

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-186/95003(DNMS)

Docket No. 50-186

License No. R-103

Licensee: University of Missouri - Columbia

Facility Name: Missouri University Research Reactor (MURR)

Inspection At: Research Reactor Facility, Columbia, Missouri

Inspection Conducted: October 2-6, 1995

Inspector: T. D. Reidinger  
Timothy. D. Reidinger  
Fuel Cycle Inspector

2 NOV 95  
Date

Approved By: J. W. McCormick-Barger  
J. W. McCormick-Barger, Chief  
Decommissioning Branch

2 NOV 95  
Date

Inspection Summary

Inspection on October 2-6, 1995 (Report No. 50-186/95003(DNMS))

Areas Inspected: This was a routine, announced inspection to evaluate compliance with requirements specified in NRC regulations, the license, and Technical Specifications, including a review of the following activities: Organization, Logs, and Records (Inspection Procedure (IP) 39745); Review and Audit (IP 40745); Surveillance (IP 61745); Procedures (IP 42745); Experiments (IP 69745); Requalification Training (IP 41745); Fuel Handling Activities (IP 60745); Emergency Planning (IP 82745); Radiation Controls (IP 83743); Environmental Protection (IP 80745); Transportation Activities (IP 86740); Licensee Event Followup (IP 92700); Corrective Actions for Violations (IP 92702); and Periodic and Special Reports (IP 90713).

Results: Within the scope of this inspection, one violation was identified. Operating logs and records were very well kept. The continuance of the high quality of procedures, record keeping, and surveillance records remain especially noteworthy. Staffing requirements were verified during fuel handling or refueling operations by log reviews. The licensee's Emergency Planning program was being adequately maintained and continued to have adequate management support. The licensee continued to implement its Requalification program and Environmental Protection program as specified. The licensee's audit of transportation activities demonstrates compliance with 10 CFR 71, "Packaging and Transportation" requirements. Three violations and

one licensee event report were closed. The overall operation of the facility remained good. The radiation protection program, with one exception, appeared to be adequate in protecting the health and safety of the public. A violation indicated a weakness in the implementation of the licensee's program for release of potentially contaminated materials to a unrestricted area. Administrative controls failed to prevent unauthorized or inadvertent removal of contaminated lead containers (pigs) from the MURR center. In addition, these administrative controls failed to ensure that contamination surveys were properly conducted by either the reactor staff or the research scientists prior to the release of the contaminated lead "pigs" from the MURR center.

Violation:

Failure to ensure that contamination surveys were properly conducted for lead "pigs" released for unrestricted use. (Section 13, Radiation Control)

## DETAILS

### 1. Persons Contacted

#### University of Missouri-Columbia

- \*N. Tritschler, Shift Supervisor
- \*J. Ernst, Health Physics Manager
- \*S. Gunn, Manager, Services Applications
- \*C. McKibben, Associate Director
- \*W. Meyer, Reactor Manager
- \*J. Rhyne, Director
- \*A. Schoone, Operations Engineer
- \*J. Schuh, Health Physicist
- \*R. Dinger, Information Specialist

Additional technical, operational, and administrative personnel were contacted by the inspector during the course of the inspection.

\*Denotes those attending the exit meeting on October 6, 1995.

### 2. General

This inspection, which began on October 2, 1995, was conducted to examine the research reactor program at the University of Missouri Columbia. The facility was toured shortly after arrival. The general housekeeping of the facility was acceptable, but appeared to have slipped slightly from the last inspection. The reactor operated on a weekly cycle, shutting down each Monday for refueling and/or maintenance outages. The facility was used primarily for irradiation services and research activities.

