September 22, 2006

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

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 50-186/2006-202

Dear Mr. Butler:

On June 19 - 22, 2006, 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 June 22, 2006, with you and other 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 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).

Sincerely,

/RA/

Johnny 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. 50-186/2006-202

cc w/enclosure: Please see next page

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

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

Docket No.:	50-186
License No.:	R-103
Report No.:	50-186/2006-202
Licensee:	Curators of the University of Missouri - Columbia
Facility:	University of Missouri - Columbia Research Reactor
Location:	Research Park Columbia, Missouri
Dates:	June 19-22, 2006
Inspector: Accompanied by:	Craig Bassett Kamal Talha
Approved by:	Johnny 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.: 50-186/2006-202

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 programs including: organizational structure and staffing, review and audit and design change functions, procedures, 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, components, and documentation of the facility and procedures satisfied NRC requirements.

Radiation Protection

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

- Postings met regulatory requirements.

- Personnel dosimetry was being worn 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, Amendment No. 33, dated January 29, 2004, the inspector reviewed:

- current MURR organizational structure
- administrative controls and management responsibilities
- MURR Reactor Operations Annual Reports for 2004 and 2005
- operations and health physics staffing requirements for safe operation of the facility

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. 50-186/2005-201). The Reactor Operations group was fully staffed. The Health Physics (HP) section, within the Regulatory Assurance Group, was fully staffed with a Health Physics Manager, a Rad Waste Coordinator, two Health Physicists, and three HP technicians.

The organization and staffing at the facility, required for reactor operation, were as specified in the TS. Qualifications of the staff met program requirements. Review of records verified that management responsibilities were discharged as required by applicable procedures.

c. Conclusions

The licensee's organization and staffing 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:

- Radiological Control Procedures Audit for 2005
- Radiation Protection Plan Audit for 2004 and 2005

- Selected audits and reviews completed by various management and Health Physics (HP) personnel
- Selected Subcommittee meeting minutes from March 2005 to the present including the Isotope Use Subcommittee, the Reactor Safety Subcommittee, and the Procedure Review Subcommittee
- MURR Reactor Advisory Committee (RAC) meeting minutes, and related documents, from May 2005 to the present

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed the meeting minutes of the RAC and the meeting minutes of various subcommittees from March 2005 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 meetings were appropriate and as stipulated in the TS.

A subcommittee of the RAC or other designated persons, including HP personnel, conducted audits and reviews as required and the full RAC reviewed the results. The inspector noted that no significant issues were identified during the audits conducted by the licensee. The inspector also verified that the licensee had completed annual reviews of the Radiation Protection Program as required by 10 CFR Part 20. All aspects of the program had been reviewed. The inspector noted that the safety reviews and audits, and the associated findings, were acceptably detailed and that the licensee responded and took corrective actions as needed.

(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 2005. The completed forms showed that the issues were acceptably reviewed in accordance with the procedures. It was noted that no 50.59 Evaluations were required to be completed to date in 2006. Also, none of the changes or 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 2005
- radiation protection training program records
- Dose Report Review Forms for January - May 2006
- MURR Reactor Operations Annual Reports for 2004 and 2005
- 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 two years
- MURR Center Security, Emergency, and Health Physics Indoctrination Booklet
- selected MURR Corrective Action Program (CAP) reports concerning radiation protection issues
- Semi-Annual Calibration of the NMC-RAK Stack Monitor, dated March 24, 2005
- MURR Procedure AP-HP-105, “Radiation Work Permit,” Rev. 4, dated October 21, 2005, and the associated form, Form FM-17, “Radiation Work Permit”
- MURR Procedure AP-HP-117, “MURR Initial Radiation Worker Training Program,” Rev. 7, dated January 30, 2006, 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, dated March 24, 2006
- MURR Procedure AP-HP-125, “Review of Unplanned Radiation Exposure,” Rev. 1, dated June 2, 2005
- MURR Procedure IC-HP-300, “Calibration - Radiation Survey Instruments,” Rev. 4, dated 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, dated January 30, 2006
- MURR Procedure IC-HP-335, “Calibration - Portal Monitor Gamma-60 - S/N 900644,” Rev. 6, dated March 24, 2006
- MURR Procedure OP-HP-220, “Tritium Bioassay,” Rev. 3, dated August 18, 2005
- MURR Procedure RP-HP-100, “Contamination Monitoring - Performing a Swipe,” Rev. 3, dated December 19, 2005
- MURR Procedure RP-HP-120, “Personnel Radioactive Contamination,” Rev. 4, dated March 24, 2006, 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, dated March 24, 2006

