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RADIATION LABORATORY

Leo M. Bobek
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August 28, 2009

U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Re: License No. R-125, Docket No. 50-223

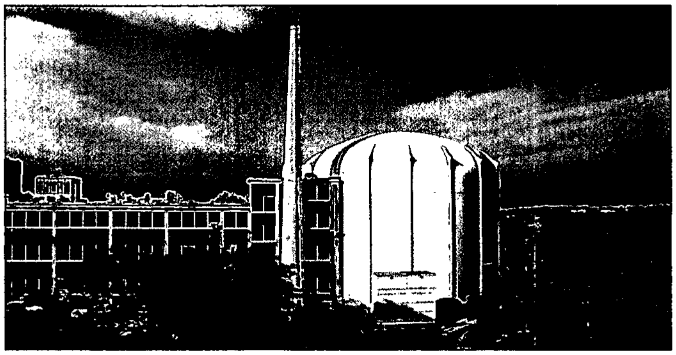
Pursuant to Technical Specification NRC License No. R-125 we are submitting the Annual Report for the University of Massachusetts Lowell Research Reactor.

Sincerely,

Leo M. Bobek,
Reactor Supervisor

A020
NRR

University of Massachusetts Lowell Research Reactor (UMLRR)



2008-2009 OPERATING REPORT

NRC Docket No. 50-223

NRC License No. R-125

University of Massachusetts
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One University Avenue
Lowell, Massachusetts 01854

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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.

Facility History and Overview

In the late 1950's, the decision was made to build a Nuclear Center at what was then Lowell Technological Institute. Its stated aim was to train and educate nuclear scientists, engineers and technicians, to serve as a multi-disciplinary research center for LTI and all New England academic institutes, to serve the Massachusetts business community, and to lead the way in the economic revitalization of the Merrimack Valley. The decision was taken to supply a nuclear reactor and a Van-de-Graaff accelerator as the initial basic equipment.

Construction of the Center was started in the summer of 1966. Classrooms, offices, and the Van-de-Graaff accelerator were in use by 1970. Reactor License R-125 was issued by the Atomic Energy Commission on December 24, 1974, and initial criticality was achieved on January 1975.

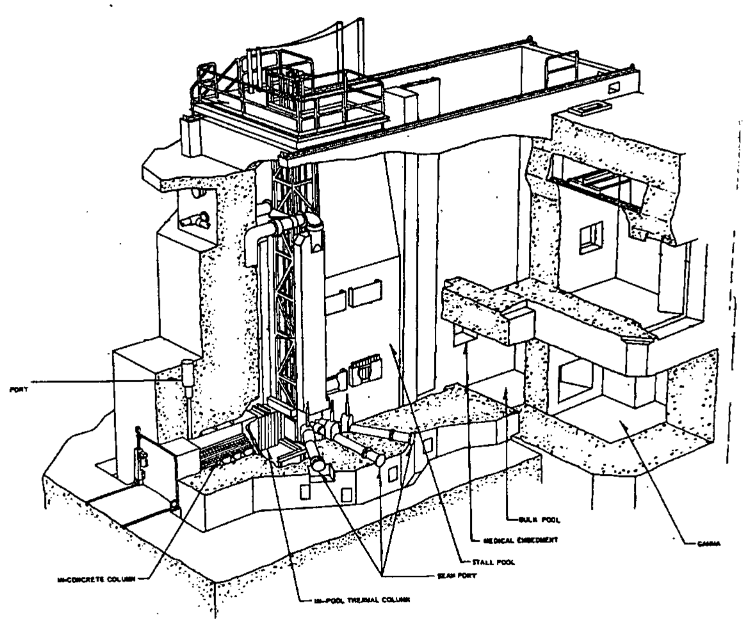
The name of the Nuclear Center was officially changed to the "Pinanski Building" in the spring of 1980. The purpose was to reflect the change in emphasis of work at the center from strictly nuclear studies. At that time, the University of Lowell Reactor became part of a newly established Radiation Laboratory. The Laboratory occupies the first floor of the Pinanski Building and performs or coordinates research and educational studies in the fields of physics, radiological sciences, and nuclear engineering. The remaining two floors of the Pinanski Building are presently occupied by various other University departments.