During the course of the inspection, the inspector observed a reactor startup and post scram recovery operations after an unscheduled shutdown. The operators appeared proficient and knowledgeable, demonstrated good procedural compliance, and made appropriate log entries for the observed evolutions. Various evolutions requiring temporary radiation monitoring inside the restricted area, the changeout of several experiments from the pool and the conduct of several experiments involving the pneumatic tube operating (rabbit) system were observed with no deficiencies noted. In addition, the tagout log was reviewed. Discussion with the licensee indicated that there was an isolated incident in 1994 in which a researcher operated a handle that opened a beam shutter with a "Do not operate" tag on it. The opening of the shutter had no safety significance. The tag was typically used to coordinate the researcher and the health physics (HP's) efforts to monitor the area around the beam port after work has been performed on

a beam port which could potentially increase radiation levels in the area. Remedial training regarding the "tagout system" was conducted for the researcher.

No violations or deviations were identified.

3. Action on Previous Inspection Items (92701)

- a. (Closed) Violation (50-186/92002-01): Inadvertent switching of two radioactive material shipments.

On July 27, 1992, MURR mistakenly switched two aliquots of a holmium-166 (Ho-166) sample from a research project. The aliquot containing 18.3 millicuries of Ho-166 intended for the Dow Chemical Company in Freeport, Texas (Dow-Freeport) was sent to the University of Texas. This package was externally labeled as containing 482 millicuries of Ho-166. On the same day, the aliquot containing 482 millicuries of Ho-166 intended for University of Texas was sent to Dow-Freeport. This package was externally labeled as containing 18.3 millicuries of Ho-166. Although the external labels identified incorrect activities, the labels on the internal lead sample containers identified the correct activities. The destination information on the inner labels were switched when corrections were made to labels for the lead sample containers. Following this event, the licensee has implemented the following corrective actions: revised procedures for other work groups to require a line item verification of shipping documents and labels for all radioactive material shipments; required a comparison between the shipping request and the sample container label; required packaging labels from other groups to include activity identification; required a letter identifier to be added to the MURR number for multiple samples made from a single irradiation target; and required management to routinely review the daily shipping summary log for discrepancies and inconsistencies. Additional corrective actions included the establishment of a Shipping Task Force (STF). The STF conducted a global review of MURR's shipping activities and instituted changes to correct generic weaknesses in the shipping program that had contributed to the shipping violations. The Irradiation Subcommittee (IS), a subcommittee of the STF, was formed in December 1992 to respond to concerns raised by task force members about the accuracy of irradiation target identification and the accuracy of the shipping papers and package labels in identifying isotopes and curie contents of the packages. All outgoing packages were required to be screened by the NaI detector to facilitate accurate isotopic mixes and curie content identification on shipping papers and labels. Corrective actions appeared to be in place that would prevent shipping errors from recurring.

This item is closed.

- b. (Closed) Violation (50-186/92002-02): Mislabeled of a radioactive material shipment.

On August 25, 1992, shipping personnel at MURR delivered to a carrier a package containing approximately 5.57 curies of gold-198. On August 26, 1992, MURR was notified by the carrier regarding improper labeling of a radioactive material shipment. This package was found to have a Yellow II label that was marked with a Transport Index of 1.2. The package was relabeled correctly with a Yellow III label with the required information. Licensee corrective actions included relabeling of the shipment and utilizing arabic numerals versus Roman numerals for primary hazard listings on check sheets. In addition, the STF developed the Incident Report (IR) system to identify and correct shipping problems. The IR system was designed as a corrective action program to document and track problems identified in the shipping process. An IR would be initiated describing the problem, identifying corrective actions, and identifying a root cause. The inspector reviewed selected IRs generated. The system appeared to be working well.

This item is closed.

- c. (Closed) Violation (50-186/92002-03): Shipments of radioactive material to an individual in excess of the quantities authorized in the receiver's license.

On June 15, 1992, MURR sent 6.69 curies of iridium-192 to R/A Services in Odessa, Texas. On June 16, 1992, R/A Services received the shipment and noted that the 6.69 curies on the shipping documents was in excess of the 4 curies allowed by their license from the State of Texas, an agreement state. The package was not opened and was returned to MURR. MURR revised their license verification process to require that personnel verify the current amendment, obtain a copy of the current license for confirmation prior to shipping and require that their receivers identify their upper limit of authorized activities in their procurement documents.

