UNIVERSITY OF MASSACHUSETTS LOWELL
1 UNIVERSITY AVENUE
LOWELL, MA 01854
(508) 934-3365

August 18, 1994

Docket No. 50-223
License No. R-125

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Gentlemen:

SUBJECT: ANNUAL OPERATING REPORT

Enclosed is the annual report of operation of the University of Massachusetts Lowell Reactor (UMLR). This report is provided pursuant to the requirements of Technical Specification 6.6.4 for the reactor.

Sincerely yours,

Lee H. Bettenhausen
Reactor Supervisor

cc: Region I Administrator
T. S. Michaels, Senior Project Manager
S. H. Weiss, Chief, ONDB Directorate

230008
9408240238 940818
PDR ADOCK 05000223
P PDR

IE47
1/1

OPERATING REPORT

FOR THE

UNIVERSITY OF MASS. LOWELL REACTOR

FOR THE PERIOD

JULY 1, 1993 TO JUNE 30, 1994

Docket No. 50-223

License No. R-125

A. INTRODUCTION

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.

CONTENTS

B. FUNCTION

The Radiation Laboratory is a major research focal point of the University. More than 200 graduate students have used or are using the Laboratory's services; the comparable number for the faculty is in excess of 25. The University departments utilizing the facility include Biology, Chemistry, Geology, Physics, Mechanical Engineering, Plastics Engineering, Radiological Science and Nuclear Engineering. Much research is correlated with safety and efficiency in the nuclear and radiation industries, including public utilities, pharmaceuticals, medical applications, health effects, 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 facilities are used in the course work of various departments of the University. It also provides these services to other universities in the New England area, government agencies and, to a limited extent, industrial organizations in Massachusetts and the New England area

C. OPERATING EXPERIENCE

1. Experiments and Facility Use

The major uses of the reactor during this fiscal year were activation analysis, dosimetry studies, calibrations, limited isotope production, neutron damage studies, fission decay product studies, teaching and personnel training.

Activation techniques were used to study geologic composition of rock samples. The evaluation of the neutron to the gamma ratio for in-core experiments is continuing.

Dosimetry studies and calibrations utilized N-16 production for high energy gamma fields.

Isotopes were produced for calibration standards and lab practicums.

Reactor operating time used for teaching purposes included a reactor

operations course emphasizing control rod calibrations, critical approaches, period measurement, prompt drops and calorimetric measurement of power and preparation of students and staff members for NRC licensing examinations.

Radiological science students utilized the facility by performing standard surveys. Senior students participated in a laboratory that required locating and identifying an unknown isotope of low activity. The isotope was provided for the students in an isolated area in containment during non-operating hours. During the practicum, the students were supervised by faculty and staff. The reactor served as a source of neutron and gamma radiation for radiological science laboratories.

Several activation and decay experiments were performed for both university and non-university students alike. For the seventh consecutive year, activation and decay experiments were provided for local high school physics classes involving over 2,000 students who observed the experiment at the reactor or in their classrooms via interactive cable T.V.

The major outside use for the reactor facility is neutron and gamma damage studies of electronic components.

2. Changes in Facility Design

None.

3. Performance Characteristics

Overall, the performance of the reactor and associated systems has been normal over the past year.

4. Changes in Operating Procedures Related to Reactor Safety

A new Operating Procedure related to Reactor Safety was added in May 1994. This Procedure is to be utilized in the simulation of a critical experiment which entails loading the core to a known configuration for training purposes.

We are presently waiting for the NRC to approve the Safety Analysis Report for the Low Enriched Uranium (LEU) and the new Technical Specifications related to use of the LEU fuel. Changes to operating procedures will then be needed to implement the new fuel use.

The Security Plan has been revised to show changes in security

measures. The plan was accepted by the NRC on June 9, 1993.

5. Results of Surveillance Test and Inspections

All Technical Specification Surveillances required during the fiscal year were performed in a timely manner. The results of each requirement have been reviewed by the Reactor Supervisor and Chief Reactor Operator. All surveillance test results were found to be within specified limits and surveillance inspections revealed no abnormalities which would jeopardize the safe operation of the reactor. Each required calibration was also performed.

