

February 25, 2008

Dr. Gunter Kegel
Director - Radiation Laboratory
University of Massachusetts - Lowell
One University Avenue
Lowell, MA 01854

SUBJECT: NRC INSPECTION REPORT NO. 50-223/2008-201

Dear Dr. Kegel:

This letter refers to the inspection conducted on February 11 to 15, 2008, at your Research Reactor Facility. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concern or noncompliance of Nuclear Regulatory Commission (NRC) requirements was identified. No response to this letter is required.

In accordance with 10 CFR Part 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Marcus Voth at 301-415-1210.

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. 50-223
License No. R-125

Enclosure: As stated

cc w/ enclosure:
See next page

University of Massachusetts - Lowell

Docket No. 50-223

cc:

Mayor of Lowell
City Hall
Lowell, MA 01852

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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: 50-223

License No: R-125

Report No: 50-223/2008-201

Licensee: University of Massachusetts

Facility: University of Massachusetts – Lowell Research Reactor

Location: Lowell, Massachusetts

Dates: February 11-15, 2008

Inspector: Marcus H. Voth
Stephen C. Pierce

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 Massachusetts - Lowell
Research Reactor Facility
NRC Inspection Report No.: 50-223/2008-201

This routine, announced inspection included on-site review of the licensee's programs concerning requalification training for reactor operators; experiments; health physics; effluents and environmental monitoring; emergency planning; and transportation of radioactive material. Specific findings in each of these areas include:

Requalification Training

- Operator requalification was conducted as required by the Requalification Program and 10 CFR Part 55; however, the basis for declaring an operator to be medically fit for duty lacked specificity and will be revisited.

Experiments

- Experiments appeared to be reviewed and performed in accordance with Technical Specification requirements and the licensee's written procedures. However, documentation of the review process will be re-inspected.

Health Physics

- The inspector verified that the licensee's radiation safety program was effective in minimizing radiation doses to individuals through ALARA actions, training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

Effluents and Environmental Monitoring

- Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

Emergency Planning

- Emergency preparations were in accordance with the Emergency Preparedness Plan and regulatory requirements.

Transportation

- Radioactive material shipments were made according to procedures and regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The one megawatt University of Massachusetts - Lowell Research Reactor (UMLRR) had been operated in support of educational experiments and demonstrations, research and service irradiations, reactor operator training, and periodic equipment surveillances. The licensee reported annual operation of 146 critical hours and 90 megawatt hours. The information detailed below was gathered by the inspector through personal observations when touring the facility, observations of specific tasks and evolutions, discussions with members of the licensee's staff, and review of records.

1. Requalification Training

a. Inspection Scope (Inspection Procedures (IP) 69001-02.04 and 92701)

The inspector reviewed the following to verify that the requirements of 10 CFR Part 55, Operators' Licenses, and the licensee's Requalification Program were being met:

- Requalification Program for Licensed Reactor Operators and Licensed Senior Reactor Operators, June 22, 1978
- Training Record binder, 2002-2008
- Training and Requalification file
- Operator Requalification Audits file
- Written Examination administered March 17, 2006
- Reactor Logbook # 28, February 8, 2005 to June 28, 2007
- Reactor Logbook # 29, June 29, 2007 to present
- Reply to a Notice of Violation, Report 50-223/2007-201, May 16, 2007
- Individual Reactor Operator (RO) and Senior Reactor Operator (SRO) files

b. Observations and Findings

During the previous inspection (March 2007), the licensee was cited for the violation (VIO), "Failure of SRO to take requalification written examinations and annual operating tests." In a May 16, 2007, response the licensee explained how the regulations had been misunderstood and outlined changes that were being made to achieve compliance. The inspector verified that the changes had been implemented and that the requalification program was in conformance with the regulations. Specifically, a two-year cycle was defined that applied to all operators (rather than a unique cycle for each individual operator, based on the initial license issuance date) and all operators took the required examinations in the newly defined common cycle. Therefore, the violation was declared closed (VIO 50-223/2007-201-02).

