May 6, 2014

Dr. Partha Chowdhury
Director - Radiation Laboratory
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854

SUBJECT: UNIVERSITY OF MASSACHUSETTS LOWELL – NRC ROUTINE INSPECTION REPORT NO. 50-223/2014-201

Dear Dr. Chowdhury:

From April 7–10, 2014, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection at the University of Massachusetts Lowell Research Reactor facility. The enclosed report documents the inspection results, which were discussed on April 10, 2014, with members of your staff.

During this inspection the NRC examined activities conducted under your license as they relate to public health and safety to confirm compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel. Based on the results of this inspection, no findings of significance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if you choose to provide one) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Taylor Lamb at (301) 415-7128 or by electronic mail at Taylor.Lamb@nrc.gov.

Sincerely,

/RA/

Gregory T. Bowman, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-223
License No. R-125

Enclosure:
NRC Inspection Report No. 50-223/2014-201

cc w/encl: See next page

cc:

Mayor of Lowell
City Hall
Lowell, MA 01852

Mr. Leo Bobek
Reactor Supervisor
University of Massachusetts – Lowell
One University Avenue
Lowell, MA 01854

Department of Environmental Protection
One Winter Street
Boston, MA 02108

Director
Radiation Control Program
Department of Public Health
90 Washington Street
Dorchester, MA 02121

Nuclear Preparedness Manager
Massachusetts Emergency Management Agency
40 Worcester Road
Framingham, MA 01702-5399

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:	50-223/2014-201
Licensee:	University of Massachusetts Lowell
Facility:	University of Massachusetts Lowell Research Reactor
Location:	Lowell, Massachusetts
Dates:	April 7–10, 2014
Inspector:	Taylor A. Lamb
Approved by:	Gregory T. Bowman, Chief Research and Test Reactors Oversight Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Massachusetts Lowell
Research Reactor Facility
NRC Inspection Report No.: 50-223/2014-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Massachusetts Lowell's (the licensee's) Class II research reactor safety program including: organization and staffing; procedures; requalification training; experiments; health physics; committees, audits, and reviews; emergency preparedness; and transportation since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's programs were acceptably directed toward the protection of public health and safety, and were generally in compliance with NRC requirements.

Organization and Staffing Organization and Staffing

- Organizational structure and responsibilities were consistent with Technical Specification (TS) requirements.

Procedures

- The licensee was maintaining and implementing written procedures in accordance with license requirements.

Requalification Training

- Operator requalification was conducted as required by the Requalification Program and Title 10 of the *Code of Federal Regulations* Part 55.

Experiments

- Experiments were reviewed and performed in accordance with TS requirements and the licensee's written procedures.

Health Physics

- The radiation safety program was effective in minimizing radiation doses to individuals through as low as reasonably achievable actions, training, notices to workers, radiation monitoring and surveys, and the use of properly calibrated equipment.

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

Committees, Audits, and Reviews

- The Reactor Safety Subcommittee provided the oversight required by the TS.

Emergency Planning

- Emergency planning activities were generally in accordance with the Emergency Preparedness Plan and regulatory requirements.

- One inspector follow-up item was identified to verify the licensee's actions to either perform annual drills or change the emergency plan to reflect the conduct of biennial tabletop exercises.

Transportation

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

REPORT DETAILS

Summary of Facility Status

The University of Massachusetts Lowell's (UML's or the licensee's) one megawatt research reactor was operated in support of educational experiments and demonstrations, research and service irradiations, reactor operator training, and periodic equipment surveillances. During this inspection the reactor was operated in support of surveillance testing.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specifications (TS) Section 6.1, "Organization and Management," were being met:

- University of Massachusetts Lowell Research Reactor (UMLRR) Console Log Books, dated from May 4, 2012, to present
- Annual Report for the UMLRR, dated August 27, 2013
- Annual Report for the UMLRR, dated August 28, 2012
- Reactor Safety Subcommittee (RSSC) meeting minutes, first quarter 2012 to present
- Procedure AP-0, "Authority," Rev. 3, dated March 3, 2004

b. Observations and Findings

The organizational structure at the facility had not changed since the last NRC inspection in this area (refer to the U.S. Nuclear Regulatory Commission (NRC) Inspection Report No. 50-223/2012-201). Through the review of logbooks and records, the inspector determined that operational staffing met the minimum TS requirements.

c. Conclusion

The facility organizational structure and functions were consistent with TS Section 6.2.