This item is closed.

#### 4. License Event Reports (92700)

(Closed) LER 95-01: Reactor startup with the source range monitor in a degraded condition.

On March 20, 1995, a reactor startup was commenced with the source range initial count rate indicating 900 counts per second (cps). The startup was discontinued when control rods were withdrawn 10 inches as the senior operator in charge observed no significant change in source range counts from those initially measured with rods at zero inches. The reactor was shutdown to investigate the lack of expected response. In

analyzing the event, the licensee speculated that the higher than expected initial count rate of 900 cps may have been caused by high background due to brittle detector cable insulation. The cables were replaced and source range counts returned to the range logged for several previous startups. A standing order was issued which provided a range of expected values for source range counts based on time after shutdown. Count rates higher or lower than the expected range required an investigation prior to a reactor startup. Operation procedures will be revised to require verification of source range operability before a reactor startup.

This item is closed.

5. Organization, Logs, and Records (39745)

The organization was verified to be consistent with the Technical Specifications and Safety Analysis Report (SAR). The minimum staffing requirements were verified to be met during reactor operations and fuel handling or refueling operations by actual observation and log reviews. Selected reactor operator logs for 1994 through October 1995 were reviewed with no concerns identified. The licensee records were well-maintained.

No violations or deviations were identified.

6. Reviews and Audits (40750)

The Reactor Advisory Committee (RAC) met on a quarterly basis as required by TS. The Isotope Use, Safety, and Procedures Subcommittees meeting minutes and the progress of the Shipping Task Force were reviewed by the RAC. The inspector reviewed meeting minutes, which included candid discussions by the committee members and guests. The meeting minutes were of good quality and provided a clear record of review and approval of reactor activities including the subcommittees' activities.

The inspector reviewed several facility modifications, i.e. Source Range Monitor Replacement, Stack Monitoring System Replacement, and the Plate Pool Heat Exchanger Replacement to ensure that the associated safety evaluations complied with 10 CFR 50.59. The safety evaluations were found to be very thorough and well documented. Meeting minutes indicated that the modifications and the safety evaluations were also reviewed by the RSC.

The operation's audit for 1994 was reviewed by the inspector. The audit report was very thorough and detailed. Items of concern were addressed by the Reactor Manager and reported to the RAC accordingly.

No violations or deviations were identified.

7. Requalification Training (41745)

The inspector reviewed procedures, logs, and training records and interviewed personnel to verify that the requalification training program was being carried out in conformance with the facility's approved plan and NRC regulations. The facility program stated the requirements for ensuring operators maintain their license. These included training lectures of various subject areas, i.e., Emergency Procedures, Technical Specifications, revised procedures and Facility Design changes. Additional requirements included performing a minimum number of required reactivity manipulations, passing annual written examinations, meeting medical qualifications, passing remedial training if required, and complying with record requirements.

The control room logs were also reviewed, which indicated that licensed operators had maintained their licenses active for 1994.

No violations or deviations were identified.

8. Procedures (42745)

The inspector reviewed the startup procedure during a hot reactor startup to verify procedure compliance. No discrepancies were noted. The inspector determined that the required procedures were available to the operators and the contents of selected procedures were found to be of adequate quality with sufficient detail to perform each task as required. Meeting minutes indicated that procedure changes were reviewed and approved by the Procedures Subcommittee. The licensee maintained a large number of procedures which are reviewed on a yearly basis and revised as required. During several evolutions, the inspector noted good procedural compliance and use of checklists. Procedure changes were reviewed and approved by the Procedures Subcommittee.

No violations or deviations were identified.

9. Surveillance (61745)

The "Compliance Check Procedure," listed weekly, monthly, semiannual, and annual surveillance activities that were required to be accomplished. The inspector reviewed selected checklists for 1994 through October 1995 and verified surveillances were being completed within the required time schedule. The procedure also identified preventive maintenance activities and the month they were required to be complete; no discrepancies were noted. Selected surveillance procedures were reviewed and determined to be adequate to verify the Technical Specification requirements. Surveillance records were very well kept.