In the March 2007 inspection an unresolved item (URI) was also identified, "Documentation of the application of ANS/ANSI-15.4-1988 in reactor operator medical examinations." The licensee indicated that this matter had not been resolved but rather was being considered along with the need to update the entire Requalification Program. The inspector reviewed the files of one RO and three SROs, verifying that NRC Form

396, Certification of Medical Examination by Facility Licensee, and supporting medical records were on file; however, no basis for acceptance was stated. The inspector encouraged the licensee to include this matter in a review and update the 1978 vintage Requalification Program, leaving the URI open for consideration at the next inspection (URI 50-223/2007-201-01).

The licensee's requalification program included the regulatory requirement for an annual operating test and a biennial written examination. The inspector verified that both examinations were administered at the required frequency and that the level of difficulty was comparable to that of NRC-administered examinations. The inspector also verified that information about facility and procedural changes had been routed to licensed operators in accordance to the written Requalification Program.

Record of reactor manipulations performed by each operator and internal audit records clearly demonstrated that operators had met those minimum requirements specified in the Requalification Program.

c. Conclusions

Operator requalification was conducted as required by the Requalification Program and 10 CFR Part 55; however, the basis for declaring an operator to be medically fit for duty lacked specificity and will be revisited.

2. Experiments

a. Inspection Scope (IP 69001-02.06 and 92701)

The inspector reviewed the following to verify compliance with Technical Specification (TS) Sections 3.6, Limitations of Experiments, and 6.8, Approval of Experiments:

- Memo from L. Bobek to File, Review of Reactor Experiment Approvals, February 14, 2008
- Files of eight experimental approvals currently being used, dated February 19, 1975 to June 14, 2006
- Procedure SP-25, Sample Handling for the Reactor, July 15, 1991
- Procedure RO-4, Addition or Removal of Core Samples, Rev. 6, June 14, 2005
- File of Reactor Irradiation Request Forms for 2007
- Reactor Logbook # 28, February 8, 2005 to June 28, 2007
- Reactor Logbook # 29, June 29, 2007 to present

b. Observations and Findings

At the previous inspection in March of 2007 the inspector noted that experiments were routinely approved by the Reactor Supervisor (RS) and Radiation Safety Officer (RSO) with the understanding that they were within the scope of previously approved experiments. However, the original experiment approval was frequently not reviewed to verify that a new request was within the scope of its safety analysis. Furthermore, it was not clear that the RS and RSO signatures on the Reactor Irradiation Request Form indicated that all TS requirements pertaining to the experiment were met and the basis for that conclusion (e.g., within the safety analysis of the original approved experiment or

by an amendment to the original safety analysis by the RS and RSO.) This was the basis of the inspector followup item (IFI) "Documentation of TS compliance when approving minor variations of routine experiments" (IFI 50-223/2007-201-03).

In response to the IFI, the RS had created files for the eight experiments being used most frequently, consisting of the original approved experiment and other relevant information. This provided a reference from which the RS and RSO could make their determination regarding the envelope of the original safety analysis. The inspector reviewed the file of Reactor Irradiation Request Forms for experiments that had been performed during the past year, noting that many blanks on the form did not have data entries. The RS explained that most of the unused blanks were not relevant but agreed that in some cases relevant data had been omitted. The IFI was left open for review at the next inspection to verify that the Reactor Irradiation Request Form clearly indicates what information is required and that the required information is being recorded.

c. Conclusions

Experiments appeared to be reviewed and performed in accordance with Technical Specification requirements and the licensee's written procedures. However, documentation of the review process will be re-inspected.

