

University of Massachusetts Lowell Research Reactor (UMLRR)



2016-2017 OPERATING REPORT

NRC Docket No. 50-223

NRC License No. R-125



*One University Avenue
Lowell, Massachusetts 01854*

CONTENTS

- A. Narrative Summary
 - 1. Operation Experience and Experiments
 - 2. Facility Design Changes
 - 3. Performance Characteristics Changes
 - 4. Changes in Operating Procedures Related to Reactor Safety
 - 5. Results of Surveillance Tests and Inspections
- B. Tabulations
- C. Inadvertent and Emergency Shutdowns
- D. Major Maintenance
- E. Facility Changes Related to 10 CFR 50.59
- F. Environmental Surveys
- G. Radiation Exposures and Facility Surveys
 - 1. Personnel Exposures
 - 2. Radiation Surveys
 - 3. Contamination Surveys
- H. Nature and Amount of Radioactive Effluents
 - 1. Liquid Wastes and Gaseous Wastes
 - 2. Solid Wastes

A. NARRATIVE SUMMARY

This report is submitted as required by the Technical Specification 6.6.4 of reactor license R-125 and provides the information as outlined in the specification.

1. Operating Experience and Experiments

The UML research reactor is designed to produce thermal (low energy) neutrons for radioactivation and neutron radiography purposes, and fast (high energy) neutrons for radiation effects studies. Uses include neutron activation analysis research, materials atomic displacement damage studies, neutron absorption studies, short-lived radioisotope production, neutron detector studies, and neutron imaging (radiography). Education uses include a variety of lab courses in the nuclear engineering and radiological sciences programs. Tours and demonstrations are provided to several other UMass Lowell courses, as well as other universities, high schools, and various organizations.

Short lived isotopes (e.g., Al-28, Na-24) were produced for routine practicum and demonstration purposes. The reactor was used for several nuclear engineering and non-nuclear engineering laboratory exercises and demonstrations. In addition, the reactor was used for training of student operator license candidates. Student candidates are provided an opportunity to work at the reactor and gain practical experience while studying for a future licensing examination.

Organized tours were provided to UMass students, local college students, grade school students, and other groups and individuals. As part of emergency responder training, tours and presentations also were provided to the UML Police Department and city of Lowell Fire Department.

2. Facility Design Changes

There were no facility design changes during the reporting period.

3. Performance Characteristics Changes

As noted in previous annual reports, the linear power monitoring channels have exhibited electronic problems resulting in several spurious scrams (Section C). Replacement power monitoring channels have been ordered and received. We are currently working with NRC on an approval for use of these units as part of the facility relicensing effort.

Performance of all other the reactor and related equipment has been normal during the reporting period. There were no discernable changes that would indicate any degradation of other systems or components.

4. Changes in Operating Procedures Related to Reactor Safety

There were no changes to procedures during the reporting period.

5. Results of Surveillance Test and Inspections

All surveillance test results were found to be within specified limits and surveillance inspections revealed no abnormalities that could jeopardize the safe operation of the reactor. Each required calibration was also performed.

B. TABULATIONS

Energy generated this period (MWD)	3.19
Critical hours	230.92
Cumulative energy to date (MWD)	74.12

C. INADVERTENT AND EMERGENCY SHUTDOWNS

There were no emergency shutdowns for the reporting period. There were 12 inadvertent non-emergency automatic shutdowns during the reporting period. Most were due to electronic noise problems associated with the power monitoring channels (see A3). There was no safety significance associated with any of the inadvertent scrams. Descriptions of all manual and automatic scrams are noted in operator logs and are analyzed by an SRO for safety significance and technical specification requirements.

D. MAJOR MAINTENANCE

There was one major maintenance activity during the reporting period. As noted in the 2014-15 and 2015-16 Annual Reports, efforts have been underway to replace the Boral control blades with a control blades made from a boron-aluminum metal-matrix composite (MMC). The new control blades were evaluated under 50.59 in 2015. Two additional Boral control blades

were replaced in June of this year. Control rod drop times and reactivity measurements have shown there no measurable difference from the Boral blades.

E. FACILITY CHANGES RELATED TO 10CFR50.59

There no changes (other than that specified in D) requiring an evaluation under the provisions of 10CFR 50.59 during the reporting period.

