

June 12, 2015

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

SUBJECT: UNIVERSITY OF MASSACHUSETTS LOWELL – NRC SAFETY INSPECTION
REPORT NO. 50-223/2015-201

Dear Dr. Chowdhury:

On April 6-9, 2015, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an announced safety inspection at the University of Massachusetts Lowell Research Reactor (UMLRR) facility (Inspection Report No. 50-223/2015-201, enclosed) and a re-exit meeting on May 14, 2015. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of this inspection.

During this 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

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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.

Sincerely,

/RA/

Kevin Hsueh, 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. 50-223/2015-201

cc: See next page

P. Chowdhury

- 2 -

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University of Massachusetts - Lowell

Docket No. 50-223

cc:

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Lowell, MA 01852

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Beverly Anderson, Interim Director
Radiation Control Program
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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: 50-223/2015-201

Licensee: University of Massachusetts Lowell

Facility: University of Massachusetts Lowell Research Reactor

Location: Lowell, Massachusetts

Dates: April 6-9, 2015

Inspectors: Ossy Font
Craig Bassett

Approved by: Kevin Hsueh, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

ENCLOSURE

EXECUTIVE SUMMARY

University of Massachusetts Lowell
Research Reactor Facility
Inspection Report No. 50-223/2015-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the University of Massachusetts Lowell Research Reactor (UMLRR) facility's (the licensee's) Class II research reactor facility safety program including: operation logs and records, surveillance and limiting conditions for operation, design changes, committee audits and reviews, maintenance logs and records, and fuel handling 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.

Operations Logs and Records

- Operation logs and records were maintained as required by the licensee's administrative procedures.

Surveillance and Limiting Conditions for Operation

- Limiting conditions for operation and surveillances required by Technical Specifications were being properly implemented.

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 Technical Specifications and conducting annual audits of facility programs as required.

Maintenance Logs and Records

- Maintenance was performed and logs and records were maintained and consistent with Technical Specifications and licensee procedure requirements.

Fuel Handling

- Fuel movements and inspections were conducted in accordance with Technical Specifications and facility procedural requirements.
- Fuel inspections were being conducted biennially as required.

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 an educational experiment for nuclear engineering exchange students from Saudi Arabia.

1. Operations Logs and Records

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

The inspectors reviewed selected aspects of the following to ensure that the operations program was being implemented as required in Technical Specifications (TS) Sections 3.0, 4.0, and 6.0:

- University of Massachusetts Lowell Research Reactor (UMLRR) Console Log Books, Numbers (Nos.) 32, 33, and 34, dated from May 3, 2012 to the present
- Annual Report for the UMLRR, dated August 27, 2014
- 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 2014 to present
- Reactor Operating (RO) Procedure RO-5, "Reactor Operations," Revision (Rev.) 3, approval dated October 12, 2005
- Procedure RO-7, "Reactor Checkout," Rev. 2, approval dated October 3, 2014
- Form RF-4, "Daily Routine Check Sheet"
- Form RF-5, "Radiation Monitoring System Daily Checks"
- Form RF-RO-6A, "Critical Hourly Readings"
- Form RF-RO-6B, "Radiation Monitoring Critical Hourly Readings"
- Form RF-RO-6C, "Reactor Shutdown Sheet"
- Form RF-RO-7B, "Pre-Startup Checksheet (Forced Convection)"
- Form RF-RO-7C, "Pre-Startup Checksheet (Natural Convection)"
- Form RF-RO-9A, "Reactor Operator Instruction Form"

b. Observations and Findings

During the inspection, the inspectors reviewed the UMLRR console log books for the past three years, monthly and daily surveillance sheets, and operation record forms. The inspectors verified that the reactor operating characteristics, and other procedurally required entries, were logged appropriately and that the checklists were completed. A review of the licensee's logs and records also indicated that the TS operational limits had not been exceeded and that the shift staffing met the minimum requirements.

