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

August 23, 1995

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) for the period July 1, 1994 to June 30, 1995. 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

310015

IE47
1/1

OPERATING REPORT

FOR THE

UNIVERSITY OF MASS. LOWELL REACTOR

FOR THE PERIOD

JULY 1, 1994 TO JUNE 30, 1995

Docket No. 50-223

License No. R-125

OP95-1

CONTENTS

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.

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. The University's Amherst campus and Medical Center have active research programs at the Radiation Laboratory. 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, as well as high school science programs in the Merrimack Valley.

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, combined neutron and gamma radiation effects on elecrical cables, 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 and detailed neutron spectral mapping 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, medical research use, 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 radiation and contamination surveys. Senior students participated in a laboratory that required locating and identifying an unknown isotope of low activity in a mockup power plant environment. The isotope was provided for the students in an isolated area in the reactor pump room 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 various radiological science and biology laboratories.

A number of 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 science 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 and electrical cable.

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, except for the ventilation valves discussed in Section F, Maintenance.

4. Changes in Operating Procedures Related to Reactor Safety

A revised Emergency Plan was prepared in September 1994. Training and an exercise of the plan were conducted in November and December, 1994. Emergency operating procedures were revised to conform to the plan and the plan was made effective in January 1995.

We are presently waiting for the Department of Energy to provide a firm schedule for fuel element fabrication and 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.

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. Almost 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. One surveillance test found that one rod drop time was slightly greater than specification; investigation found an oil film on the magnets which delayed breakaway by about 100 milliseconds. The magnets and rod heads were cleaned and drop times were reduced to the values of 1987. Magnet cleaning will be incorporated in the annual rod maintenance. Each required calibration was also performed.

6. Staff Changes

As of June 30, 1995 the operations staff consists of three Trainees, two part time student Reactor Operators, three part time student Senior Reactor Operators with the most senior serving as Chief Reactor Operator, and two staff Senior Operators, including the Reactor Supervisor.

7. Operations Summary

During the course of the fiscal year 1994-1995 the reactor was critical a total of 555.72 hours. The utilization is broken down as follows:

Operating Hours

Critical hours	555.72
Hours at full power*	451.78
Megawatt hours*	425.32

Experimental Utilization

Sample hours (includes multiple samples)	1613.00
Number of irradiations	221
Number of training hours	14

* much of the "full power" operation was done at 800 kw for experimental purposes.

D. ENERGY GENERATED

Total energy generated (MWD)	17.72
Number of hours reactor was critical	555.72
Total cumulative energy output (MWD)	185.39

E. INADVERTENT AND EMERGENCY SHUTDOWNS

There were 25 inadvertent scrams. All but two of these scrams were due to aging instrumentation for which replacement is planned in the near future. The two scrams not related to instruments were operator actions taken in response to new core and sample interactions which were subsequently incorporated into new operator guidance, which eliminated the cause of the scrams. A concerted effort at instrument calibration and maintenance reduced the instrument scrams from 17 in the first quarter to 1 or 2 in subsequent quarters.

F. MAJOR MAINTENANCE

A purchase order has been executed for new nuclear instrumentation; plans for instrument change over in late 1995 are in progress. A series of problems occurred with ventilation valves in this reporting period. The facility exhaust valve, Valve E, would only stay open for brief intervals; a repair effort found that the quick-release valve diaphragm had failed. The valve was rebuilt, tested satisfactorily, and returned to service with no subsequent problems. The emergency exhaust valve, Valve D, failed to close after a setpoint surveillance test; this made the containment system inoperable. Disassembly revealed that the threads on the piston head failed, apparently from lack of full engagement. A thread repair was made, the valve seals rebuilt, the quick-release rebuilt, air leaks eliminated, and the valve and containment returned to service after closure time testing. The last problem occurred when exhaust valve C closed for no apparent reason, necessitating a ventilation shutdown. The cause was a failed electrical coil in the air control valve. Replacement coil and seal parts were obtained from the manufacturer, installed, tested satisfactorily, and the system returned to service.

G. FACILITY CHANGES RELATED TO 10 CFR 50.59

There have been no facility changes to date which pose an unreviewed safety question.

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 the Pinanski building have shown no reactor produced radioactivity. Thermoluminescent dosimeters are used to monitor unrestricted areas outside of the Reactor. The results of these measurements show that doses in these areas were indistinguishable from background radiation levels during the period of July 1, 1994 to June 30, 1995..

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, two received external deep dose equivalents of 60 mrem. Four other individuals received 10 mrem each.

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

Liquid wastes are stored for decay of the short lived isotopes and then released to the sanitary sewer in accordance with 20 CFR 2003. A total of 25.5 μCi were released over the 12 month period. The principle isotopes released were corrosion products ie. Mn-54, Co-60, Zn-65 and Sb-124.

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:

Month	Full Power Hours	Ar-41 Released Curies
July 1994	64	2.2
August 1994	51	1.5
September 1994	33	1.1
October 1994	28	0.9
November 1994	36	1.1
December 1994	68	2.2
January 1995	40	1.3
February 1995	37	1.2
March 1995	44	1.5
April 1995	15	0.5
May 1995	30	1.0
June 1995	4	0.1
Total	450	14.6

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 waste (< 5 cubic feet) was collected and stored in a designated long lived waste storage area.