August 13, 2012

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

SUBJECT: UNIVERSITY OF MASSACHUSETTS LOWELL – NRC ANNOUNCED ROUTINE INSPECTION REPORT NO. 50-223/2012-201

Dear Dr. Chowdhury:

A U.S. Nuclear Regulatory Commission (NRC) inspection was conducted from July 16 to 19, 2012, at the University of Massachusetts Lowell 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 enclosed 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 concerns or noncompliances with NRC requirements 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 and requests for withholding," 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 Mike Morlang at 301-415-4092 or email at Gary.Morlang@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: As stated

cc: w/encl: See next page

cc:

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

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

Docket No:	50-223
License No:	R-125
Report No:	50-223/2012-201
Licensee:	University of Massachusetts
Facility:	University of Massachusetts – Lowell Research Reactor
Location:	Lowell, Massachusetts
Dates:	July 16-19, 2012
Inspectors:	Mike Morlang Ossy Font (Trainee)
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.: 50-223/2012-201

This routine, announced inspection included on-site review of the University of Massachusetts Lowell (the licensee's) programs concerning organization and staffing; committees, audits, and reviews; procedures; requalification training; experiments; health physics; effluents and environmental monitoring; emergency planning; and transportation of radioactive material. Specific findings in each of these areas include:

Organization and Staffing Organization and Staffing

- The licensee's organization and staffing were in compliance with the requirements of the license.

Committees, Audits, and Reviews

- The Reactor Safety Subcommittee provided the oversight required by the Technical Specifications.

Requalification Training

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

Procedures

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

Experiments

- Experiments were reviewed and performed in accordance with Technical Specification 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 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 University of Massachusetts - Lowell (UML or the licensee) one megawatt research reactor had been operated in support of educational experiments and demonstrations, research and service irradiations, reactor operator training, and periodic equipment surveillances. The information detailed below was gathered by the inspectors 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. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69001-02.01)

The inspectors 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:

- UML Radiation Laboratory Administrative Organizational Chart, TS Section 6.1.3, Figure 6.1
- Reactor Console Logbook #30, August 3, 2009 to February 23, 2011
- Reactor Console Logbook #31, February 24, 2011 to March 3, 2012
- Reactor Console Logbook #32, March 4, 2012 to present
- Administrative Procedure (AP)-0, "Reactor Operations Authority"
- Reactor Safety Subcommittee (RSSC) Meeting Minutes for meetings of March 24, 2011; June 16, 2011; September 29, 2011; December 16, 2011, March 29, 2012; and June 28, 2012

b. Observations and Findings

Licensed operators for the facility consisted of five reactor operators (ROs) and six senior reactor operators (SROs).

The previous director of the radiation laboratory had retired and a new director had been appointed.

The minimum staffing required at the reactor and on-call when the reactor is not secured was specified in TS 6.1.4 and 6.1.5. The inspectors reviewed the console logbooks for the past 3 years and determined that staffing requirements had been met.

c. Conclusion

The licensee's organization and staffing were in compliance with the requirements of the license. Records confirmed that shift staffing met the minimum requirements for duty and on-call personnel.

2. Committees, Audits, and Reviews

a. Inspection Scope (IP 69001-02.09)

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 Lowell Radiation Safety Committee Charter, dated October 1994
- Reactor Safety Subcommittee Appendix I: Committee Membership, dated July 2012
- RSSC Meeting Minutes for meetings of March 24, 2011; June 16, 2011; September 29, 2011; December 16, 2011, March 29, 2012; and June 28, 2012
- Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, 2011 and 2012

b. Observations and Findings

The inspectors reviewed the University of Lowell Radiation Safety Committee Charter, which includes the RSSC. The inspectors verified that the composition of the RSSC was as specified in the TS and the Charter, quorums were present at meetings, meetings were held at the required frequency, and meeting minutes were published 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.

Committee membership was changed since the last inspection. The Radiation Safety Officer (RSO) acts as the secretary of the committee. The previous RSO is leaving the university at the end of July 2012. On June 28, 2012, the assistant RSO (ARSO) was voted by the RSSC as the interim RSO while the selection committee determines a permanent RSO. The inspectors verified that the committee membership was updated.

The inspectors reviewed annual audits focused on the research reactor prepared by the RSO/ARSO and verified findings were within TS requirements.

c. Conclusion

The RSSC provided the oversight required by the TS.

3. Requalification Training

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

The inspectors reviewed the following to verify that the requirements of Title 10 of the *Code of Federal Regulations* (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, dated September 18, 2008
- Training Record binder, dated 2002-2012
- Training and Requalification file
- Operator Requalification Audits file
- Written Examination administered April 8, 2012
- Reactor Console Logbook #30, August 3, 2009 to February 23, 2011
- Reactor Console Logbook #31, February 24, 2011 to March 3, 2012
- Reactor Console Logbook #32, March 4, 2012 to present
- Individual RO and SRO files

b. Observations and Findings

The inspectors reviewed the files of five ROs and six SROs, verifying certification of medical examination by a designated medical examiner.

