensatory actions to address degraded or non-conforming conditions. The procedures adequately incorporated criteria provided by the regulations with additional requirements mandated by local conditions.

The inspectors reviewed selected Modification Records and 50.59 Screen Forms processed during 2008. The completed forms showed that the proposed changes and/or modifications were acceptably reviewed in accordance with the procedures. It was noted that the proposed changes or modifications did not deal specifically with radiation protection or radiation monitoring systems but were those that affected reactor operations or related systems. None of the modifications were determined to constitute a safety question or concern and none required a license or TS amendment.

c. Conclusions

Review and oversight functions required by the TS were acceptably completed by the RAC. The design change program was comprehensive and satisfied NRC requirements.

3. Procedures

a. Inspection Scope (IP 69008)

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

- MURR Procedure AP-DC-100, “Controlled Document Revisions,” Rev. 9, issued October 1, 2008
- MURR Procedure AP-HP-119, “High Radiation Area Access,” Rev. 2, issued February 10, 2009

- MURR Procedure AP-RR-011, "Facility Access Process," Rev. 15, issued March 4, 2009
- MURR Procedure AP-RR-022, "Administrative Concern and Conflict Resolution," Rev. 6, issued March 4, 2009
- MURR Procedure BP-SH-052, "Radioactive Material Shipment Package Documentation and Labeling," Rev. 4, issued April 8, 2009
- MURR Procedure RP-HP-300, "Personnel Radioactive Contamination," Rev. 6, issued April 29, 2009
- MURR Procedure SM-RO-640, "Retracting and Reinserting Beamport 'F' Liner," Rev. 4, issued February 27, 2009
- MURR Procedure SV-HP-119, "Property Release," Rev. 3, issued April 29, 2009
- MURR Reactor Operations Annual Report for the period from January 1, 2007 through December 31, 2007, issued February 27, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2008 through December 31, 2008, issued February 23, 2009

b. Observations and Findings

Technical Specification 6.1.c required that the RAC review procedure changes with safety significance. The Reactor Procedure Review Subcommittee was chartered to fulfill this requirement. The inspectors verified that the subcommittee was meeting as required to review current procedure revisions and changes.

The inspectors noted that the majority of MURR procedures had been through a full review and revision process. The procedures reviewed by the inspectors had been reviewed during the annual review as required.

The inspectors observed various activities during the inspection. All operations were conducted in accordance with procedures and no problems were noted. Procedure compliance was acceptable.

c. Conclusions

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

4. Radiation Protection

a. Inspection Scope (IP 69012)

The inspectors reviewed the following to verify compliance with 10 CFR Part 20 and the applicable licensee TS requirements and procedures:

- MURR dosimetry records for 2007 and 2008
- Radiation protection (Rad Worker) training records
- Dose Report Review Forms for October 2008 – February 2009
- Selected radiation and contamination survey records for the past year

- MURR Center Security, Emergency, and Health Physics Indoctrination Booklet
- 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 two years
- MURR Procedure AP-HP-105, "Radiation Work Permit," Rev. 8, issued July 30, 2008, and the associated form, Form FM-17, "Radiation Work Permit"
- MURR Procedure AP-HP-117, "MURR Initial Radiation Worker Training Program," Rev. 8, issued April 18, 2007, and the associated forms, Form FM-26, "MURR Training Questionnaire," and Form FM-29, "Initial Training Packet"
- MURR Procedure AP-HP-119, "High Radiation Area Access," Rev. 2, issued February 13, 2009
- MURR Procedure AP-HP-123, "Visitor Dosimetry – Reception Desk," Rev. 6 issued March 11, 2009
- MURR Procedure AP-HP-125, "Review of Unplanned Radiation Exposure," Rev. 2, issued April 18, 2007
- MURR Procedure AP-HP-130, "Reactor License Projects Annual Review," Rev. 3, issued December 17, 2008
- MURR Procedure IC-HP-300, "Calibration - Radiation Survey Instruments," Rev. 5, issued March 18, 2009, and the associated form, Form FM-62, "Radiation Instrument Certificate of Calibration"
- MURR Procedure IC-HP-333, "Calibration - Eberline BC-4 Beta Swipe Counter," Rev. 5, issued February 13, 2009
- MURR Procedure IC-HP-335, "Calibration - Portal Monitor Gamma-60 - S/N 900644," Rev. 7, issued April 29, 2009
- MURR Procedure OP-HP-220, "Tritium Bioassay," Rev. 4, issued July 30, 2008
- MURR Procedure OP-HP-306, "Daily Facility Checks," Rev. 1, issued November 8, 2007
- MURR Procedure RP-HP-100, "Contamination Monitoring - Performing a Swipe," Rev. 5, issued January 18, 2008
- 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 Procedure SV-HP-119, "Property Release," Rev. 3, issued March 29, 2000
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 8, issued September 16, 2008
- MURR Administrative Policy, POL-17, "MURR Training Booklet (Security, Emergency, and Health Physics)," Rev. 0, issued October 17, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2007 through December 31, 2007, issued February 27, 2008