3. Health Physics

a. Inspection Scope (IP 69001-02.07.a-d & g-p)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and TS Sections 3.4 and 4.3, Radiation Monitoring Equipment, requirements:

- 2007 Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, D. Medich, February 7, 2008
- U Mass, Lowell Radiation Safety Guide, January 2008
- Landauer Records of Personnel Dosimetry, 2007
- Reactor Monthly Radiation Survey file for 2007
- Health Physics Training for Reactor Operators file
- Procedure SP-1, Environmental Radiation Monitoring System Check and Calibration, December 11, 2007

b. Observations and Findings

The inspector toured the facility, finding practices regarding the use of dosimetry, radiation monitoring equipment, placement of radiological signs and postings, calibration of radiation monitoring instruments, and the handling and storing of radioactive material or contaminated equipment to be in accordance with regulations and the licensee's written Radiation Safety Guide. The licensee RSO had performed and documented an annual radiation safety audit in assuring effective implementation of As Low As Reasonably Achievable (ALARA) practices, focusing the 2008 audit on activities related to activities licensed under the R-125 reactor license.

The inspector reviewed records of radiation surveys of the reactor facility and found them to be generally low and in line with facility postings and instrument readings. No

unmarked radioactive material was found in the facility. A copy of the current NRC Form 3 Notice to Radiation Workers required by 10 CFR Part 19 was posted at numerous places throughout the facility, including the Control Room and entrance to the Reactor Bay.

Dosimetry results were reviewed by the inspector. The licensee used optically stimulated luminescent dosimeters (OSLDs) for personnel whole body monitors and thermal luminescent dosimeters (TLDs) for extremity dosimetry (finger rings) and environmental area monitors. The whole body doses to the 13 individuals designated as reactor radiation workers showed no detectable radiation exposure above background during the past year. The licensee attributed the low exposure in part to recent radiation shielding initiatives.

Radiation monitoring devices were calibrated per written procedures on the frequencies specified in the procedures. The Assistant Radiation Safety Officer (ARSO) calibrated all portable instruments while the reactor operations staff, in consultation with the ARSO calibrated in-line process instrumentation. The licensee did not maintain a respiratory protection program.

The inspector noted from records that training was provided for radiation workers, including examination and a passing grade before being issued dosimetry. The training addressed special considerations of the embryo and fetus, including distribution of Regulatory Guide 8.13 to all female radiation workers.

c. Conclusions

The inspector verified that the licensee's radiation safety program was effective in minimizing radiation doses to individuals through ALARA actions, training, notices to workers, radiation monitoring and surveys, and calibrated equipment.

4. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69001-02.07.e, f, & g)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and TS Sections 3.4 and 4.3, Radiation Monitoring Equipment, requirements regarding effluents, and environmental monitoring:

- U Mass, Lowell 2006-2007 Annual Operating Report, August 30, 2007
- 2007 Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, D. Medich, February 7, 2008
- Landauer Records of Personnel Dosimetry, 2007
- Reactor Monthly Radiation Survey file for 2007
- Procedure SP-1, Environmental Radiation Monitoring System Check and Calibration, December 11, 2007

b. Observation and Findings

The annual report referenced above describes the gaseous, liquid and solid waste generated at the reactor facility during the year 2006. Argon-41 produced by the

irradiation of atmospheric air was the only effluent of significance, that being extremely small. The reported 3.84 Curie Argon-41 annual emission from the stack, when using the conservative approximations of Level 4 of the EPA COMPLY code, indicated a dose of less than 1.3 millirem relative to an ALARA goal of less than 10 millirem. The annual liquid effluent to the public sewer system of approximately six microcuries was not detectable in the effluent stream. There were less than ten cubic feet of solid waste generated by the reactor facility during the year which was set aside for decay and ultimate disposal.

