

April 25, 2008

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

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 50-186/2008-201

Dear Mr. Butler:

On April 7 - 10, 2008, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your University of Missouri - Columbia Research Reactor facility. The enclosed report documents the inspection results, which were discussed on April 10, 2008, with you and members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the NRC's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel. Based on the results of this inspection, no findings of significance were identified.

In accordance with 10 CFR 2.390 of the NRC's, "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document 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.

Sincerely,

/RA/

Johnny H. Eads, Branch 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

Enclosures: NRC Inspection Report No. 50-186/2008-201
cc w/enclosure: Please see next page

University of Missouri-Columbia

Docket No. 50-186

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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ACCESSION NO.: ML081140098

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

Docket No.: 50-186

License No.: R-103

Report No.: 50-186/2008-201

Licensee: Curators of the University of Missouri - Columbia

Facility: University of Missouri - Columbia Research Reactor

Location: Research Park
Columbia, Missouri

Dates: April 7-10, 2008

Inspector: Craig Bassett

Approved by: Johnny H. Eads, Branch 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.: 50-186/2008-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the licensee's 10 Megawatt, Class I research reactor safety program including: organizational structure and staffing, review and audit and design change functions, radiation protection, effluent and environmental monitoring, and transportation of radioactive materials since the last NRC inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

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.

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 during the week 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 inspector reviewed:

- Current MURR organizational structure
- Administrative controls and management responsibilities
- MURR Reactor Operations Annual Reports for 2006 and 2007
- Operations and health physics staffing requirements for safe operation of the facility

b. Observations and Findings

The inspector noted that the organizational structure had changed somewhat since the last inspection in the area of radiation protection (refer to NRC Inspection Report No. 50-186/2007-201). As mentioned in NRC Inspection Report No. 50-186/2007-203, the Manager of Health Physics now reports to the Chief Operating Officer. He formerly reported to the Associate Director of Regulatory Assurance. It was noted that 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 four HP technicians.

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, the inspector reviewed:

- Radiation Protection Plan Audit for 2006 and 2007

- Selected audits and reviews completed by various management and HP personnel
- Selected Subcommittee meeting minutes from January 2007 to the present including the Isotope Use Subcommittee, the Reactor Safety Subcommittee, and the Procedure Review Subcommittee
- MURR Reactor Advisory Committee meeting minutes, and related documents, from January 2007 to the present
- MURR Procedure AP-RR-003, "10 CFR 50.59 Evaluations," Rev. 4, issued July 6, 2006
- MURR Procedure AR-RO-115, "Modification Records," Rev. 3, issued October 18, 2007
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 7, issued September 20, 2007

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed the meeting minutes of the Reactor Advisory Committee (RAC) and the meeting minutes of various subcommittees from January 2007 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 inspector noted that, in the past, a subcommittee of the RAC or other designated persons, including HP personnel, conducted audits and reviews of the radiation protection (RP) program and the full RAC reviewed the results. No significant issues were identified during the audits conducted by the licensee. During this inspection, it was noted that the audit of the RP program had been performed by the Manager of Health Physics. It consisted of a review of the MURR policy document, MURR Administrative Policy POL-3, "Radiation Protection Program." A few minor changes to the document had been suggested.

A new format for the audit and review of the RP program was being developed by the licensee. This was being done to facilitate completion of the review and audit by someone in the Health Physics Group, or the Regulatory Assurance Group or by a member of the RAC. Completion of this new audit will be reviewed during the next inspection at the facility.

(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 inspector reviewed selected Modification Records and 50.59 Screen Forms processed during 2007. 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. Audits of various reactor operations and programs were being conducted. The design change program was comprehensive and satisfied NRC requirements.