F. ENVIRONMENTAL SURVEYS

Members of the Radiation Safety Office performed an ALARA review for the 2016 calendar year with the results summarized in Sections G and H. The following actions are performed in the indicated time period as part of the UMLRR radiation safety program:

1. Reactor Field Surveys – monthly (byproduct materials license)
2. Reactor Contamination Surveys – monthly (byproduct materials license)
3. Primary water analysis – weekly (SP-10)
4. 20 ml Secondary Water Analysis – each Rx operations day (SP-10)
5. 3 L Secondary Water Analysis - Semi-annually (SP-10)
6. liquid waste (sewer) – prior to disposal (SP-10)
7. Rad Monitor Check – each detector checked prior to each day’s operations by Rx staff.
8. Personnel dosimetry – quarterly; obtained using a NVLAP accredited dosimetry lab.
9. Environmental dosimetry – quarterly; using NVLAP lab accredited dosimetry lab.

G. RADIATION EXPOSURES AND FACILITY SURVEYS

1. Personnel Exposures

An ALARA assessment of the UMass Lowell radiation safety program is performed annually. This review is reported to and reviewed by the Radiation Safety Committee. The 2016 ALARA goal for radiation workers at UMass Lowell was to limit the most exposed radiation worker at UML to less than 10% of the federal radiation exposure limits. In addition, the radiation safety manual requires a 100 mrem per week TEDE administrative level. No

occupational exposure exceeded an ALARA limit in 2015. Personnel dosimetry was obtained by review of the 2015 Landauer dosimetry reports. These reports include, where appropriate, whole body OSL dosimetry and finger TLD dosimetry. Landauer is a NVLAP accredited dosimetry company.

OCCUPATIONAL EXPOSURES

<u>GROUP</u>	<u>NUMBER</u> <u>BADGED</u>	<u>Average</u> <u>Whole Body</u> <u>Dose</u> <u>(<500mrem)</u>	<u>Average</u> <u>Extremity</u> <u>Dose</u> <u>(<5000 mrem)</u>
Reactor	20	5	29

2. Radiation and Contamination Surveys

A review of all 2016 Research Reactor Radiation Survey and Contamination forms found no measurable removable contamination levels due to unexpected occurrences in the facility. The UML byproduct materials license specifies contamination as ≥ 500 dpm/100cm² (beta) or ≥ 50 dpm/100cm² (alpha). No appreciable stray radiation fields (>2 mR/hr) were identified in a free area within the reactor. Radiation levels measured in the reactor building have been typically less than 0.1 mrem/hr in general areas. Experiments have been conducted in which transient levels at specific locations have been in excess of 100 mrem/hr. Doses in these instances have been controlled by use of shielding, visual and audial notifications, and/or personnel access control. The pump room and Beamport facility remain designated as a high and very high radiation area respectively during reactor operation and access is controlled.

H. NATURE AND AMOUNT OF RADIOACTIVE WASTES

1. Liquid Wastes and Gaseous Wastes

As part of UMass Lowell ALARA goals, the radiation safety office has set a campus goal of limiting exposures to members of the public to less than 10% of the federal regulatory limits. No detectable radioactive material was released through the reactor sewer system during the reporting period (detection limit of approximately 3.3×10^{-8} μ Ci/ml). Argon-41 continues to be

the only significant reactor produced radioactivity identifiable in the gaseous effluent. The reactor stack released roughly .254 Ci in 2016 resulting in a (conservative) estimated upper limit to the TEDE of 0.1 mrem/year 100 m from the stack.

ENVIRONMENTAL RELEASES

<u>SOURCE</u>	<u>ACTIVITY</u>	<u>DOSE</u>	<u>GOAL</u>
	<u>Ci</u>	<u>mrem</u>	<u>mrem</u>
Sewer Releases	M*	M*	≤10
Stack Releases	2.54	0.1	≤10

****NOTE: ‘M’ indicates no detectable releases or exposure***

2. Solid Wastes

Solid wastes, primarily paper, disposable clothing, and gloves, along with other miscellaneous items have been disposed of in appropriate containers. Most of the activity from these wastes consisted of short lived induced radioactivity. These wastes were held for decay and then released if no activity remained. In May of 2017, a one-time shipment of 740 lbs. of activated metals and dry active waste (DAW) in a total volume of 3 cubic meters and total activity of 22.3 mCi. The shipment included both waste from the reactor as well as waste collected from other campus labs.

End of Report