The licensee's requalification program included the regulatory requirement for an annual operating test and a biennial written examination. The inspectors verified that both examinations were administered at the required frequency. Operating exams were conducted in April 2012 along with a written exam. The inspectors also verified that information about facility and procedural changes had been routed to licensed operators in accordance with 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.

UML Requalification Program, Section 4.5.4, requires review of emergency operating procedures (EOPs) annually. Documented training confirmed operators completed reviews for 2011 and were in progress for 2012.

c. Conclusion

Operator requalification was conducted as required by the Requalification Program and 10 CFR Part 55.

4. Procedures

a. Inspection Scope (IP 69001-02.03)

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

- Procedure AP-1, "Control and Distribution," Revision (Rev.) 1, dated December 16, 2009
- Procedure AP-2, "Procedure Development," Rev. 1, dated September 18, 2003
- Procedure AP-4, "Routine Opening and Closing of Containment," Rev. 2, dated March 22, 2007
- Procedure RO-5, "Reactor Operations," Rev. 3, dated October 12, 2005
- Procedure RO-7, "Reactor Checkout," Rev. 1, dated July 28, 2008
- Procedure AP-6, "10 CFR 50.59 Screening and Evaluation," Rev. 0, dated December 16, 2009

b. Observations and Findings

The inspectors observed that written procedures were used by the RO during the startup checklist and startup operations. The inspectors also observed that the licensee maintained written procedures covering the areas specified in TS Section 6.3. A systematic approach was being used to update and reissue procedures in accordance with a written procedure on document control. New procedures and major changes were reviewed and approved by the RSSC as required by TS Section 6.2, "Review and Audit."

c. Conclusion

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

5. Experiments

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

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

- Reactor Console Logbook #30, August 3, 2009 to February 23, 2011
- Reactor Console Logbook #31, February 24, 2011 to March 3, 2012

- Reactor Console Logbook #32, March 4, 2012 to present
- Files of eight experimental approvals currently being used, dated February 19, 1975 to present
- Procedure FP-05, "Sample Handling for the Reactor," Rev. 1, dated September 18, 2008
- Procedure RO-4, "Addition or Removal of Core Samples," Rev. 6, dated June 14, 2005
- File of Reactor Irradiation Request Forms for 2011 and 2012
- Procedure AP-6, "10 CFR 50.59 Screening and Evaluation," Rev. 0, dated December 16, 2009.

b. Observations and Findings

The inspectors reviewed experiment approvals for experiments being used most frequently. Experiment approval was clearly tracked in the minutes of the RSSC, including all documentation, safety evaluation, and committee discussions. The inspectors reviewed the file of Reactor Irradiation Request Forms for experiments that had been performed during the past 2 years, noting that the screening and evaluation process was in place and successfully used by staff personnel. The Reactor Irradiation Request Form clearly indicates what information is required and that the required information is being recorded.

c. Conclusion

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

6. Health Physics

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

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

- Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, 2011 and 2012
- Landauer Records of Personnel Dosimetry, 2011 and 2012
- Reactor Monthly Radiation Survey file for 2011 and 2012
- Health Physics Training for ROs file

b. Observations and Findings

The inspectors 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. The annual Radiation Safety Audit is a program-wide review of

the university's radiation safety program. The inspectors reviewed the section of the audit focused on the research reactor, which includes the effective implementation of As Low As Reasonably Achievable (ALARA) practices for the period of 2010 to 2012.

The inspectors reviewed records of radiation surveys of the reactor facility and found them to be generally low. 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.

Dosimetry results were reviewed by the inspectors. The licensee used optically stimulated luminescent dosimeters for personnel whole body monitors and thermal luminescent dosimeters (TLDs) for extremity dosimetry (finger rings) and environmental area monitors. Dosimetry records showed that exposure in 2011 was negligible and well below Part 20 limits. The highest radiation exposure to the whole body received in 2011 was 20 mrem (deep dose equivalent) and 120 mrem (shallow dose equivalent) for an extremity. To date the radiation exposure in 2012 is below detectable limits for the whole body and extremity.

The licensee attributed the low exposure, in part, to ALARA initiatives. The 2011 ALARA review included an exposure limit goal for the campus of less than 500 mrem/year whole body and less than 5,000 mrem/year to the extremities for occupational workers.

A sample records review showed that radiation monitoring devices were calibrated per written procedures on the frequencies specified in the procedures. The licensee did not maintain a respiratory protection program but one is available should the need occur.

Radiation safety training was performed more often than required. Additional training was held as new topics/issues arose, including waste handling training conducted by a contractor in January 2011 and beam and irradiation specific training held in November 2011.

c. Conclusion

The inspectors 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.