The inspector also toured the licensee's facility, conducted a radiation survey in laboratory areas of the reactor building, 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 2005, 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 would be knowledgeable of the radiological conditions that existed therein.

During the inspection the inspector accompanied a health physics technician on a routine radiation survey of laboratory areas throughout the reactor building. The radiation levels noted by the inspector using an NRC survey meter were similar to those detected by the licensee and listed on survey maps of the areas. No anomalies were noted.

(2) Postings and Notices

Copies of current notices to workers were posted in appropriate areas in the facility. Radiological signs and 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. 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.

(3) Dosimetry

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 year 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 2005 was 1,175 millirem deep dose equivalent (DDE). The highest annual extremity exposure for 2005 was 3,670 millirem shallow dose equivalent (SDE). Review of exposure records showed that the Reactor Operations group received approximately 60% of the facility's annual dose for 2005. The facility also collected and analyzed urine samples for Tritium (H-3) bioassay purposes. The

highest attributable dose in 2005 for H-3 was 1 millirem committed effective dose equivalent (CEDE).

Through direct observation the inspector determined that dosimetry was acceptably used by facility and contractor personnel. The inspector also verified that no unplanned single exposures (greater than 5% of any federal regulatory limit) had occurred during the previous 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 Protection Program

The licensee's Radiation Protection and ALARA programs were established and described in the MURR Radiation Protection Program Manual dated April 19, 2006, 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, which was consistent with the guidance in 10 CFR Part 20, provided instructions to and guidance for keeping doses as low as reasonably achievable.

(6) Radiation Work Permit Program

The inspector reviewed all Radiation Work Permits (RWPs) that had been written, used, and closed out during 2005 and the first part of 2006. It was noted that the instructions specified in MURR Procedure AP-HP-105, "Radiation Work Permit," Rev. 2, dated October 28, 2003, 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.

(7) Radiation Protection Training

The inspector reviewed the training given to MURR staff members, to those who are not on staff but who are authorized to use the experimental facilities of the

reactor, 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 had been conducted during the months of September through November 2005.

(8) 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.

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:

- Monthly ALARA Environmental Review Reports for 2006
- MURR Reactor Operations Annual Reports for 2004 and 2005
- Liquid Batch Release Review Forms for 2006 associated with the Monthly ALARA Environmental Review Reports
- the environmental monitoring program outlined through various procedures
- MURR Procedure IC-HP-310, "Calibration - Eberline Model PING 1A Stack Monitor - Particulate Channel," Rev. 4, dated February 10, 2006
- MURR Procedure IC-HP-311, "Calibration - Eberline Model PING 1A Stack Monitor - Iodine Channel," Rev. 4, dated February 10, 2006
- MURR Procedure IC-HP-312, "Calibration - Eberline Model PING 1A Stack Monitor - Gas Channel," Rev. 4, dated February 10, 2006
- MURR Procedure OP-HP-200, "Air Sampling - Containment Building Tritium," Rev. 1, dated November 25, 2003
- MURR Procedure OP-HP-221, "Environmental Sample - Analysis," Rev. 4, dated March 24, 2006
- MURR Procedure OP-HP-222, "Air Sampling - Containment Building Ar-41," Rev. 2, dated December 19, 2005

- MURR Procedure OP-HP-353, "Waste Tank Sample - Analysis," Rev. 3, dated September 16, 2005
- MURR Procedure SV-HP-121, "Building Exhaust Stack Effluent - Ar-41 Monitoring," Rev. 2, dated March 24, 2006

b. Observations and Findings

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 4.3 millirem for 2004. Data for 2005 indicated an annual dose to the public of 4.1 millirem. By applying an occupancy factor for each year (occupancy factor of 0.24), the resulting annual dose to the public for 2004 was 1.0 millirem and for 2005 the annual dose to the public was 0.98 millirem.