The licensee placed TLDs around the reactor facility as environmental radiation monitors. In all cases the TLDs indicated no significant difference from background radiation levels.

c. Conclusions

Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

5. Emergency Planning

a. Inspection Scope (IP 69001-02.10)

The inspector reviewed the emergency preparedness program and its implementation through the following:

- Submittal of Revision 6 to the Emergency Plan, August 24, 2007
- Emergency Preparedness Plan for the U Mass, Lowell, Research Reactor, Rev. 6, August 2007
- Reactor Emergency Drill file (for February 20, 2007 drill)
- Emergency Call List, May 31, 2007

b. Observations and Findings

The licensee had not conducted an emergency drill since the previous NRC inspection. However, since that inspection the licensee submitted revisions to their Emergency Preparedness Plan pursuant to 10 CFR Part 50.54(q). The inspector concurred with the licensee's assessment that the changes did not decrease the effectiveness of the plan.

The inspector reviewed the licensee's implementing procedures for their Emergency Preparedness Program, finding two deficiencies. First, the plan called for an annual review of the plan by the RS and RSO; there was no evidence that this was being done. Second, there was no evidence that the emergency call list was reviewed periodically to verify its accuracy and in fact, one of the posted call lists was an out-dated version. The licensee promptly revised surveillance checklists, making the emergency plan review an annual surveillance requirement and the verification of current emergency call list postings a quarterly requirement.

The inspector reviewed the file for the last emergency drill and noted that training was offered, a post-drill critique was conducted, and action items were identified and dispositioned.

c. Conclusions

Emergency preparations were in accordance with the Emergency Preparedness Plan and regulatory requirements.

6. Transportation

a. Inspection Scope (IP 86740)

The inspector interviewed personnel and reviewed the following to verify compliance with regulatory and procedural requirements for transferring licensed material:

- Procedure HPP-3, Work Instruction, Shipment of Radioactive Material, Rev. B, February 5, 2008
- Completed HPP-3 Radioactive Material Shipment Form and Packaging Slip for the shipment on January 2, 2008

b. Observations and Findings

The RSO/ ASRO were responsible for all of the licensee's shipments of radioactive material. However, very few shipments were performed under the reactor license. Exceptions were the receipt and discharge of cobalt-60 for the irradiator, spent reactor fuel, and fission chambers tested at the UMLRR for offsite clients. The latter are generally excepted quantities. The reference above documents the only radioactive material shipment made under the reactor license since the previous inspection of transportation activities. The inspector reviewed the shipping papers for this shipment, a fission chamber that had been irradiated in the reactor.

c. Conclusions

Radioactive material shipments were made according to procedures and regulatory requirements.

7. Exit Interview

The inspection scope and results were summarized on February 15, 2008, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek	Reactor Supervisor
C. French	Professor of Physics and Chairman of the Radiation Safety Committee
G. Kegel	Radiation Laboratory Directory
D. Medich	Radiation Safety Officer
P. Chowdhury	Interim Vice-Chancellor for Research
N. Rashidifard	Senior Reactor Operator
T. Regan	Chief Reactor Operator
S. Snay	Assistant Radiation Safety Officer
J. White	Professor of Chemical Engineering and Chairman of the Reactor Safety Subcommittee

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation
IP 92701	Followup

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-223/2007-201-02	VIO	Failure of SRO to take requalification written examinations and annual operating tests
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Discussed

50-223/2007-201-01	URI	Documentation of the application of ANS/ANSI-15.4-1988 in reactor operator medical examinations
50-223/2007-201-03	IFI	Documentation of TS compliance when approving minor variations of routine experiments

PARTIAL LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access and Management System
ALARA	As Low As Reasonably Achievable
ARSO	Assistant Radiation Safety Officer
CFR	Code of Federal Regulations
IFI	Inspector Followup Item

IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
OSLD	Optically Stimulated Luminescent Dosimeter
PARS	Publicly Available Records
Rev.	Revision
RO	Reactor Operator
RS	Reactor Supervisor
RSO	Radiation Safety Officer
SRO	Senior Reactor Operator
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications
UMLRR	University of Massachusetts - Lowell Research Reactor
URI	Unresolved Item
VIO	Violation