- MURR Reactor Operations Annual Report for the period from January 1, 2008 through December 31, 2008, issued February 23, 2009

The inspectors also toured the licensee's facility and witnessed the use of dosimetry and survey meters. Licensee personnel were interviewed as well.

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 2008, were completed by HP staff members. Any contamination detected in concentrations above established action levels was noted and the areas were decontaminated. Results of the surveys were typically documented on survey maps and posted at the entrances of the various areas surveyed so that facility workers and visitors would be aware of the radiological conditions that existed therein.

(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 on the main bulletin board, in main hallways, and at the entrance to the Beam Port Floor area. The inspectors determined that radiological signs and, as noted above, survey maps were typically posted at the entrances to controlled areas. Other postings also showed the industrial hygiene hazards that were present in the areas as well.

(3) Dosimetry Use and Results

Through direct observation the inspectors determined that dosimetry was acceptably used by facility and contractor personnel. The inspectors determined that 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. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program accredited vendor (Landauer).

An examination of the OSL results indicating radiological exposures at the facility for the past two years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limits. The records showed that approximately half of the facility personnel received occupational exposures of zero (0) to only a few millirem above background. The highest annual whole body exposure received by a single individual for 2007 was 3,910 millirem (mr) deep dose equivalent (DDE). The highest annual extremity exposure for 2007 was 3,910 mr

and the highest shallow dose equivalent (SDE) was 1,212 mr. The highest annual whole body exposure received by a single individual for 2008 was 1,140 mr DDE. The highest annual extremity exposure for 2008 was 6,420 mr and the highest SDE was 1,109 mr. In both years the highest whole body exposure was received by a reactor operator. The highest extremity exposure was received by a person processing samples in 2007 while the highest extremity exposure in 2008 was received by a person in the shipping group. Review of exposure records also showed that the Reactor Operations Group received approximately 55% of the facility's annual dose for 2007 and approximately 52% of the facility's annual dose for 2008.

The facility also collected and analyzed urine samples for Tritium (H-3) bioassay purposes. The highest attributable dose in 2007 from H-3 was 1.2 mr committed effective dose equivalent (CEDE). The highest H-3 attributable dose in 2008 was approximately 1.97 mr CEDE.

(4) Radiation Monitoring Equipment

Examination of selected radiation monitoring equipment indicated that the instruments had the acceptable up-to-date calibration sticker attached. The instrument calibration records indicated that the calibration of certain portable survey meters (friskers) was typically completed by licensee staff personnel. Other instruments, such as high range ion chambers and neutron detectors that could not be calibrated by the licensee, were shipped to vendors for calibration. Calibration frequency met procedural requirements and records were maintained as required. Area Radiation Monitors (ARMs) and stack monitors were also being calibrated as required. These monitors were typically calibrated by licensee staff personnel.

(5) Radiation Work Permit Program

The inspectors reviewed selected Radiation Work Permits (RWPs) that had been written, used, and closed out during 2008 and those issued for 2009. It was noted that the instructions specified in MURR Procedure AP-HP-105, Attachment 7.1, and those on the associated forms (Form FM-17, "Radiation Work Permit Instructions") had been adequately followed. Appropriate review by management and health physics personnel had been completed. The controls specified in the RWPs were acceptable and applicable for the type of work being done.