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

Environmental soil, water, and vegetation samples were collected, prepared, and analyzed consistent with procedural requirements. 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 as well. The review of data indicated that there were no measurable doses above any regulatory limits. The highest unrestricted area dose rate was located on the University golf course near the 12th tee approximately 65 meters from the MURR stack and read 95 millirem for 2005.

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. 3, dated January 11, 2006

- MURR Procedure BPB-SH-002, "20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 6, dated January 11, 2006
- MURR Procedure BPB-SH-005, "DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material," Rev. 3, dated November 30, 2005
- MURR Procedure BPB-SH-008, "Type B(U) F-327 Series Packaging of Type B Non-Waste Radioactive Material," Rev. 3, dated October 20, 2005
- MURR Procedure BP-SH-007, "F-327 Packaging and Shipment of Type A Non-Waste Radioactive Material," Rev. 2, dated June 16, 2006
- MURR Procedure BP-SH-010, "Packaging and Shipment of Non-Waste Radioactive Materials in Excepted Packages," Rev. 1, dated November 30, 2005
- MURR Procedure BP-SH-011, "Shipment of Non-Waste DOT 7A Type A (Gemstore) Radioactive Material Package," Rev. 1, dated October 20, 2005
- MURR Procedure BP-SH-013, "Packaging and Shipment of Radioactive Material Using MURR Reusable Type A Package," Rev. 1, dated April 17, 2006
- MURR Procedure BP-SH-014, "Packaging and Shipment of Radioactive Material Using an Overpack," Rev. 0, dated March 7, 2006
- MURR Procedure BP-SH-052, "Radioactive Material Shipment Package Documentation and Labeling," Rev. 0, dated June 16, 2006
- MURR Procedure BP-SH-099, "Packaging of Radioactive Material Using MURR Model 1500," Rev. 0, dated October 20, 2005
- MURR Procedure WMB-SH-005, "Shipment of Type B Radioactive Waste Using Chem-Nuclear System 1-13G Cask," Rev. 3, dated August 16, 2005
- MURR Procedure WM-SH-011, "Shipment of Radioactive Material, Hot Cell Host Cans Waste," Rev. 2, dated January 11, 2006
- MURR Procedure WM-SH-100, "Radioactive Waste - Preparation and Storage," Rev. 3, dated June 1, 2005
- MURR Procedure WM-SH-300, "MURR Exclusive Use Shipment of LSA or SCO Radioactive Waste," Rev. 2, dated August 16, 2005

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that 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. All radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation (DOT) and NRC regulations.

The inspector verified that the licensee maintained copies of shipment recipients' 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 had training covering the DOT, IATA, and ICAO requirements.

The inspector observed a shipment of radioactive material from the facility as well. The shipment was classified as Yellow-III and was contained in Type A packaging. The inspector verified that the shipping papers contained the appropriate information and that the appropriate markings were made on the outside of the package. Proper

techniques were followed in conducting surveys of the package and the quality assurance checks of the shipments. The staff conducting these shipments were knowledgeable of their duties and conducted a thorough review of all documentation.

c. Conclusions

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

6. Follow-up on Previously Identified Items

a. Inspection Scope (IP 69012)

The inspector reviewed actions concerning various Inspector Follow-up Items (IFIs) identified during an inspection in April 2005.

b. Observations and Findings

(1) (Closed) IFI 50-186/2005-202-01 - Follow-up on the completion of an audit of the ALARA program for 2004 as described in the Radiation Protection Program Manual dated March 1, 2004.