On February 14, 1985, the University of Lowell submitted an application to the Nuclear Regulatory Commission for renewal of the facility operating license R-125 for a period of 30 years. On November 21, 1985, the license renewal was granted as Amendment No. 9 of License R-125 in accordance with the Atomic Energy Act of 1954.

In 1991, the University of Lowell name was changed to University of Massachusetts Lowell. On August 4, 2000, the reactor was converted from high enrichment uranium fuel to low enrichment uranium fuel.

The University of Massachusetts Lowell Radiation Laboratory (UMLRL) is one of 22 research centers at the University. The University departments utilizing the laboratory include Biology, Chemistry, Earth Sciences, Physics, Mechanical Engineering, Plastics Engineering, Radiological Sciences, and Chemical/Nuclear Engineering. The University's Amherst campus and Medical Center have active research programs at the Radiation Laboratory. Much research is concerned with safety and efficiency in the nuclear and radiation industries, including pharmaceuticals, medical applications, health effects, public utilities, etc.; however, much research is also done by workers in other fields who use the unique facilities as analytical tools.

In addition, the Laboratory's reactor and Cobalt-60 facilities are used in the course work of various departments of the University. It also provides these services to other campuses of the Massachusetts system, other universities in the New England area, government agencies and to a limited extent, industrial organizations in Massachusetts and the New England area, as well as numerous school science programs in the Merrimack Valley.



UMLRR Cutaway View

A. NARRATIVE SUMMARY

1. Operating Experience and Experiments

The major uses of the reactor during the reporting period were activation analysis, neutron radiography, neutron irradiation of electronics, neutron irradiation of biological media, neutron irradiation of borated materials for spent-nuclear fuel storage systems, production of short-lived isotopes for educational purposes, teaching and personnel training.

Neutron activation analysis was used for several research projects involving geologic and nanotech materials. The neutron radiography system was used to evaluate various concrete specimens for micro-fractures. Neutron irradiation of various electronics was performed to enhance performance characteristics and for tolerance testing. Cell cultures were irradiated to evaluate radio-protective agents. Grass seeds were irradiated to study neutron induced mutagenic enhancements. Borated aluminum was irradiated to evaluate neutron aging of materials to be used in spent fuel storage systems. 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 practicum and demonstration purposes. In addition, the reactor was used for training operator license candidates.

2. Facility Design Changes

Two potential facility changes were evaluated by the Reactor Safety Subcommittee (RSSC) during the reporting period to determine the applicability of a 10CFR 50.59 review process (Section G of this report). A removable dry tube assembly was designed and tested for use with the in-core irradiation baskets. The design was evaluated and considered to be similar to a previously reviewed and approved dry tube irradiator used with the reactor. A high-voltage power supply and accompanying scram circuit was replaced (see 3 below). The replacement was determined not to be a change as described in the Final Safety Analysis Report. Neither change was considered to be a design change requiring a 10CFR 50.59 evaluation.

3. Performance Characteristics Changes

A high-voltage power supply (HVPS) for one of two linear power measuring channels was replaced due to a short circuit. The short circuit was caused by water seepage into a compensated ion chamber (CIC). The HVPS is isolated such that no other components or systems were affected. The HVPS was subsequently replaced and the CIC was re-sealed to prevent water seepage. The performance of all other reactor and related equipment has been normal during the reporting period. There were no other discernable changes that would indicate any degradation of the systems or components important to safety.

4. Changes in Operating Procedures Related to Reactor Safety

There is a continuing effort to update and re-format all procedures associated with the reactor. Several procedures had minor revisions or updates non-substantive in nature. Such changes are kept on file and summarized for review by the Reactor Safety Subcommittee at each meeting.

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)	5.73
Critical hours	169.3
Cumulative energy to date (MWD)	37.94

C. INADVERTENT AND EMERGENCY SHUTDOWNS

There were four inadvertent non-emergency shutdowns (scrams). Two were due to a linear power range switch being left in manual, causing a trip on a low power range.

