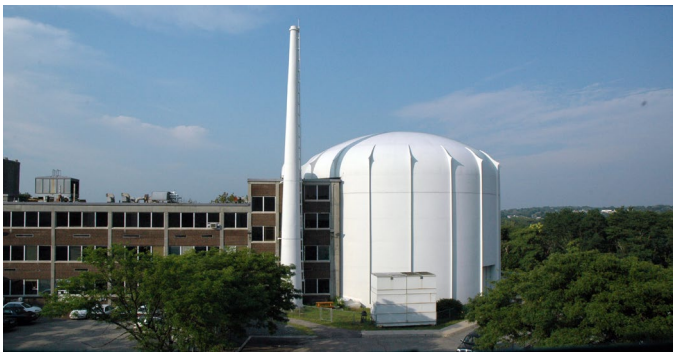
University of Massachusetts Lowell
Research Reactor (UMLRR)



2020-2021 OPERATING REPORT

NRC Docket No. 50-223

NRC License No. R-125

University of Massachusetts Lowell

One University Avenue
Lowell, Massachusetts 01854

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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.

During the reporting period, the reactor facility staff remained at a reduced on-site level to maintain a low personnel density for social distancing requirements under COVID-19 restrictions. The reactor continued to operate as needed during the reporting period while maintaining or exceeding the minimum staff requirements under the Technical Specifications. All staff will return to on-site full-time status as of September 1, 2021.

2. Facility Design Changes

There were no facility design changes during the reporting period.

3. Performance Characteristics Changes

The linear power monitoring channels continue to exhibit electronic problems resulting in spurious scrams (Section C). The channels will be replaced once relicensing is completed, or if a complete failure of a channel necessitates a replacement under the provisions of 10CFR 50.59.

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 was one change to the temperature channels calibration procedure (see section E).

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)	5.06
Critical hours	337.47
Cumulative energy to date (MWD)	90.90

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. All were due to electronic noise problems associated with the aging power monitoring channels. This particular type of inadvertent shutdown will be remedied with the replacement of the linear monitoring channels (A.3 above). There was no safety significance associated with any of the inadvertent scrams.

However, the scrams are nuisance for researchers and staff. 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 no major maintenance performed during the reporting period.

E. FACILITY CHANGES RELATED TO 10CFR 50.59

Procedure CP-4 "Calibration of Temperature Monitor Devices" was revised for a change of the calibration standard used for checking the accuracy of the temperature measuring channels. The change was reviewed under the screening process and was determined not to require a full 50.59 evaluation. There were no other facility changes related to 10CFR 50.59 during the reporting period.

F. ENVIRONMENTAL SURVEYS

Members of the Radiation Safety Office performed an ALARA review for the 2020 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
2. Reactor Contamination Surveys – monthly
3. Primary water analysis – weekly
4. Secondary Water Analysis – each day's operation
5. 3-liter Secondary Water Analysis – semi-annually
6. Liquid waste (sewer) – prior to disposal
7. Area Radiation Monitors Check – detectors checked prior to each day's operation
8. Personnel dosimetry – quarterly
9. Environmental dosimetry – quarterly

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 2020 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 2020. Personnel dosimetry was obtained by review of the 2020 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

GROUP	NUMBER BADGED	MAX Whole Body Dose (<500mrem)	MAX Extremity Dose (<5000 mrem)
Reactor	18	M	167

NOTE: No one person exceeded the ALARA limits. " M" indicates no detectable releases or exposure, No one person exceeded the ALARA limits

2. Radiation and Contamination Surveys

A review of all 2020 Research Reactor Radiation Survey and Contamination forms found no measurable removable contamination levels due to unexpected occurrences in the facility. The byproduct materials license specifies contamination as ≥500 dpm/100cm^2 (beta, gamma) or ≥50 dpm/100cm^2 (alpha). No appreciable stray radiation fields (>2mR/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 beam port 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 radioactive material was released through the reactor sewer. Argon-41 continues to be the only significant reactor produced radioactivity identifiable in the gaseous effluent. The reactor stack released roughly 5.98 Ci in 2020 resulting in a (conservative) estimated upper limit to the TEDE of 0.2 mrem/year 100 m from the stack.

REACTOR ENVIRONMENTAL RELEASES

SOURCE	ACTIVITY Ci	DOSE mrem	GOAL mrem
Sewer Releases	0	<0.1	≤10
Stack Releases	5.98	0.2	≤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. Long lived waste (<40 cubic feet) is stored in a designated long lived waste storage area awaiting ultimate disposal at a low-level radioactive waste disposal site.

End of Report