During the NRC inspection at the facility in April 2005, the inspector noted that, as part of the radiation protection program, an audit of the ALARA program is typically conducted on an annual basis. The licensee did not complete this audit for 2004 and was in the process of completing the document during that inspection.

During this inspection, the inspector reviewed the status of the audit of the ALARA program for 2004. The audit had been completed as required. The inspector also reviewed the audit of the ALARA program for 2005. The audits were comprehensive and explained the reasons for each group's increase or decrease in dose for that year. This item is considered closed.

(2) (Closed) IFI 50-186/2005-202-02 - Follow-up to ensure that diagnostic and source alarm checks for the facility portal monitors are conducted and properly documented on a weekly basis.

During the inspection in April 2005, the inspector reviewed weekly checks for the portal monitors throughout the facility. It was noted that a portion of the lobby portal monitor printouts that verify the weekly checks could not be located. Weekly diagnostic and source alarm checks were missing in between the dates of November 19, 2004 to December 2, 2004, January 21, 2005 to February 10, 2005 and March 2, 2005 to March 24, 2005. MURR Procedure IC-HP-335, "Calibration - Portal Monitor Gamma-60 - S/N 900644," specifies that this check must be conducted on a weekly basis, not to exceed nine days. The licensee indicated that the checks had been made but that the forms were apparently missing. The inspector noted that the completion of the checks was indicated on weekly assignment sheets which were initialed by the HP Technicians who had been assigned that responsibility during the weeks in question. Even though the checks were apparently completed, the issue of properly maintaining the lobby portal

monitor printouts was noted by the NRC as an Inspector Follow-up Item (IFI) and was reviewed during this inspection.

During this inspection, the inspector reviewed the printout sheets documenting the diagnostic and source alarm checks for the portal monitors. The checks had been completed weekly as required and the proper data was recorded. This item is considered closed.

(3) (Closed) IFI 50-186/2005-202-03 - Follow-up on the development of alternate methods to reduce Ar-41 emissions below facility investigational levels.

During the April 2005 NRC inspection, the inspector noted that, the main isotope being emitted from the facility stack was Argon-41, which is an activation product of air. The licensee set investigational levels for emitted isotopes at 85% of the annual TS limit to be reviewed on a monthly basis. The average concentration for Ar-41 release for several months in 2004 exceeded these levels and the licensee analyzed it as required by procedure. Since the licensee could not reduce this particular emission from the facility without affecting research and development, the licensee indicated that they would continue investigating alternate methods of reducing Ar-41 emissions.

During this inspection, the inspector reviewed the various actions and proposals taken and made by the licensee in an attempt to reduce Ar-41 levels. Beam Port B collimator had been repaired during the Be Changeout that occurred early in 2006 and potentially split reflector wedges were replaced. Also, the building exhaust relief damper was repaired to bring reactor exhaust flow characteristics back to design parameters. This resulted in a 10% decrease in Ar-41 concentration. The licensee has made efforts to ensure that the exhaust damper position does not move significantly over time. Future plans are to investigate the amount of air that is trapped in silicon samples. Also, the licensee plans to investigate the feasibility of a nitrogen bleed system for the pneumatic tube system and is considering changing the pneumatic tube blower inlet position back to the basement area from the cold deck. Because the licensee has been looking at and continues to concentrate on the problem of Ar-41 emissions, this item will be closed.

(4) (Closed) IFI 50-186/2005-202-04 - Follow-up to determine the licensee's actions concerning assigning a value of zero instead of a negative number for the summation of the annual environmental TLD summary.

During the inspection in April 2005, the inspector noted that, environmental soil, water, and vegetation samples were collected, prepared, and analyzed consistent with procedural requirements. 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 as well. The inspector reviewed the calculations for the annual environmental TLD summary and noticed that negative doses are being added into the year end doses. General health physics practice dictates that assigning a negative number to a

dose is unacceptable. The licensee was asked to consider assigning a dose of zero instead of a negative number to prevent any confusion on this subject.

