

University of Massachusetts Lowell Research Reactor (UMLRR)



2021-2022 OPERATING REPORT

NRC Docket No. 50-223

NRC License No. R-125



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Lowell, Massachusetts 01854*

This report is submitted as required by the Technical Specification 6.7.1 of reactor license R-125 and provides the information as outlined in the specification.

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1. NARRATIVE SUMMARY – TABULATIONS

a. Narrative Summary

The UML research reactor is designed to produce thermal neutrons for radioactivation and neutron radiography purposes, and fast 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.

The operating license for the reactor was renewed by the Nuclear Regulatory Commission on February 3, 2021 for a 20-year period.

b. Tabulations

Energy generated this period (MWD)	2.24
Critical hours	247.33
Cumulative energy to date (MWD)	93.14

2. INADVERTENT AND EMERGENCY SHUTDOWNS

There were no emergency shutdowns for the reporting period. There were 9 inadvertent non-emergency automatic shutdowns during the reporting period. Seven were due to electronic noise problems associated with the aging power monitoring channels. Notably, these noise issues have been greatly improved since the renewed license was implemented, allowing the replacement of the linear power monitoring channels. Two inadvertent scrams were due to operator error whereby a linear power monitoring channel was not placed in auto-ranging

mode, thereby causing a trip on the lowest range of power indication. There was no safety significance associated with any of the inadvertent scrams.

3. MAJOR PREVENTIVE AND CORRECTIVE MAINTENANCE

There were no major preventive or corrective maintenance operations having safety significance during the reporting period.

4. CHANGES AND TESTS AND EXPERIMENTS RELATED TO 10 CFR 50.59

a. Changes to the Facility

There was one change to the facility during the reporting period. The recorder for the primary coolant temperatures and the recorder for the primary coolant flow and reactor power were replaced with one digital paperless recorder. The change was evaluated and implemented under 10CFR 50.59.

b. Changes to Procedures

As a result of the implementation of the renewed reactor license and revised technical specifications, the following procedures were changed:

RO-7 Reactor Checkout – changes incorporated for new linear power monitoring channels evaluated by NRC as part of the relicensing effort.

FP-7 Beamport Operations – changes incorporated to conform with new technical specification limiting conditions of operation and surveillances associated with beamport operations.

CO-5 Gamma Cave Operations and CO-7 ELDRS Facility Operations – changes incorporated to conform with new technical specification limiting conditions of operation and surveillances associated with gamma facility operations.

The changes were evaluated and implemented under 10CFR 50.59.

c. New Tests and Experiments

There were no new tests or experiments during the reporting period requiring a 10CFR 50.59 evaluation.

5. NATURE AND AMOUNT OF RADIOACTIVE EFFLUENTS

a. 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. 84.5 μ Ci was released through the reactor sewer and were well below the monthly limits for sewer releases. Argon-41 continues to be the only significant reactor produced radioactivity identifiable in the gaseous effluent. The reactor stack released roughly 5.635 Ci in 2021 resulting in a (conservative) estimated upper limit to the TEDE of 0.2 mrem/year 100 m from the stack.

REACTOR 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	0	<0.1	≤ 10
Stack Releases	5.635	0.2	≤ 10

**NOTE: 'M' indicates no detectable releases*

b. 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.

6. ENVIRONMENTAL SURVEYS

A review of all 2021 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/100cm² (beta, gamma) or ≥ 50 dpm/100cm² (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.

Environmental monitoring external to the reactor building found no measurable doses.

7. 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 2021 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. Personnel dosimetry was obtained by review of the 2021 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>MAX</u>	<u>MAX</u>
	<u>BADGED</u>	<u>Whole Body</u>	<u>Extremity</u>
		<u>Dose</u>	<u>Dose</u>
		<u>(<500mrem)</u>	<u>(<5000 mrem)</u>
Reactor	18	20	246

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

End of Report