2. Procedures

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the requirements of TS Section 6.3, "Operating Procedures," were being met:

- RSSC meeting minutes, first quarter 2012 to present
- Procedure AP-1, "Procedure Control and Distribution," Rev. 1, dated September 18, 2003
- Procedure AP-2, "Procedure Development," Rev. 1, dated September 18, 2003
- Procedure AP-3, "Testing of the Reactor Intrusion Alarms," Rev. 1, dated January 29, 2004
- Procedure AP-4, "Routine Opening and Closing of Containment," Rev. 2, dated March 22, 2007
- Procedure AP-5, "Reactor Access," Rev. 3, dated July 7, 2009
- Procedure RO-2, "Unloading and Reloading the Core to a Known Configuration," Rev. 5, dated April 1, 2005
- Procedure RO-3, "Changes which can Affect Reactivity Other than Movement of Fuel," Rev. 2, dated February 16, 1984
- Procedure RO-5, "Reactor Operations," Rev. 3, dated October 12, 2005
- Procedure RO-7, "Reactor Checkout," Rev. 1, dated July 28, 2008
- Procedure FP-6, "Airlock Doors Bypass," Rev. 1, dated June 26, 2013
- Procedure FP-7, "Beamport Irradiation Facility Operations," Rev. 0, dated June 26, 2013

b. Observations and Findings

Procedures were available for the activities and items required by TS 6.3. The procedures provided adequate guidance for the conduct of reactor and other operations. The inspector reviewed the process used to make changes and temporary changes to facility procedures. The licensee implemented the change, review, and approval process by use of administrative procedures and through approval by the RSSC.

c. Conclusion

The inspector determined that the procedural change, control, and implementation program was acceptably maintained as required by TS 6.3.

3. Requalification Training

a. Inspection Scope (IP 69001)

To verify that operator requalification activities and training were conducted in accordance with the NRC-approved Operator Requalification Program and other regulatory requirements, the inspector reviewed selected aspects of:

- Operator Requalification Program for the University of Massachusetts Lowell Research Reactor Licensed Reactor Operators and Licensed Senior Reactor Operators, Rev. 2.0, dated April 2008
- Training record binder
- Training and requalification records

- Written examinations administered on April 8, 2012
- UMLRR Console Log Books, dated from May 4, 2012, to present
- Individual reactor operator and senior reactor operator files

b. Observations and Findings

The licensee's requalification program included requirements for an annual operating test and a biennial written examination. The inspector verified that both examinations were administered at the specified frequency and that the level of difficulty was comparable to that of NRC-administered examinations. The inspector confirmed that the requalification program was being administered in a manner that sufficiently maintains the qualifications and proficiency of all licensed operators.

Records of reactor manipulations performed by each operator and internal audit records demonstrated that operators had met the minimum requirements specified in the Operator Requalification Program. If an operator did not meet the minimum operating hours requirement, that individual would be placed into a remedial training program and they would be required to perform the required 6 hours of operation under supervision of another licensed operator.

Section 4.5.4 of UML's Operator Requalification Program requires review of emergency operating procedures annually. Documented training confirmed that operators completed these reviews for 2012 and 2013, and they were in progress for 2014. Additionally, through review of files for each of the reactor operators and senior reactor operators at the facility, the inspector verified that the required medical examinations had been completed by a designated medical examiner.

c. Conclusion

Operator requalification was conducted as required by the Requalification Program and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 55.

4. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with TS Sections 3.6, "Limitations of Experiments," and Section 6.8, "Approval of Experiments":

- UMLRR Console Log Books, dated from May 4, 2012, to present
- RSSC meeting minutes, first quarter 2012 to present
- "Requirements for Approval of Experiments (Guideline)," Rev. 0, dated September 18, 2008
- Files of experimental approvals currently being used
- File of irradiation request forms for 2012, 2013, and 2014

- Procedure FP-5, "Sample Handling for the Reactor," Rev. 1, dated September 18, 2008
- Procedure CO-4, "Movement of Co-60 Source in the Reactor Pool," Rev. 4, dated March 3, 2004
- RO-1, "Initial and New Core Configurations," Rev. 1, dated February 16, 1984
- Procedure RO-4, "Addition or Removal of Core Samples," Rev. 6, dated June 14, 2005
- Procedure AP-6, "10 CFR 50.59 Screening and Evaluation," Rev. 0, dated December 16, 2009.

b. Observations and Findings

The inspector reviewed experiment approvals for experiments being used regularly. Experiment approval was clearly tracked in the minutes of the RSSC, including the safety evaluation, supporting documentation, and committee discussions. The inspector reviewed the file of reactor irradiation request forms for experiments that had been performed in 2012 through the date of the inspection in 2014, noting that the screening and evaluation process was in place and used by staff personnel. The reactor irradiation request form clearly indicated what information was required and the inspector verified that this information was properly recorded.

c. Conclusion

Experiments were reviewed and performed in accordance with TS requirements and the licensee's written procedures.

5. Health Physics

a. Inspection Scope (IP 69001)

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:

- "Audit of the 2012 UMass Lowell Radiation Safety Program," performed from January 16, 2013, through April 19, 2013
- "Audit of the 2013 UMass Lowell Radiation Safety Program," performed from January 22, 2014, through March 4, 2014
- Annual Report for the UMLRR, dated August 27, 2013
- Annual Report for the UMLRR, dated August 28, 2012
- As Low As Reasonably Achievable (ALARA) Reports for 2012 and 2013
- Landauer Records of Personnel Dosimetry, 2012 to present
- Reactor monthly radiation survey file for 2012 to present
- Health physics training for reactor operators file
- Detector calibration records for 2010 to present
- Procedure RO-10, "Radiation Monitoring System Checkout," Rev. 2,

dated March 9, 2006

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 storage of radioactive material or contaminated equipment to be in accordance with NRC requirements.

The licensee conducts an annual program-wide review of UML's radiation safety program. The inspector reviewed the section of the most recent audit focused on the research reactor, which included the effective implementation of ALARA practices for the period of 2012 through 2013. This audit identified that Argon-41 continues to be the only significant reactor-produced radioisotope identifiable in the gaseous effluent. The inspector confirmed that the annual reported emission of Argon-41 from the reactor ventilation stack did not exceed NRC requirements for gaseous emissions.

Dosimetry results were reviewed by the inspector. The licensee used optically-stimulated luminescent dosimeters for personnel whole body monitoring and thermoluminescent dosimeters for extremity dosimetry (finger rings) and environmental area monitors. Dosimetry records showed that exposure in 2012 and 2013 was well below 10 CFR Part 20 limits. As of the date of the inspection, the radiation exposure at the facility in 2014 was below detectable levels for the whole body and extremity.

A review of a sample of calibration records showed that radiation monitoring devices were calibrated per written procedures at the frequency specified in those procedures. The records of radiation surveys demonstrated low levels of radiation at the facility and postings were found to be in compliance with NRC regulations. A copy of the current NRC Form 3, "Notice to Radiation Workers," was posted at both entrances to the reactor bay as required by 10 CFR Part 19.

Radiation safety training was performed at the required frequency. Additional training was held as new topics/issues arose, including waste handling training conducted by a contractor and beam and irradiation specific training held at least biennially.

c. Conclusion

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 the use of properly calibrated equipment. Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

6. Committees, Audits, and Reviews

b. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 6.2, "Review and Audit," were being completed:

- University of Massachusetts Lowell Radiation Safety Committee Charter, dated October 1994
- RSSC meeting minutes, first quarter 2012 to present
- "2011–2012 Radiation Safety Program Review: Focus – UML Research Reactor"

c. Observations and Findings

The inspector reviewed the UML's Radiation Safety Committee Charter, which includes the RSSC. The inspector verified that the composition of the RSSC was as specified in the TS, that quorums were present at meetings, that meetings were held at least quarterly, and that meeting minutes were documented in accordance with TS requirements. A review of records indicated that the RSSC was informed of all activities at the reactor facility and provided the oversight and reviews of the reactor programs as required by the TS.

d. Conclusion

RSSC review functions required by the TS were being implemented and documented in accordance with NRC requirements.