During this inspection, the inspector reviewed the MURR Reactor Operations Annual Report for 2005. It was noted that the environmental TLD summary totals were listed as positive numbers or as a dose of zero. The licensee plans to continue to use this format. This item is considered closed.

(5) (Closed) IFI 50-186/2005-202-05 - Follow-up on the removal of the requirement to label limited surface activity packages with the appropriate LSA number (i.e. LSA-I, LSA-II or LSA-III) in MURR Procedure WM-SH-300, "Exclusive Use Shipment of LSA or SCO Radioactive Waste," Rev. 1, dated July 1, 2004, Section 3, Step 4.a.

During the April 2005 inspection, the inspector observed a shipment of radioactive waste from the facility as well as several radioisotopes. The shipment of radioactive waste was classified as limited surface activity and therefore was exempt from marking and labeling requirements as specified in 49 CFR 173.427(a)(6)(vi). The inspector verified that this shipment was conducted as an exclusive use shipment and saw that the proper precautions were taken by the licensee and the carrier. During review of Attachment 10.1 to Procedure WM-SH-300, which is the procedural checklist for shipment of LSA radioactive waste, the inspector noted that there were additional requirements (Section 3, Step 4.a) for labeling the package with the appropriate LSA number (i.e. LSA-I, LSA-II or LSA-III). The inspector noted that this is not required by the regulations nor is it practiced by the licensee. The licensee agreed to modify the procedure to accurately reflect what is currently practiced in accordance with Federal Transportation regulations.

During this inspection, the inspector reviewed Attachment 10.1 to Procedure WM-SH-300. It was noted that the checklist had been changed to eliminate the requirement for labeling the package with an LSA number. This item is considered closed.

c. Conclusions

Five IFIs were reviewed and closed during this inspection.

7. Exit Interview

The inspection scope and results were summarized on June 22, 2006, 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
J. Ernst, Associate Director, Regulatory Assurance Group
L. Foyto, Reactor Manager
A. Gaddy, Compliance Specialist
S. Kelley, Health Physics Technician II
M. Kilfoil, Senior Reactor Service Project Specialist/Shipping Manager
K. Kutikkad, Assistant Reactor Manager, Physics
C. McKibben, Senior Advisor
R. Maxey, Health Physics Specialist/Shipping Technician
S. Meier, Manager, Radioactive Materials Shipping
W. Meyer, Chief Operating Officer
M. Nichols, Health Physics Technician/Shipping Technician
D. Nickolaus, Health Physics Technician
N. Pearson, Health Physics Technician/Shipping Technician
C. Roberts, Interim Shipping Manager
R. Taylor, Radioactive Waste Coordinator

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

None

Closed

50-186/2005-201-01	IFI	Follow-up on the completion of an audit of the ALARA program for 2004 as described in the Radiation Protection Program Manual dated March 1, 2004.

50-186/2005-201-02	IFI	Follow-up to ensure that diagnostic and source alarm checks for the facility portal monitors are conducted and properly documented on a weekly basis.
50-186/2005-201-03	IFI	Follow-up on the development of alternate methods to reduce Ar-41 emissions below facility investigational levels.
50-186/2005-201-04	IFI	Follow-up to determine the licensee's actions concerning assigning a value of zero instead of a negative number for the summation of the annual environmental TLD summary.
50-186/2005-201-05	IFI	Follow-up on the removal of the requirement to label limited surface activity packages with the appropriate LSA number (i.e. LSA-I, LSA-II or LSA-III) in MURR Procedure WM-SH-300, "Exclusive Use Shipment of LSA or SCO Radioactive Waste," Rev. 1, dated July 1, 2004, Section 3, Step 4.a.

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
ICAO	International Civil Aviation Organization
IFI	Inspector Follow-up Item
IP	Inspection Procedure
LSA	Limited Surface Activity
mCi	Millicurie
MURR	University of Missouri - Columbia Research Reactor
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