(6) Radiation Protection Training

The inspectors reviewed the radiation protection training (also known as rad worker training) given to MURR staff members, to those authorized to use the experimental facilities of the reactor, to students, and to visitors. The training satisfied the requirements of 10 CFR Part 19 and the training program was acceptable. It was noted that the rad worker annual refresher training for all staff personnel was completed by each individual

on the anniversary date of their initial training. Additional training was generally conducted for all facility personnel during the months of September through November to review any current issues in the areas of safety, operations, security, and facility status, as well as radiation protection. The inspectors reviewed the annual "current issues" training given in 2008. It was noted that the training had been completed in late October and early November.

(7) Radiation Protection Program

The licensee's Radiation Protection and ALARA programs were established and described in the MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," and 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 inspectors 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.

(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 in 2001 was 42.9 rem. Due to the establishment of aggressive ALARA goals, continued efforts on dose reduction, worker awareness, and engineered improvements, the facility dose was 34 rem in 2002, 26.9 rem in 2003, and 27 rem in 2004. 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, less than the annual dose received in 2000, 2001, or 2002. . In 2007 the cumulative facility dose was 33.6 rem. During 2008 MURR management and staff continued to focus on efforts to maintain personal doses ALARA. It was noted that the total cumulative facility dose for 2008 increased slightly and was 33.7 rem

(9) Facility Tours

The inspectors toured the Hot Cell area, Beam Port Floor area, and selected support laboratories with licensee representatives on various occasions. During one of those tours, an inspector conducted a radiation survey along with a licensee representative. During the survey, the inspector noted an unmarked container on the Beam Port Floor with radiation levels higher than the others in the area. Upon investigation, five small bolts reading approximately 40 mr were found in the container. It was noted that the bolts were within a posted radioactive material storage area and a posted radiation area but not in a marked container. The licensee immediately collected the bolts and place them in a shielded container marked with a "Radioactive Material" label. No other unmarked radioactive material was noted 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 as required and properly controlled.

c. Conclusions

The inspectors 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) the radiation protection training program was acceptable.

5. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

The inspectors reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Section 3.7:

- Environmental monitoring program outlined through various procedures
- Monthly ALARA Environmental Review Reports for 2008 and to date in 2009
- Liquid Batch Release Review Forms for 2008 associated with the Monthly ALARA Environmental Review Reports
- MURR Procedure IC-HP-310, "Calibration - Eberline Model PING 1A Stack Monitor - Particulate Channel," Rev. 5, issued January 18, 2008
- MURR Procedure IC-HP-311, "Calibration - Eberline Model PING 1A Stack Monitor - Iodine Channel," Rev. 5, issued January 18, 2008
- MURR Procedure IC-HP-312, "Calibration - Eberline Model PING 1A Stack Monitor - Gas Channel," Rev. 5, issued January 18, 2008

- MURR Procedure OP-HP-200, “Air Sampling - Containment Building Tritium,” Rev. 3, issued December 17, 2008
- 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. 4, issued January 18, 2008
- MURR Procedure OP-HP-353, “Waste Tank Sample - Analysis,” Rev. 5, issued March 18, 2009
- MURR Procedure SV-HP-110, “Environmental Sampling,” Rev. 4, issued February 15, 2008
- MURR Procedure WM-SH-105, “Radioactive Waste Processing,” Rev. 4, issued August 7, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2007 through December 31, 2007, issued February 27, 2008
- MURR Reactor Operations Annual Report for the period from January 1, 2008 through December 31, 2008, issued February 23, 2009

b. Observations and Findings

(1) Gaseous and Liquid Releases

The inspectors 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 well within the concentrations stipulated in 10 CFR 20, Appendix B, Table 2, and TS limits. 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) of 10 millirem per year. COMPLY code results indicated an annual dose to the public of 4.2 mr for 2007, before an occupancy factor was applied. Data for 2008 indicated an annual dose to the public of 4.1 mr before application of an occupancy factor.

It was noted that, for 2007, the licensee had added 0.7 mr to the 4.2 mr calculated by using the COMPLY code. This was done to be conservative and to compensate for an environmental TLD reading of a TLD that was located at the nearest occupied building 150 meters to the northeast of MURR. This resulted in a dose of 4.9 mr in 2007. In 2008, no significant radiation dose was recorded on the environmental TLD at the nearest occupied building so the licensee had added no dose (0.0 mr) to that calculated by using the COMPLY code.

Thus, by applying an occupancy factor (0.24) for each year (occupancy factor multiplied by the calculated dose), the resulting annual dose to the public for 2007 was 1.2 mr and the annual dose to the public for 2008 was 0.98 mr.