3. Radiation Protection

a. Inspection Scope (IP 69012)

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

- MURR dosimetry records for 2006 and 2007
- Radiation protection (Rad Worker) training records
- Dose Report Review Forms for October 2007 - February 2008
- MURR Reactor Operations Annual Reports for 2006 and 2007
- 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. 7, issued November 8, 2007, and the associated form, Form FM-17, "Radiation Work Permit"
- MURR Procedure AP-HP-117, "MURR Initial Radiation Worker Training Program," Rev. 9, issued November 8, 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. 1, issued March 24, 2006
- 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. 2, issued November 29, 2006
- MURR Procedure AP-RR-001, "Corrective Action Program," Rev. 9, issued June 21, 2007
- MURR Procedure IC-HP-300, "Calibration - Radiation Survey Instruments," Rev. 4, issued March 24, 2006, 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. 4, issued January 30, 2006
- MURR Procedure IC-HP-335, "Calibration - Portal Monitor Gamma-60 - S/N 900644," Rev. 6, issued March 24, 2006
- MURR Procedure OP-HP-220, "Tritium Bioassay," Rev. 3, issued August 18, 2005
- MURR Procedure RP-HP-100, "Contamination Monitoring - Performing a Swipe," Rev. 5, issued June 6, 2007
- MURR Procedure RP-HP-120, "Personnel Radioactive Contamination," Rev. 5, issued June 6, 2007, 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. 2, issued March 24, 2006
- MURR Administrative Policy, POL-3, "MURR Radiation Protection Program," Rev. 7, issued September 20, 2007

The inspector 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 2007, 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 inspector 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 inspector determined that dosimetry was acceptably used by facility and contractor personnel. The inspector 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.

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 2006 was 1,146 millirem (mr) deep dose equivalent (DDE). The highest annual extremity exposure for 2006 was 3,670 mr and the highest shallow dose equivalent (SDE) was 7,027 mr. The highest annual whole body exposure received by a single individual for 2007 was 1,241 mr DDE. The highest annual extremity exposure for 2007 was 3,910 mr and the highest SDE was 1,212 mr. In both years the highest whole body exposure was received by a reactor operator and the highest extremity exposure was received by a person processing samples. Review of exposure records also showed that the Reactor Operations Group received approximately 58% of the facility's annual dose for 2006 and approximately 55% of the facility's annual dose for 2007.

The facility also collected and analyzed urine samples for Tritium (H-3) bioassay purposes. The highest attributable dose in 2006 from H-3 was 11.5 mr committed effective dose equivalent (CEDE). The highest H-3 attributable dose in 2007 was approximately 1.2 mr CEDE. It was noted that the dose in 2006 resulted from the beryllium changeout project which occurred in January of that year.

(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 inspector reviewed selected Radiation Work Permits (RWPs) that had been written, used, and closed out during 2007 and those issued for 2008. 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 inspector reviewed the 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 annual refresher training for all staff personnel was generally conducted during the months of September through November. However, in 2007, the training had not been completed within that time frame and had actually been completed in January 2008. When asked about this delay, the licensee indicated that, because of numerous office moves (into the new office building) in the fall, the training was delayed. Then during November and December, there were various ice storms and many employees took vacation. All these factors forced the licensee to postpone the training until January 2008. The licensee indicated that this issue had been noted and that they would more closely track the training and schedule it in the fall as had been done in the past.

(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 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.

(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, and 2002. During 2007 MURR management and staff continued to focus on efforts to maintain personal doses ALARA. It was noted that the total cumulative facility dose for 2007 increased somewhat and was 33.6 rem

(9) Facility Tours

The inspector toured the Hot Cell area, Beam Port Floor area, and selected support laboratories with licensee representatives on various occasions. The inspector noted that facility radioactive material storage areas were properly posted. No unmarked radioactive material was noted. Radiation and High Radiation Areas were posted as required and properly controlled.

(10) Reactor License Projects Annual Review

TS Section 6.1 requires that the licensee have written procedures for normal operations of the reactor, emergencies, radiological control, and shipping.

MURR Procedure AP-HP-130, "Reactor License Projects Annual Review," Rev. 2, issued November 29, 2006, states in Section 1.0 that the purpose of the procedure is to provide instructions for performing an annual review of projects that are authorized under NRC Reactor License, R-103. The procedure goes on to list various items or issues to be reviewed and verified by the HP representative conducting the review including: 1) the list of personnel approved to work on the project (and their training), 2) the list of radioactive materials authorized for use in the project, 3) the work locations, and 4) any special equipment required. The inspector also noted that each project was to be reviewed and approved (or re-approved) every three years by the Isotope Use Subcommittee (IUS).