7. Emergency Planning

a. Inspection Scope (IP 69001)

To verify that the licensee was implementing and complying with emergency plan requirements, the inspector reviewed selected aspects of:

- "Emergency Preparedness Plan for the UMLRR," Rev. 7, dated May 2013
- Emergency Procedures, dated March 31, 2004
- Reactor emergency drill file
- Emergency Contact Sheet, dated January 2014
- Emergency Equipment Checkout List, dated February 11, 2014
- Emergency Services Agreements with UMLRR:
  - City of Lowell Police Department, dated June 3, 2013
  - City of Lowell Fire Department, dated August 2, 2013
  - Lowell General Hospital, dated June 2, 2013
  - Trinity Emergency Medical Services Inc., dated June 12, 2013

b. Observations and Findings

The inspector reviewed the licensee's implementing procedures for their Emergency Preparedness Plan and verified that the annual review of the plan was completed by the Reactor Supervisor and Radiation Safety Officer. Additionally, the emergency call list was noted to be reviewed periodically to verify its accuracy. The inspector also verified that written agreements were maintained up-to-date with the police and fire departments, the local hospital, and emergency medical services.

The inspector reviewed the annual emergency drills held in 2012 and 2013. The Emergency Preparedness Plan requires biennial offsite coordination and participation in these drills. In May 2012 the drill scenario included a contaminated immobilized individual and emergency medical services and police dispatch participated in the drill. A post-drill critique was conducted and action items were identified and addressed.

It was noted that for the 2013 drill, the licensee had organized a tabletop exercise with the emergency medical services and the local fire department to discuss two scenarios. However, the inspector identified that the licensee's NRC-approved emergency plan requires, in part, that these annual drills be executed as realistically as possible and that they include use of the appropriate emergency equipment. The inspector identified that the failure to perform realistic drills annually, to include the use of emergency equipment, was a violation of the licensee's emergency plan. Because the licensee had been conducting effective tabletop exercises in opposing years in lieu of performing such exercises, the inspector determined that this was an issue of minor significance. Inspector follow-up item 50-223/2014-201-01 was opened to review the licensee's actions to correct this issue through either performing annual drills or changing their emergency plan to reflect the conduct of biennial tabletop exercises.

The inspector visited Lowell General Hospital on April 9, 2014, for a tour with the Emergency Management Coordinator and Paramedic Supervisor. The hospital had a decontamination room specifically for radiological emergencies and was noted as also having an agreement with Seabrook Power Station. The hospital had participated in several drills with the UMLRR, Federal Emergency Management Agency, and Seabrook Power Station. The inspector observed that the hospital was equipped, properly trained, and prepared to respond to a medical emergency at the UMLRR.

c. Conclusion

The emergency preparedness program was generally conducted in accordance with the NRC-approved emergency plan and implementing procedures. One inspector follow-up item was identified to verify the licensee's actions to either perform annual drills or change their emergency plan to reflect the conduct of biennial tabletop exercises.

8. Transportation

a. Inspection Scope (IP 86740)

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

- FHPP-3, "Radioactive Material Shipment Form"
- UML Radioactive Materials Package Receipt Forms

b. Observations and Findings

The Radiation Safety Officer was responsible for all of the licensee's shipments performed under the reactor license from 2012 through the date of the inspection in 2014. The inspector reviewed the shipments of irradiated electronic components and found the records and packaging slips to be completed as required.

c. Conclusion

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

9. Exit Interview

The inspection scope and results were summarized on April 10, 2014, 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. The licensee acknowledged the results of the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek	Reactor Supervisor
D. Lajeunesse	Reactor Operations
E. Mohan	Radiation Services
T. Regan	Research Engineer
S. Snay	Radiation Safety Officer

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-223/2014-201-01	IFI	Verify the licensee's actions to either perform annual drills or change their emergency plan to reflect the conduct of biennial tabletop exercises.

Closed

None

PARTIAL LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
ADAMS	Agencywide Document Access and Management System
ALARA	As Low As Reasonably Achievable
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
RSSC	Radiation Safety Subcommittee
TS	Technical Specifications
UML	University of Massachusetts Lowell
UMLRR	University of Massachusetts Lowell Research Reactor