

May 9, 2016

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

SUBJECT: UNIVERSITY OF MASSACHUSETTS LOWELL – U.S. NUCLEAR  
REGULATORY COMMISSION SAFETY INSPECTION REPORT  
NO. 50-223/2016-201

Dear Dr. Chowdhury:

From April 4-7, 2016, the U.S. Nuclear Regulatory Commission (NRC, or the Commission) conducted an announced safety inspection 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 this inspection.

During the inspection, the NRC staff 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 non-compliance 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 any) 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).

P. Chowdhury

- 2 -

Should you have any questions concerning this inspection, please contact Mr. Ossy Font at (301) 415-2490 or by electronic mail at [Ossy.Font@nrc.gov](mailto:Ossy.Font@nrc.gov).

Sincerely,

**/RA/**

Anthony J. Mendiola, 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: See next page



P. Chowdhury

- 2 -

Should you have any questions concerning this inspection, please contact Mr. Ossy Font at (301) 415-2490 or by electronic mail at [Ossy.Font@nrc.gov](mailto:Ossy.Font@nrc.gov).

Sincerely,

**/RA/**

Anthony J. Mendiola, 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: See next page

**DISTRIBUTION:**

PUBLIC  
PROB R/F  
RidsOgcMailCenter Resource  
MCompton, NRR

RidsNrrDprPrtb  
RidsNrrDprPrta  
OFont, NRR  
NParker, NRR

RidsNrrDpr Resource  
STraiforos, NRR  
AMendiola, NRR

**ADAMS Accession No.: ML16124B155; \*concurred via e-mail**

**NRC-002**

<b>OFFICE</b>	NRR/DPR/PROB/RI	NRR/DPR/PROB/LA*	NRR/DPR/PROB/BC
<b>NAME</b>	OFont	NParker	AMendiola
<b>DATE</b>	05/05/2016	05/04/2016	05/09/2016

**OFFICIAL RECORD COPY**

University of Massachusetts - Lowell

Docket No. 50-223

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

Beverly Anderson, Interim Director  
Radiation Control Program  
Department of Public Health  
Schrafft Center, Suite 1M2A  
529 Main Street  
Charlestown, MA 02129

John Giarrusso, Planning and Preparedness Division Chief  
Massachusetts Emergency Management Agency  
400 Worcester Road  
Framingham, MA 01702-5399

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

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

Docket No. 50-223

License No. R-125

Report No. 50-223/2016-201

Licensee: University of Massachusetts Lowell

Facility: University of Massachusetts Lowell Research Reactor

Location: Lowell, Massachusetts

Dates: April 4-7, 2016

Inspector: Ossy Font

Approved by: Anthony J. Mendiola, 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  
Inspection Report No. 50-223/2016-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Massachusetts Lowell Research Reactor facility's (the licensee's) Class II research reactor facility safety program including: (1) procedures, (2) experiments, (3) health physics, (4) design changes, (5) committee audits and reviews, and (6) 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 in compliance with NRC requirements.

### Procedures

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

### Experiments

- Experiments were performed in accordance with Technical Specification (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.

### Design Changes

- The review, evaluation, and documentation of changes to the facility satisfied NRC requirements.

### Committee Audits and Reviews

- The Reactor Safety Subcommittee was meeting quarterly and reviewing the topics outlined in the TSs and conducting annual audits of facility programs as required.

### Transportation

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





## REPORT DETAILS

### Summary of Facility Status

The University of Massachusetts Lowell (UML, the licensee) one megawatt research reactor continued to be operated in support of educational experiments and demonstrations, research and service irradiations, reactor operator training, and periodic equipment surveillances. During the inspection, the reactor was operated to support education.

#### 1. Procedures

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

To ensure that the requirements of Technical Specification (TS) Section 6.3, "Operating Procedures," were being met the inspector reviewed the following:

- AP-0, "Authority," Revision (Rev.) 3, dated March 3, 2004
- AP-1, "Procedure Control and Distribution," Rev. 1, dated November 4, 2015
- AP-2, "Procedure Development," Rev. 1, dated November 4, 2015
- AP-2 (R), "Procedure Action Form- Revised Procedure," Rev. 1, dated October 28, 2015
- Form APF-1 (S), "Procedure Training and Review," Rev. 1, dated October 28, 2015
- HPP-1, "Calibration of Port Survey Meter for gamma-exposure," Rev. E, dated April 6, 2016
- AP-6, "10 CFR 50.59 Screening and Evaluation," Rev. 1, dated December 18, 2015

##### 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 a procedure revision developed during the inspection. The process and forms used were found to be appropriate. The licensee also updated AP-6 as a result of previous inspection, discussed further in Section 4, of this report. The update was reviewed and approval by the Radiation Safety Subcommittee (RSSC), and implemented.