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 the following:

- (a) Project RL-12 was last reviewed and approved by the IUS on February 15, 2008. The HP reviews of RL-12 had been completed on December 15, 2003, December 30, 2004, December 5, 2006, and January 3, 2008. No review form was available for 2005.
- (b) Project RL-26 was last reviewed and approved by the IUS on January 21, 2005. FM-86 forms for Project RL-26 indicated that the project had been reviewed by the HP group on January 7, 2004, January 7, 2005, and February 29, 2008. No FM-86 form was located for 2006 but the HP Monthly Log (a log containing assignment sheets for HP personnel to initial when jobs are completed) indicated that the review had been completed the week of April 14, 2006.
- (c) Project RL-58 was last reviewed and approved by the IUS on February 27, 2008. FM-86 forms for Project RL-58 indicated that the project had been

reviewed by the HP group on October 25, 2004, October 25, 2005, March 22, 2006, and September 21, 2007. The period of time between the March 2006 review and the September 2007 review was one year and six months.

- (d) It was noted that Project RL-69 had been reviewed and approved by the IUS on July 26, 2007. One FM-86 form had been completed for the project. The form indicated that Project RL-69 had been reviewed by the HP group on April 4, 2008.

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 this issue would be identified as an Unresolved Item¹ (URI) by the NRC and will be reviewed during a future inspection (URI 50-186/2008-201-02).

c. Conclusions

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) the radiation protection training program was acceptable.

4. 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 and TS Section 3.7:

- MURR Reactor Operations Annual Reports for 2006 and 2007
- Environmental monitoring program outlined through various procedures
- Monthly ALARA Environmental Review Reports for 2007 and to date in 2008
- Liquid Batch Release Review Forms for 2007 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. 2, issued November 7, 2006

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.

- 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. 4, issued November 8, 2007
- MURR Procedure SV-HP-110, "Environmental Sampling," Rev. 4, issued February 15, 2008

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 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 3.9 mr for 2006, before an occupancy factor was applied. Data for 2007 indicated an annual dose to the public of 4.2 mr before application of an occupancy factor.

(It was noted that, for 2006, the licensee had added 6.6 mr to the 3.9 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 10.5 mr in 2006. Using this same reasoning, in 2007, the licensee had added 0.7 mr [TLD results] to the 4.2 mr calculated by using the COMPLY code, resulting in a total dose of 4.9 mr.)

Thus, by applying an occupancy factor for each year (occupancy factor of 0.24), the resulting annual dose to the public for 2006 was 2.54 mr and for 2007 the annual dose to the public was 1.2 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 inspector 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

TS Section 6.1 requires that the licensee have written procedures for normal operations of the reactor, emergencies, radiological control, and shipping.

MURR Procedure SV-HP-110, "Environmental Sampling," requires in Section 4.0 that environmental sampling shall be performed semi-annually at all testing locations.

MURR Procedure OP-HP-221, "Environmental Sample - Analysis," requires in Section 4.0 that gross gamma counting of water samples must be performed within 168 hours (7 days) from the time the water sample was obtained.

The inspector reviewed the environmental soil, water, and vegetation samples that were collected, prepared, and analyzed during 2006 and 2007. It was noted that the samples taken in April 2006 were analyzed on April 19, 2006 and the samples taken in October 2006 were analyzed on October 30, 2006. When the inspector reviewed the analyses for 2007, it was noted that environmental samples had been taken in April 2007 but had not been analyzed at that time. The samples that were due in October 2007 were not collected until January 2008. Both sets of samples for 2007 were noted to have been analyzed in the January/February time period of 2008. This was a violation of procedure.