No violations or deviations were identified.

10. Experiments (69745)

No new experiments were approved since the last inspection.

11. Fuel Handling (60745)

The facility fuel handling program was reviewed by the inspector. The review included the verification of approved procedures for fuel handling and their technical adequacy in the areas of radiation protection, criticality safety, TS, and security plan requirements. The inspector determined by records review and discussions with personnel that fuel handling operations were carried out in conformance to procedures. The inspector reviewed log entries and fuel location maps for fuel handling activities and noted that the appropriate entries were made and that minimum staffing requirements were met.

No violations or deviations were identified.

12. Emergency Planning (82745)

No significant changes in the Emergency Response Organization were noted. The required annual training requirements were met. The annual exercise was held on May 22, 1995, and the scenario involved an electrical fire involving radioactive material. The drill ensured necessary equipment was available, operators were knowledgeable in emergency procedures, and the adequacy of evacuating the building and surrounding area. Operators were trained and examined on emergency procedures yearly as part of the operator requalification program.

The Emergency Plan states, in part, that an appraisal of the evacuation effectiveness will be conducted after emergency drills. Documentation was available regarding the evaluations of practice emergency preparedness drill and the evaluation of the emergency evacuation effectiveness. The emergency kits were inventoried, and the emergency plan reviewed, as required.

No violations or deviations were identified.

13. Radiation Control (83743)

a. Training

The inspector reviewed the associated lesson plans used for initial radiation protection training and annual retraining of facility staff and visitors. The lesson plans were current including the revised radiation dose limits, and provisions for declaration of pregnancy. The licensee added that these training aids are supplemented by individual instruction which emphasized the revisions to 10 CFR Part 20 regulations. Discussions with facility staff indicated that the training provided adequate knowledge of the current radiation protection regulations.



b. Contamination Surveys

The inspector toured the facility and performed confirmatory contamination and dose rate measurements inside the restricted area, which generally agreed with the licensee's postings and surveys. In addition, a room adjacent to the area used to survey (NaI gamma spectroscopy) outgoing packages was properly posted to indicate transient radiological conditions.

The inspector performed a survey on the lead recycle bin (designated as a "clean lead collection point") located outside the MURR center on the loading dock. Materials leaving the restricted area are required by licensee policy and procedure to be monitored for contamination prior to their release from the MURR center. The action level for potential contamination (fixed plus removable) of equipment and supplies released from the restricted area, was incorporated into HP procedure (HP-40), "Survey of Items for Unrestrictive Use." The level was any positive indication of radioactivity above background. In addition, licensee policy, C4:056, "Removal of Items from MURR" stated, in part, that it was the responsibility of the person removing any potentially radioactive materials from the MURR center to ensure that the appropriate contamination surveys has been performed on materials prior to unrestricted release or to contact the HP technicians to perform surveys on potentially contaminated material.

The inspector's survey on October 5, 1995, revealed contamination on four lead containers (pigs) in the lead recycle bin. Contamination levels ranged from a few hundred to approximately 3000 counts per minute (cpm) above background. These levels were approximately 2-22 times the background count rate of approximately 130 cpm. The licensee immediately returned the four lead "pigs" inside the restricted area and conducted a survey of the rest of the lead recycle bin contents. No additional contaminated "pigs" were noted. Confirmatory measurements conducted by the NRC agreed with the licensee's survey results. The recycle bin contents consisted predominately of lead pigs that had been previously used for storing radioactive material in either the research labs or at the reactor at MURR. The recycle bin typically was stored on the loading dock for several months prior to sending the lead contents to be smeltered and remolded into new "pigs" at the University's Science Instrument Shop. Preliminary investigation by the licensee indicated that they are unable to identify whether the research labs or the reactor facility was the origin of the lead "pigs" or when the lead "pigs" were deposited in the lead recycle bin. The lead "pigs" do not carry any identifying marks as to specific origin. The licensee planned to relocate the lead recycle bin to inside the restricted area. In addition, the licensee planned to conduct periodic refresher training at the MURR center regarding both the reactor's staff and the research scientists' responsibilities for ensuring

that university policy and HP procedures are followed regarding survey requirements. The failure to conduct contamination surveys on the lead "pigs" prior to their release for unrestricted use is a Violation (Vio. No. 50-186/95003-01(DNMS)).