##### c. Conclusion

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

#### 2. Experiments

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

To verify compliance with TSs Section 3.6, "Limitations of Experiments," and Section 6.8, "Approval of Experiments," the inspector reviewed selected aspects of the following:

- Irradiation request forms for 2014 to present
- Procedure FP-5, "Sample Handling for the Reactor," Rev. 1, dated September 18, 2008

b. Observations and Findings

The facility has not requested approval for any new experiments in the past two years; therefore, the inspector reviewed experiment approval process as described in the TS. The inspector also reviewed a sample of the irradiation request forms. These experiments were considered routine, as described in the TS, since they were previously approved by the RSSC and had no changes. The request forms clearly indicated what information was required and the inspector verified that this information was properly recorded.

c. Conclusion

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

**3. Health Physics**

a. Inspection Scope (IP 69001)

To verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection Against Radiation," and TS Sections 3.4 and 4.3, "Radiation Monitoring Equipment," the inspector reviewed the following:

- "University of Massachusetts Lowell Radiation Safety Guide", Rev. February 2015
- Training records for 2014 and 2015
- Personnel Dosimetry, 2014 to present
- HPP-1, "Calibration of Portable Survey Meters for Gamma Exposures," Rev. D, dated November 13, 2015
- HPP-7, "Radiation Survey Procedures," Rev. B, dated November 13, 2015
- SP-10, "Reactor Water Analysis," Rev. 6, dated March 7, 2006
- SP-10, Appendix 1-4
- 2014 Annual Audit
- HPP- 8b, "Radioactive Decontamination," Rev. B, dated November 13, 2015
- HPP-19, "Calibration of the hand and foot monitor," Rev. B, dated November 13, 2015

- HPP-10, "Calibration of Radiation Sources," Rev. B, dated November 13, 2015
- HPP-11, "Swipe Counting," Rev. A, October 27, 2015
- HPP-15, "Decontamination of an area or object," Rev. 6, dated November 3, 2015
- Annual Report for periods 2013-2014 and 2014-2015

b. Observations and Findings

The radiation safety guide was easily accessible, available outside of the Radiation Safety Office. Radiation safety training was performed at the required frequency.

The inspector toured the facility and observed proper 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. These practices are in accordance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

The licensee conducts an annual program-wide review of UML's radiation safety program. The inspector reviewed the research reactor audit for calendar year 2014, completed in 2015. The audit was performed by an outside group and made a number of observations, all of which were addressed by the licensee.

Dosimetry results were reviewed by the inspector and found to be well below 10 CFR Part 20 limits. The inspector noted that the processing of the dosimeters changed from monthly to quarterly. This was done campus wide.

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. Additional surveys were performed to prepare for the Cobalt-60 shipment. Also, the licensee properly identified and cleaned removable contamination following movement of the flux trap. 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, "Notices, Instructions and Reports to Workers: Inspection and Investigations."

Environmental dosimeters were placed at the doorways into the reactor containment building. Calibration of the stack particulate and gaseous monitors were being performed and certified by Canberra and are now completed by the licensee. This was being done at the required frequency. The licensee uses Comply code for effluent monitoring. Sewer and stack releases were below regulatory limits.



c. Conclusion

The inspector verified that the licensee's 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.