When this problem was discussed with the licensee, the inspector determined that the licensee became aware of this issue when they were preparing the information for their annual report. There was no data to enter into the report concerning the results of the analyses of the environmental samples for 2007. As a result, as noted above, the October 2007 samples were collected and both sets of samples were then analyzed in January/February 2008. The licensee had also opened a Corrective Action Program (CAP) item concerning this issue (CAP No. 08-009).

The licensee was informed that this non-repetitive, licensee-identified and corrected violation is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.8 of the NRC Enforcement Policy (NCV 50-186/2008-201-01).

(3) Environmental Monitoring

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. The highest unrestricted area dose was measured in an unoccupied area east northeast from the MURR stack and was 31.3 mr for 2006. The highest unrestricted area dose in 2007 was measured in an unoccupied area north northwest from the MURR stack and was 45.3 mr for all of 2007.

c. Conclusion

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

5. 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

- 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. 7, issued September 1, 2006
- MURR Procedure BPB-SH-005, "DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 5, issued December 7, 2007
- MURR Procedure BPB-SH-008, "Type B(U) F-327 Series Packaging of Type B Non-Waste Radioactive Material," Rev. 5, issued February 7, 2008
- MURR Procedure BP-SH-007, "F-327 Packaging and Shipment of Type A Non-Waste Radioactive Material," Rev. 3, issued May 24, 2007
- 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 (Gemstore) 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. 2, issued May 24, 2007
- MURR Procedure BP-SH-014, "Packaging and Shipment of Radioactive Material Using an Overpack," Rev. 1, issued April 20, 2007
- MURR Procedure BP-SH-052, "Radioactive Material Shipment Package Documentation and Labeling," Rev. 2, issued December 7, 2007
- 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 Spent Fuel Using BMI-1 Shipping Container," Rev. 1, issued August 16, 2006
- MURR Procedure WMB-SH-005, "Shipment of Type B Radioactive Waste Using Chem-Nuclear System 1-13G Cask," Rev. 5, issued April 12, 2007
- 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. 5, issued August 13, 2007

b. Observations and Findings

During the inspection, the inspector closely observed the preparations for a shipment of Iridium-192 seeds from the facility. The inspector 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 A package. Labels were applied to the package and shipping papers were prepared. The inspector 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 inspector also verified that the licensee maintained copies of consignees' licenses to possess radioactive material as required

and that the licenses 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 inspector verified that the shippers had received training covering the various requirements of the Department of Transportation (DOT) and the International Air Transport Association (IATA).

Through records review and discussions with licensee personnel, the inspector determined that the licensee had shipped spent fuel, unirradiated 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 inspector had generally been completed in accordance with DOT and NRC regulations. One minor discrepancy was noted but no violations of the requirements were identified.

c. Conclusions

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

6 Exit Interview

The inspection scope and results were summarized on April 10, 2008, 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. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

M. Ballew	Health Physics Technician II
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
M. Kraus	Safety Associate and CAP Coordinator
K. Kutikkad	Assistant Reactor Manager, Physics
R. Maxey	Health Physics Technician
W. Meyer	Chief Operating Officer
C. Mohesky	Training Coordinator
D. Nickolaus	Health Physics Technician
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

OPENED, CLOSED, AND DISCUSSED

Opened

50-186/2008-201-01	NCV	Failure to collect and analyze the semiannual environmental samples within the time frame required by procedure.
50-186/2008-201-02	URI	Follow-up to ensure that Reactor License Projects are being reviewed annually as required.

Closed

50-186/2008-201-01	NCV	Failure to collect and analyze the semiannual environmental samples within the time frame required by procedure.
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LIST OF ACRONYMS USED

ARM	Area Radiation Monitor
ALARA	As low as reasonably achievable
CAP	Corrective Action Program
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
IUS	Isotope Use Subcommittee
MURR	University of Missouri - Columbia Research Reactor
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
OSL	Optically stimulated luminescent (dosimeter)
PDR	Public Document Room
RAC	Reactor Advisory Committee
RWP	Radiation Work Permit
SDE	Shallow dose equivalent
TLD	Thermoluminescent dosimeter
TS	Technical Specification
URI	Unresolved Item