During the inspection, the inspectors observed a reactor startup and verified compliance with the appropriate written procedures and TS requirements. It was noted that the operators on duty were knowledgeable and proficient.

c. Conclusion

Operational activities were consistent with applicable TS and procedural requirements.

2. **Surveillance and Limiting Conditions for Operation**

a. Inspection Scope (IP 69001)

To determine if the licensee conducted its surveillance program as required by TS Sections 3.0 and 4.0 and licensee commitments since the last inspection, the inspectors reviewed:

- Surveillance Master Schedule 2015
- Procedures SP 1-7, 9, 11-12, 15
- Calibration Procedures 1-2, 4-6

b. Observations and Findings

Daily, weekly, monthly, annual and other periodic checks, tests, and verifications for TS required Limiting Conditions for Operation (LCOs) were being completed as required. The inspectors performed a random sampling of the UMLRR required surveillances and verified all of the recorded results were within the TS and procedurally prescribed parameters. The records and logs were noted to be complete and were being maintained as required.

During the control blade and fuel inspection surveillance, blisters were observed on control blade (CB) #3. The CB is made of Boral. There was no degradation of the Boral and therefore little to no reactivity effects from the blistering. The UMLRR was in the process of replacing CB #3. The issue is further discussed in the Maintenance section below.

During the 2013 inspection, the inspector noted that there was no "normal surveillance time," per TS surveillance intervals, set for each of the surveillances. The inspector opened Unresolved Item (URI) 50-223/2013-201-01 to follow-up on the licensee establishing normal periods for each of the surveillances. During this inspection, the inspectors reviewed the surveillance intervals and found them to be completed on time or within the allowed grace period as described in TS 1.26. Additionally, the inspectors determined that no surveillance had been missed or completed outside of the surveillance intervals covered in the 2013 inspection. The inspectors closed URI 50-223/2013-201-01.

c. Conclusion

The program for surveillance and LCOs confirmation was implemented in accordance with TS Section 3.0 and 4.0 requirements.

3. **Design Changes**

a. Inspection Scope (IP 69001)

To ensure that facility changes were reviewed and approved as required by TS Section 6.2 and Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, the inspectors reviewed selected aspects of:

- Annual Report for the UMLRR, dated August 27, 2014
- Annual Report for the UMLRR, dated August 27, 2013
- Annual Report for the UMLRR, dated August 28, 2012
- RSSC meeting minutes, First Quarter 2014 to present
- Administrative Procedure (AP) AP-1, "Procedure Control and Distribution," Rev. 1, approval dated September 18, 2003
- Procedure AP-2, "Procedure Development," Rev. 1, approval dated September 18, 2003
- Procedure AP-6, "10 CFR 50.59 Screenings and Evaluations," Rev. 0, approval dated December 16, 2009
- Activity Screening No. 13-02, "Log-N Channel Replacement," dated December 18, 2013
- Activity Screening No. 14-01, "Addition of Flow, Temperature, and Pool Height Panel Indicators," dated December 6, 2014
- Activity Screening No. 14-02, "Linear Channel 1 & 2 Amplifier/Trip Module Replacement," dated December 17, 2014
- Activity Screening No. 15-01, "Control Blade Replacement," dated March 18, 2015

b. Observations and Findings

The inspectors reviewed several changes to the facility during the past two years that 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 review of the procedure dealing with procedural changes, the inspectors noted that some issues needed to be clarified or addressed in the document. Specifically, Procedure AP-2, "Procedure Development," 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 under the 10 CFR 50.59 process. The licensee stated that they would review the

procedure and make revisions to address this issue as appropriate. The licensee was informed that the revision of procedure AP-2 would be followed up by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-223/2015-201-01).

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.

4. **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:

- RSSC meeting minutes, September 2013 to March 2015
- Radiation Safety Committee Charter rev. 2, dated July 1, 2014

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.