Two were due to electronic communication errors. None of the automatic shutdowns had any safety significance. Descriptions of each scram are noted in operator logs and are analyzed by a licensed senior reactor operator for any safety significance.

D. MAJOR MAINTENANCE

There was no major maintenance performed this reporting period.

E. FACILITY CHANGES RELATED TO 10CFR50.59

There were no facility changes related to 10CFR 50.59.

F. ENVIRONMENTAL SURVEYS

Members of the Radiation Safety Office performed an ALARA review for the 2008 calendar year with the results summarized below. Included is a summary of the environmental release pathways (sewer and stack) and the maximum environmental and occupational dosimetric exposures documented through the Global Dosimetry film badge service.

Thermoluminescent dosimeters, provided by Global Dosimetry, were used to monitor unrestricted areas outside of the Reactor and indicated that doses in these areas were statistically equivalent to background radiation levels for the 2008 calendar year. Surveys of the environs external to the reactor building also show no increase in levels or concentrations of radioactivity as a result of continued reactor operations.

All environmental releases were below the goals set by the Radiation Safety Office (10 mrem per year). All releases were well within federal, state, city, and university release limits. The reactor stack release during the 2008 was conservatively estimated to be less than 3.84 Ci and resulted in an estimated annual dose at the site boundary of 1.3 mrem in 2008. The dose estimate was obtained using the EPA Comply Code at a level 4 screening. This estimated did not take into account the removal of three reactor beamports, which would have further lowered the total estimated Argon-41 production and therefore the dose at the site boundary.

G. RADIATION EXPOSURES AND FACILITY SURVEYS

2008 ALARA Data

OCCUPATIONAL EXPOSURES

GROUP	NUMBER BADGED	MAXIMUM Wole Body DOSE (<500)	MAXIMUM Extremity DOSE (<5000)
Reactor	13	M*	60

* NOTE: M indicates no detectable exposure

1. Personnel Exposures

Personnel exposures were maintained at the lowest reasonable levels. Doses received by individuals concerned either directly or indirectly with operation of the reactor were within allowed limits. The annual ALARA goal established by the Radiation Safety Committee is less than 500 mrem per employee whole body and 5,000 mrem per employee Shallow Dose. Of the 13 badged individuals, there was no measurable external dose reported and the highest annual shallow dose was 60 mrem.

2. Radiation Surveys

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 and/or personnel access control. The pump room remains designated as a high radiation area during reactor operation and access is controlled.

3. Contamination Surveys

General area contamination has not been a problem in the reactor building. Contamination has occurred at specific locations where samples are handled and particular experiments have been in progress. Contamination in these areas is controlled by the use of easily replaced plastic-backed absorbent paper on work surfaces, contamination protection for workers, and restricted access.

H. NATURE AND AMOUNT OF RADIOACTIVE WASTES

2008 ALARA Data

ENVIRONMENTAL RELEASES

SOURCE	ACTIVITY	DOSE	GOAL
	mCi	mrem	mrem
Sewer Releases	<0.001	M*	≤10
Stack Releases	3.84 E3	1.3	≤10

*NOTE: M indicates a level below detection limits of facility instrumentation

1. Liquid Wastes

Liquid radioactive wastes are stored for decay of the short lived isotopes and then released to the sanitary sewer in accordance with 20 CFR 2003. Approximately one microCuries (1 μCi) were released over the 12 month period consisting of small amounts campus produced laboratory waste (H-3 and C-14) which was incorporated into the Reactor waste water tanks for purposes of better waste release control. Each sewer release was diluted to concentrations below the detection limits of the UML proportional counting system. The UML proportional counter detection limit is calculated to be approximately 6 microCi/mL.

2. Gaseous Wastes

Argon-41 continues to be the only significant reactor produced radioactivity identifiable in the gaseous effluent. This release represents a 12 month dose less than 0.1 mrem to the nearest member of the public using the EPA Comply code at the highest screening level (level 4).

3. 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. The remaining long lived wasted (<10 cubic feet) is stored in a designated long lived waste storage area awaiting ultimate disposal at low-level radioactive waste disposal site.

End of Report