University of Massachusetts Lowell
Research Reactor (UMLRR)

2017-2018 OPERATING REPORT

NRC Docket No. 50-223

NRC License No. R-125

University of Massachusetts Lowell

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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. 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 staff.

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)	3.31
Critical hours	196.03
Cumulative energy to date (MWD)	77.43

C. INADVERTENT AND EMERGENCY SHUTDOWNS

There were no emergency shutdowns for the reporting period. There were 14 inadvertent non-emergency automatic shutdowns during the reporting period. Most 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 were two major maintenance activities occurred during the reporting period. The air compressor inside the reactor building failed a State safety inspection in April. The

compressor provides compressed air for experimental facilities, air operated valves for the demineralizer system, and airlock door seals. A similar sized compressor was obtained, installed, and tested by the university's facilities department. The second activity involved a pool liner repair due to leaks in the reactor pool. Similar leaks on the aluminum pool liner had occurred in the late 1980's and late 1990's. Any water leaking from the reactor pool is collected inside the reactor building sump which is then pumped to holding tanks located in the attached classroom building. The water in the tanks is analyzed for radioactivity prior to discharge to the city sanitary sewer system. For the 1980's repair, aluminum sheet metal patches were welded to the leaking areas of the reactor pool liner. In 2000, a Kevlar-based epoxy coating was applied to the leaking surfaces. A partial delamination of the coating from the aluminum surface had occurred in the past few years, contributing to new leakage. For this repair, the loose epoxy was removed and new epoxy technique was applied. Since the application, the leaks have stopped and based on the effort from 2000, the coating should last at least 15 years.

E. FACILITY CHANGES RELATED TO 10CFR50.59

There were no changes 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 2017 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 milliliter Secondary Water Analysis – each Rx operations day (SP-10)
5. 3 liter 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 2017 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 2017. Personnel dosimetry was obtained by review of the 2017 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	Average Whole Body Dose (<500mrem)	Average Extremity Dose (<5000 mrem)
Reactor	20	2.2	3.0

NOTE: No one person exceeded the ALARA limits.

2. Radiation and Contamination Surveys

A review of all 2017 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 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 radioactive material was released through the reactor sewer (detection limits of approximately 6.8×10^{-9} μCi/ml). Argon-41 continues to be the only significant reactor produced radioactivity identifiable in the gaseous effluent. The reactor stack released roughly 5.23 Ci in 2017 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	M*	M*	≤10
Stack Releases	5.23	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