5. **Maintenance Logs and Records**

a. Inspection Scope (IP 69001)

To verify that the licensee's operational and maintenance activities were consistent with regulatory requirements since the last inspection, the inspector reviewed selected aspects of:

- 50.59 Screening and Evaluation; Activity Screening Number 15-01
- FSAR 4.1.5 Control Blade
- SER 4.1.2 Control Rods
- TS 3.1.1, 3.1.2, 3.1.6; Reactivity

- Control Blade Replacement Plan
- Procedures RO 1-2
- Annual Report for the UMLRR for period 2012-2013 and 2013-2014

b. Observations and Findings

As previously stated in the Surveillance section, during the annual control blade and fuel surveillance, the UMLRR observed blisters in their Boral control blade (CB) #3 and was in the process of replacing the CB. The concern was that if the blistering continues and becomes severe enough, there is a possibility of the CB binding in or out of the reactor core.

During the beginning of the replacement maintenance activity, while unloading the core, the licensee discovered that their center flux trap had swollen approximately ¼ inch and would not be reloading the core with it. Therefore, a new core configuration was designed in order to re-calibrate the reactivity worth of CB #3 for comparison with the new control blade. The core was reloaded to the new configuration and the new reactivity worth calculated. The facility will continue the CB replacement in the near future.

c. Conclusion

Maintenance activities ensured that equipment remained consistent with the Safety Analysis Report and TS requirements.

6. **Fuel Handling**

a. Inspection Scope (IP 69001)

To determine whether fuel was inspected, handled and maintained as required by TS Sections 4.7 and 6.7 since the last inspection, the inspectors reviewed the following records:

- University of Massachusetts Lowell Research Reactor (UMLRR) Console Log Books, dated from May 3, 2012, to present
- Procedure RO-1, "Initial and New Core Configurations," Rev. 1, dated February 16, 1984
- Procedure RO-2, "Unloading and Reloading the Core to a Known Configuration," Rev. 5, dated April 1, 2005
- Procedure RO-8, "Handling of Irradiated Fuel," Rev. 2, dated May 22, 1991
- Procedure SP-12, "Visual Inspection of Control Blades, Regulating Rod, and Fuel Elements," Rev. 5, dated January 13, 2011

b. Observations and Findings

The licensee is required by TS 4.7 to conduct fuel inspections every two years.

The licensee primarily conducted fuel movements for fuel inspections. The inspectors verified that fuel movements were conducted in compliance with procedures and the TS. The inspectors also verified that the licensee was maintaining the required records of fuel movements as they were completed.

The inspectors found that the procedures used for fuel handling and inspection appeared to be adequate. The procedures contained proper precautions for criticality and radiological safety. Adequate personnel were required to be present for the task and appropriate controls and equipment were stipulated.

c. Conclusion

Fuel movements were performed safely in accordance with TS requirements and licensee procedural requirements. Fuel inspections were being conducted biennially as required.

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 May 14, 2015. 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
E. Mohan	Radiation Services
D. Lajeunesse	Reactor Operations
T. Regan	Reactor Engineer

Other personnel

S. Snay	Radiation Safety Officer, UML
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INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
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ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED

50-223/2015-201-01	IFI	Follow-up on the licensee's efforts to revise and clarify facility procedure AP-2, "Procedure Development," to include a 10 CFR 50.59 review of substantive changes to procedures.
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CLOSED

50-223/2013-201-01	URI	Follow-up to potential violation of TS surveillance periodicity requirements.
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LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Document Access and Management System
IFI	Inspector Follow-up Item
IP	Inspection Procedure
IR	Inspection Report
LCO	Limiting Condition for Operation
NRC	U. S. Nuclear Regulatory Commission
Rev.	Revision
RSSC	Radiation Safety Subcommittee
TS	Technical Specifications
UML	University of Massachusetts Lowell
UMLRR	University of Massachusetts Lowell Research Reactor
URI	Unresolved Item