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 inspectors noted that the results

indicated that the releases were within the limits specified in 10 CFR 20, Appendix B, Table 3.

(2) Environmental Soil, Water, and Vegetation Samples

The inspectors reviewed the environmental soil, water, and vegetation samples that were collected, prepared, and analyzed during 2008 and the spring of 2009. These samples had all been collected and analyzed within the appropriate time frame required by procedure.

(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.

In 2007, the highest unrestricted area dose was measured in an unoccupied area north northwest from the MURR stack and was 45.3 mr. The highest unrestricted area dose in 2008 was measured in an unoccupied area south from the MURR stack and was 81.6 mr for all of 2008.

c. Conclusion

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

6. Transportation

a. Inspection Scope (IP 86740)

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

- Selected records of various types of radioactive material shipments
- Selected training records for staff personnel authorized to ship hazardous material in accordance with the regulations specified by the DOT, IATA, and ICAO
- MURR Procedure AP-SH-001, "Administrative Procedure, Radioactive Materials Shipping," Rev. 5, issued February 16, 2007
- MURR Procedure BPB-SH-002, "20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 8, issued December 10, 2008
- MURR Procedure BPB-SH-005, "DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 7, issued April 8, 2009
- MURR Procedure BPB-SH-008, "Type B(U) F-327 Series Packaging of Type B Non-Waste Radioactive Material," Rev. 6, issued April 8, 2009
- MURR Procedure BP-SH-007, "F-327 Packaging and Shipment of Type A

Non-Waste Radioactive Material," Rev. 4, issued August 7, 2008

- MURR Procedure BP-SH-010, "Packaging and Shipment of Non-Waste Radioactive Materials in Excepted Packages," Rev. 2, issued October 31, 2006
- MURR Procedure BP-SH-011, "Shipment of Non-Waste DOT 7A Type A (Gemstone) Radioactive Material Package," Rev. 3, issued October 31, 2006
- MURR Procedure BP-SH-013, "Packaging and Shipment of Radioactive Material Using MURR Reusable Type A Package," Rev. 3, issued April 8, 2009
- MURR Procedure BP-SH-014, "Packaging and Shipment of Radioactive Material Using an Overpack," Rev. 2, issued April 8, 2009
- MURR Procedure BP-SH-052, "Radioactive Material Shipment Package Documentation and Labeling," Rev. 4, issued April 8, 2009
- MURR Procedure BP-SH-099, "Packaging of Radioactive Material Using MURR Model 1500," Rev. 1, issued February 16, 2007
- MURR Procedure FB-SH-001, "Unirradiated Fuel Shipment Using the 110-Gallon USA DOT 6M Type B Package," Rev. 0, issued July 7, 2007
- MURR Procedure FB-SH-005, "Type B Shipment of Spend Fuel Using BMI-1 Shipping Container," Rev. 1, issued August 16, 2006
- MURR Procedure WM-SH-100, "Radioactive Waste - Preparation and Storage," Rev. 4, issued April 20, 2007
- MURR Procedure WM-SH-300, "MURR Exclusive Use Shipment of LSA or SCO Radioactive Waste," Rev. 6, issued September 11, 2008

b. Observations and Findings

During the inspection, the inspectors closely observed the preparations for a shipment of barium carbonate material from the facility. The inspectors observed as the material was moved from the Hot Cell to a shielded shipping container. The container was subsequently surveyed, classified as Yellow-III, and placed in a Type B package. Labels were applied to the package and shipping papers were prepared. The inspectors verified that the shipping papers contained the appropriate information and that the appropriate markings were placed on the outside of the package. Proper techniques were followed in conducting surveys of the package and the quality assurance checks of the shipments. Staff members conducting these shipments were knowledgeable of their duties and conducted a thorough review of all documentation.

During the aforementioned observations, the inspectors also verified that the licensee maintained copies of consignees' licenses to possess radioactive material as required and that the licenses of the consignees were verified to be current prior to initiating a shipment. The training of the staff members responsible for shipping the material was also reviewed. The inspectors verified that the shippers had received training covering the various requirements of the Department of Transportation (DOT) and the International Air Transport Association (IATA) and that the training was current.