c. External Exposure Results

The inspector reviewed the licensee's personnel monitoring results for external exposure for November 1994 through October 1995 for compliance with the requirements in 10 CFR 20.1201. The licensee uses film badges to monitor workers' external exposures. All doses were within the 10 CFR Part 20 limits.

d. Procedures

Health physics and radiation chemistry procedures were also reviewed by the inspector. All revised procedures were noted to have incorporated previous hand written corrections or additions. The annual review of procedures was performed as required by Technical Specifications.

e. Audits

The licensee's ALARA and radiation protection program audits were very detailed. The ALARA audit incorporated monthly dose investigation levels based on the average dose recorded for individuals. Where an investigation level was exceeded, the individual's supervisor was required to report on the circumstances of the increased dose. The inspector reviewed three investigations that were initiated by the licensee in 1994. The investigations revealed that the individuals involved neglected to periodically read their pocket dosimeters either while conducting experiments on the beam port floor or completing infrequent repair activities on reactor equipment. All doses were within regulatory limits. Remedial radiation safety training was conducted reinforcing requirements regarding the proper use of dosimeters and university expectations that the individuals remain "exposure conscious" while performing tasks where higher than normal exposure rates are expected.

f. Calibration

The calibration records for survey meters were reviewed. Calibrations were performed annually or more frequently, with adjustments made to ensure the readings were within 10% of actual. The inspector reviewed the performance tests and calibrations of the portal monitor and the hand and foot monitors. All monitors were calibrated and source checked within procedural requirements.

In addition, the monitors had been Chi Square (statically) tested to indicate drift. The monitors were recalibrated when the tests indicated a performance problem. The inspector reviewed the results and no problems were identified.

One violation was identified.

14. Environmental Protection (80745)

a. Liquid Effluents

The licensee discharged 18.50 millicurie (mCi) (684 megaBecquerels (MBq)) of activity in liquid effluents, including tritium, for January 1994 through December 31, 1994. The inspector reviewed the licensee's liquid effluent calculation form, used for analysis and discharge of liquids, no discrepancies were noted.

b. Airborne Effluents

The licensee monitored stack effluents via a particulate, iodine, and gas monitor. The stack monitor's air particulate and charcoal filters were collected weekly. The licensee analyzed the activities of the filters and entered the results into a computer program which summed the activities. The inspector reviewed the calculations and did not find any discrepancies.

No violations or deviations were identified.

15. Transportation Activities (IP 86740)

The inspector reviewed the Quality Assurance Program audit performed on the radioactive waste shipping program. The audit was very detailed. Items of concern were addressed by the Reactor Manager and reported to the RAC.

No violations or deviations were identified.

16. Review of Periodic and Special Reports (IP 90713)

The inspector reviewed the 1994 annual report for timeliness of submittal and adequacy of information submitted. The reports were submitted in a timely manner and contained the information required by the Technical Specifications.

No violations or deviations were identified.

17. MURR Safety Oversight Organization (MSOC)

Since the implementation of the MSOC process in the last 10 months, contacts between the university employees and their local representatives resulted in one new employee concern reported since June 19, 1995. The employee's concern apparently did not involve any technical safety issues and was actively being processed accordingly.

MURR management planned to strengthen the safety oversight process by providing training to all MSOC representatives in the area of discrimination issues and protected activities in the near future.

18. Exit Interview (IP 30703)

The inspector met with the licensee representatives denoted in Paragraph 1 at the conclusion of the inspection on October 6, 1995. The inspector summarized the scope and results of the inspection and discussed the likely content of this inspection report. The licensee acknowledged the information and did not indicate that any of the information disclosed during the inspection could be considered proprietary in nature.