**4. Design Changes**

a. Inspection Scope (IP 69001)

To ensure that facility changes were reviewed and approved as required by TS Section 6.2, and 10 CFR 50.59, "Changes, Tests and Experiments," the inspectors reviewed selected aspects of the following:

- Annual Report for periods 2013-2014 and 2014-2015
- RSSC meeting minutes from June 2015 to March 2016
- AP-0, "Authority," Rev.3, dated March 3, 2004
- AP-1, "Procedure Control and Distribution," Rev. 1, dated November 4, 2015
- AP-2, "Procedure Development," Rev. 1, dated November 4, 2015
- AP-2 (R), "Procedure Action Form- Revised Procedure," Rev. 1, dated October 28, 2015
- Form APF-1 (S), "Procedure Training and Review," Rev. 1, dated October 28, 2015
- AP-6, "10 CFR 50.59 Screening and Evaluation," Rev. 1, dated December 18, 2015
- Activity Screening No. 16-01, "Replacement of Control Room Alarm Annunciator," dated March 23, 2016
- Activity Screening No. 15-02, "Replacement of Graphite Radiation Basket (Flux Trap) with Graphite Reflector," dated May 12, 2015

b. Observations and Findings

The inspectors reviewed the changes to the facility during the past year. They were reviewed and approved under the 10 CFR 50.59 screening process. The procedure in use was comprehensive and easy to follow. All of the changes to the facility were well documented and a thorough evaluation was completed. The inspectors noted that the RSSC reviewed the series of documents listed above as required in the facility TS.

During the previous inspection, the inspectors noted that AP-6 excluded all procedure changes from the scope of review under the 10 CFR 50.59 process. The inspectors indicated that substantive changes to procedures should be reviewed using the 10 CFR 50.59 process. The inspector followed up on Inspector Follow-up Item (IFI) 50-223/2015-201-01 and reviewed the updated

version of AP-6, which was approved by the RSSC. The inspector found the update appropriate and closed the IFI.

c. Conclusion

Records indicated that changes at the facility were acceptably being reviewed and approved in accordance with 10 CFR 50.59 and applicable licensee administrative controls.

**5. Committee Audits and Reviews**

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to ensure that the reviews stipulated in TS Section 6.2, were being implemented as required:

- Radiation Safety Committee Charter Rev. 2, dated July 1, 2014
- RSSC meeting minutes from June 2015 to March 2016

b. Observations and Findings

The inspectors verified that the RSSC was composed of at least five members and met at least quarterly as required by Section 6.2 of the TS. The inspectors reviewed the RSSC meeting minutes for the past two years. Review of the subcommittee meeting minutes indicated that the RSSC provided appropriate guidance and direction for reactor operations, and ensured acceptable use and oversight of the reactor.

c. Conclusion

RSSC review functions required by the TS were being implemented and documented.

**6. 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:

- "University of Massachusetts Lowell Radiation Safety Guide", Rev. February 2015
- HPP-3, "Shipment of Radioactive Material"
- FHPP-3, "Radioactive Material Shipment Form"
- Transportation Certificates
- Los Alamos National Laboratory ATRO #2015:82 and #2015:83, Offsite

Source Recovery Project, "Authorization to Transfer/Relinquishment of Ownership/Custody"

- Straight Bill of Lading for shipment

b. Observations and Findings

The Radiation Safety Officer was responsible for all of the licensee's shipments performed under the reactor license. The inspector reviewed a sample of shipments and noted that they were all shipped as excepted packaging and found the records and packaging slips to be completed as required. Additionally, the licensee transferred ownership of Co-60 strip sources to the Department of Energy (DOE). DOE was the responsible party for the shipment of the strip sources. Two shipments were made in 2015. Additional strip sources will be transferred and shipped in the future.

c. Conclusion

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

**7. Exit Meeting Summary**

The inspectors reviewed the inspection results with members of licensee management and RSSC members at the conclusion of the inspection on April 7, 2016. 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
S. Snay	Radiation Safety Officer, UML

## **INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
----------	-------------------------------------

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### **OPENED**

### **CLOSED**

50-223/2015-201-01	IFI	Follow-up on the licensee's efforts to revise and clarify facility procedure AP-6, "10 CFR 50.59 Screening and Evaluation," to include a 10 CFR 50.59 review of substantive changes to procedures.
--------------------	-----	--

## **LIST OF ACRONYMS USED**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
IFI	Inspector Follow-up Item
IP	Inspection Procedure
NRC	U. S. Nuclear Regulatory Commission
Rev.	Revision
RSSC	Radiation Safety Subcommittee
TS	Technical Specifications
UML	University of Massachusetts Lowell