Through records review and discussions with licensee personnel, the inspectors

determined that the licensee had shipped spent fuel, radioactive waste, 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 inspectors had been completed in accordance with DOT and NRC regulations.

c. Conclusions

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

7. Follow-up on Previous Identified Items

a. Inspection Scope (IP 92701)

The inspectors reviewed the licensee's actions taken in response to a previously identified Unresolved Items (URI) in NRC Inspection Report No. 50-186/2008-201, dated April 25, 2008.

b. Observation and Findings

URI 50-186/2008-201-02 - Follow-up to ensure that Reactor License Projects are being reviewed annually as required.

During an inspection in 2008, the inspector reviewed four projects and their associated reviews during the inspection. They were Project RL-12, “Remote Vial Washing,” Project RL-26, “Irradiation, Processing, and Measurement of Semiconductor Materials and Similar High-Purity Materials,” Project RL-58, “Gemstone Irradiation,” and Project RL-69, “Humidity Chamber for TRIAX (RL-46) and Reflectometer (RL-34).” Verification of the HP project review was required to be documented on MURR Form FM-86, Reactor License Project Review Report.

Upon reviewing the folder for each project and the various FM-86 forms contained in each folder, the inspector noted that one or more reviews for each of the RL Projects was either missing or had been completed in a time frame greater than one year.

At the close of the inspection, the inspector learned that the RL Projects were also being audited by Regulatory Assurance Group. Because this area was the subject of an ongoing audit by the licensee and because more information was needed to determine the proper disposition of this issue, the licensee was informed that the issue would be identified as an Unresolved Item[1] (URI) by the NRC.

During this inspection, the inspectors reviewed the results of the licensee’s audit of the RL Projects as well as the status of the current required reviews. The

[1] An Unresolved Item is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation.

inspectors noted that, during their audit, the licensee had identified issues similar to those identified during the NRC inspection and as a result various corrective actions had been initiated. The information for each of the active RL Projects was placed in the licensee's MAXIMO data base to track the "due dates" and issue notification when these were approaching. The Health Physics Manager also maintained a spread sheet to track the "due dates" of the various RL Projects and then assigned the reviews to be completed as needed. When the inspectors checked on the current status of the various reviews, it was noted that the reviews had been completed as required or were in the process of being completed. This issue is considered closed.

c. Conclusions

An Unresolved Item identified during a previous inspection was reviewed during this inspection and closed.

8. Exit Interview

The inspection scope and results were summarized on May 7, 2009, with members of licensee management and staff. The inspectors 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 inspectors during the inspection as proprietary. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

K. Brooks	Associate Director, Product and Service Operations
R. Butler	Director of MURR
M. Diaz de Leon	Health Physicist
R. Dobey	Health Physics Manager
G. Ehrhardt	Senior Research Scientist and Chair, Isotope Use Subcommittee
J. Ernst	Associate Director, Regulatory Assurance Group
L. Foyto	Reactor Manager
A. Gaddy	Compliance Specialist
M. Kilfoil	Senior Reactor Services Project Specialist
K. Kutikkad	Assistant Reactor Manager, Physics
R. Maxey	Health Physics Technician
W. Meyer	Chief Operating Officer
C. Mohesky	Training Coordinator
M. Nichols	Health Physics Technician
D. Nickolaus	Health Physics Technician
S. Oberhaus	Health Physics Technician Specialist
E. Werner	Health Physics Technician

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
IP 92701	Follow-up on Previously Identified Items

OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-186/2008-201-02	URI	Follow-up to ensure that Reactor License Projects are being reviewed annually as required.

LIST OF ACRONYMS USED

ARM	Area Radiation Monitor
ALARA	As low as reasonably achievable
CEDE	Committed effective dose equivalent
CFR	Code of Federal Regulations
DDE	Deep dose equivalent
DOT	Department of Transportation
HP	Health physics
HSR	Hazards Summary Report
IATA	International Air Transport Association
IP	Inspection Procedure
MURR	University of Missouri - Columbia Research Reactor
NRC	Nuclear Regulatory Commission
OSL	Optically stimulated luminescent (dosimeter)
RAC	Reactor Advisory Committee
RWP	Radiation Work Permit
SDE	Shallow dose equivalent
TLD	Thermoluminescent dosimeter
TS	Technical Specification
URI	Unresolved Item