6. Staff Changes

On January 3, 1994, Dr. Lee H. Bettenhausen was appointed Reactor Supervisor. As of June 30, 1994 the operations staff consists of five Trainees, two part time student Reactor Operators, one part time student Senior Reactor Operator, and three staff Senior Operators, including the Reactor Supervisor.

7. Operations Summary

During the course of the fiscal year 1993-1994 the reactor was critical a total of 352.65 hours. The utilization is broken down as follows:

Operating Hours

Critical hours	352.65
Hours at full power	157.32
Megawatt hours	184.08

Experimental Utilization

Sample hours	120.11
Number of irradiations	182
Number of training hours	198.88

D. ENERGY GENERATED

Total energy generated (MWD)	7.67
Number of hours reactor was critical	352.65
Total cumulative energy output (MWD)	167.665

E. INADVERTENT AND EMERGENCY SHUTDOWNS

There were nine (9) inadvertent scrams due to equipment malfunction. There were two (2) manual scrams due to equipment malfunction. Almost all of these scrams were due to aging instrumentation for which replacement is planned in the near future.

F. MAJOR MAINTENANCE

No major maintenance was performed during this fiscal year.

G. FACILITY CHANGES RELATED TO 10 CFR 50.59

There have been no facility changes to date which pose an unreviewed safety question. All other changes made throughout the year are listed under changes in Operating Procedures (C.4).

H. ENVIRONMENTAL SURVEYS

Surveys of the environs external to the reactor building have continued to show no increase in levels or concentrations of radioactivity as a result of reactor operations. Air particulate samples collected at a continuously monitored site on the roof of an adjacent building have shown no reactor produced radioactivity. This air sampler was moved to the roof of the Pinanski Building in May 1994. Film badges collected monthly at the same location have failed to show any elevated radiation levels above background. Beginning in January 1994, quarterly thermoluminescent dosimeters replaced the monthly film badges for environmental monitoring. This change was made in order to achieve the sensitivity necessary to measure compliance with dose units in unrestricted areas as specified in the new 10CFR20. Data for the first two

quarters of 1994 show that doses in unrestricted areas are indistingishable from background radiation levels.

Analysis of water samples collected from the Merrimack River upstream and downstream of the reactor location have continued to yield no radioactivity associated with reactor operations.

I. RADIATION EXPOSURES AND FACILITY SURVEYS

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. Of the 24 individuals who were monitored by film badge during the year, the maximum external dose equivalent for one individual was 300 mrem for the year. Two other individuals received 20 and 10 mrem respectively.

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. Dose equivalent levels in the order of 10 mrem/hr are present adjacent to the closed beam ports during maximum power operation.

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

J. NATURE AND AMOUNT OF RADIOACTIVE WASTES

1. Liquid Wastes

Following is a summary of radioactivity releases to the sanitary sewer during the reporting interval:

Date	Volume Released, gallons	Activity, μCi
07/08/93	7500	28
08/25/93	7500	16
09/08/93	7500	5
09/13/93	7500	5
09/28/93	7500	5
10/19/93	7500	4
11/08/93	7500	2
12/21/93	6000	1
02/10/94	7300	1
02/28/94	7500	5
03/31/94	7500	1
06/02/94	7500	3
06/09/94	7500	3
06/14/94	7500	1
06/20/94	7500	16
06/22/94	5500	4
06/29/94	7500	19
	Annual Total	119

The 1993 total activity data was based on gross beta sample analysis. The 1994 release data was based on gamma spectral analysis of the waste water samples.

2. Gaseous Wastes

Argon-41 continues to be the only significant reactor produced radioactivity identifiable in the gaseous effluent. Following are the monthly stack release data for Ar^{41} for the reporting period:

Date	Amount Released (Ci)
July 1993	0.63
August 1993	0.25
September 1993	0.20
October 1993	0.80
November 1993	0.28
December 1993	0.29
January 1994	0.34
February 1994	0.48
March 1994	0.22
April 1994	0.80
May 1994	1.24
June 1994	0.37
Total	5.90

3. Solid Wastes

Solid wastes, primarily paper, disposable clothing, and gloves, along with other miscellaneous items have been packaged 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. A small quantity of long lived waste (< 5 cubic feet) was included as part of a shipment to the Barnwell Low Level Waste Facility during June 1994.