7. Effluent and Environmental Monitoring

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

The inspectors 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 Annual Operating Report 2010-2011,
- Radiation Safety Audit: Focus U-Mass, Lowell Research Reactor, 2011 and 2012
- Landauer Records of Personnel Dosimetry, 2011 and 2012
- Reactor Monthly Radiation Survey file for 2011-2012

b. Observation and Findings

The annual Radiation Safety Audit is a program-wide review of the university's radiation safety program. The inspectors reviewed the section of the audit focused on the research reactor. This section is used in preparing the annual reports and discussed the gaseous, liquid, and solid waste generated at the reactor facility during the reporting periods from 2010 to 2012. The 2012 annual report has yet to be issued. Argon-41 continues to be the only significant reactor produced radioisotope identifiable in the gaseous effluent, that being extremely small. The reported annual emission from the stack was 4.1 Ci for 2011 and 3.7 Ci for 2012. The annual liquid effluent to the public sewer system was less than 2 µCi (2011) and 0.5 µCi (2012) in the effluent stream. Most of the solid waste activity consisted of short lived induced radioactivity and held for decay and then released. The remaining long lived waste (less than 10 cubic feet) is stored in a waste storage area awaiting 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. Conclusion

Effluent releases were below detectable release or exposure levels. Effluent releases, effluent monitoring, and environmental monitoring satisfied license and regulatory requirements.

8. Emergency Planning

a. Inspection Scope (IP 69001-02.10)

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

- Emergency Preparedness Plan for the U Mass, Lowell Research Reactor, Rev. 6, dated August 2007
- Emergency Procedures, dated March 31, 2004
- Reactor Emergency Drill file, April 2011 and May 2012
- Emergency Call List, dated January 17, 2012
- Biennial Written Agreements; Police Dept. (April 2, 2012), Fire Dept. (April 3, 2012), Hospital (April 5, 2012), and Emergency Medical Services (April 4, 2012)

b. Observations and Findings

The inspectors reviewed the licensee's implementing procedures for their Emergency Preparedness Program. The plan called for an annual review by the Reactor Supervisor and RSO and the emergency call list to be reviewed periodically to verify its accuracy. The inspector verified these were completed.

The inspectors also verified that biennial written agreements were maintained up-to-date with the police and fire departments and the hospital and emergency medical technician services. Training for external emergency responders was done annually as required. Additionally, voluntary, non-required training was held for the District 6 Hazardous Material team and for members of the incident response center.

The inspectors reviewed the Emergency Equipment Checkout List and determined the surveillance had been completed and that the operational and calibration checks were recorded and in calibration.

The inspectors reviewed the annual emergency drills held in 2011 and 2012. In April 2011 the drill scenario was a pool leak. The Emergency Preparedness Plan requires biennial offsite coordination/participation. In May 2012 the drill scenario was a contaminated immobilized individual. Emergency medical services (an ambulance) and police dispatch participated. The emphasis was on the medical condition being a priority over the contamination. Police dispatch used the newly installed cameras provided as part of the National Nuclear Security Administration's Global Threat Reduction Initiative. Post-drill critiques were conducted and action items were identified and addressed.

The inspectors visited the fire department. Their Special Operations Response Unit has a standard radiation meter. The other fire trucks have original 1962 civil defense meters. They do not have a radiological response unit. Their role is defensive operations for mitigation. The university is in District 6, which has their own response team. Through interview the inspectors determined that the fire department has a well-established relationship with UML personnel.

c. Conclusion

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

9. Transportation

a. Inspection Scope (IP 86740)

The inspectors 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, dated February 5, 2008
- FHPP-3 Radioactive Material Shipment Form, Rev. B and packaging slip for shipments on February 17, 2011; March 31, 2011; May 5, 2011; March 2, 2012; March 7, 2012; May 23, 2012

b. Observations and Findings

The RSO and ARSO were responsible for all six of the licensee's shipments performed under the reactor license from 2011 to 2012. The inspectors reviewed the six shipments of irradiated electronic components and found the records and packaging slips to be completed as required.

The inspectors also discussed and were walked through the process of preparing a package for shipment.

c. Conclusion

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

10. Exit Interview

The inspectors reviewed the inspection results with members of licensee management at the conclusion of the inspection on July 19, 2012. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek	Reactor Supervisor
P. Chowdhury	Director Radiation Laboratory
C. French	Professor of Physics and Chairman of the Radiation Safety Committee
D. Medich	Radiation Safety Officer
S. Snay	Assistant Radiation Safety Officer
J. White	Professor of Chemical Engineering and Chairman of the Reactor Safety Subcommittee
M. Stelmokes	Hazardous Material Lieutenant, Lowell Fire Department

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation
IP 92701	Follow-up

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

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
AP	Administrative Procedure
ARSO	Assistant Radiation Safety Officer
EOP	Emergency Operating Procedures
IP	Inspection Procedure
NRC	U.S. Nuclear Regulatory Commission
PARS	Publicly Available Records
Rev.	Revision

RO	Reactor Operator
RSO	Radiation Safety Officer
RSSC	Radiation Safety Subcommittee
SRO	Senior Reactor Operator
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications
UML	University of Massachusetts Lowell