

OPERATING REPORT
FOR THE
UNIVERSITY OF LOWELL REACTOR

FOR THE PERIOD
JULY 1, 1984 TO JUNE 30, 1985

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

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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 radiological sciences and nuclear engineering. The remaining two floors of the Pinanski

Building are presently occupied by the Computer Science Department.

On February 14, 1985, the University of Lowell submitted a timely application to the Nuclear Regulatory Commission for renewal of the facility operating license R-125 for a period of 30 years. The renewal process continues to proceed during this reporting period.

B. FUNCTION

The Radiation Laboratory is a major research focal point of the University. More than 170 graduate students have used or are using the Laboratory's services; the comparable number for the faculty is in excess of 25. 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. Staff Changes

One person has taken and passed the reactor operator licensing exam. Another person has taken the senior reactor operator licensing exam and failed one section. This candidate has been scheduled to retake the failed section. A reactor operator trainee was hired during this period. The operations staff now consists of one trainee, three operators, three senior operators, one senior operator candidate and one supervisor.

2. Experiments

The major uses of the reactor during this fiscal year were activation analysis, dosimetry studies, teaching, and for training of new personnel. Activation analysis techniques were used to study clay, glass, soil, rubber, water, geological rocks, and electronic components.

A large amount of reactor time was used in direct support of University courses. Foils and wires were irradiated for flux measurements, various isotopes were produced for activation analysis and for counting classes and labs. Control rod calibrations, an approach to criticality, measurements of positive and negative periods, prompt drops, temperature coefficient and calorimetric measurements of power were included in a Reactor Operations course. Students in Radiological Sciences measured radioactive effluents, performed standard surveys, and

activated some foils. Physics testing continues to included the evaluation of neutron damage to electronic components and neutron spectra measurements.

3. Operations Summary

During the course of the fiscal year 1984-1985 the reactor was critical a total of 420.14 hours. The utilization is broken down as follows:

<u>Operating Hours</u>	420.14
Hours at full power	178.69
Megawatt hours	293.94
<u>Experimental Utilization</u>	
Sample hours	130
Number of irradiations	121
Number of hours for training	1000

4. Changes in Facility Design

There has been no changes in the facility design during this reporting period.

5. Performance Characteristics

The Reactor's performance has been normal over the past year. The picoammeter range switches continue to be a problem as is evidenced by the number of scrams associated with them. Following is a breakdown of all scrams and their explanation.

(a) Noise spike on Period meter	1
(b) Noise spike while range switching	10

- (c) Improper range switching on linear power channel 2
- (d) Loss of normal power 3
- (e) Manual 3

One manual scram was due to a pair of eyeglasses falling in the pool. The other two were for prompt drop measurements during a laboratory demonstration.

Radiation surveys at licensed power showed no adverse variation from expected levels, and no fission products were detected outside the reactor core.

6. Results of Surveillance Tests and Procedures

Surveillance tests and inspections were performed according to schedule. Components were rebuilt or replaced as necessary to maintain normal operation of this system. There were no abnormalities discovered which would violate the Technical Specifications or good practice.

All operating procedures, emergency procedures, emergency plan, security plan, requalification plan, as well as the facility's Final Safety Analysis Report were updated and reviewed by the Radiation Safety Subcommittee as part of the reactor's license renewal effort.

D. ENERGY GENERATED

Energy generated during report period (MWD) 12.35

Number of hours reactor was critical	420.14
Total cumulative energy output (MWD)	128.80

E. MAJOR MAINTENANCE

The primary coolant flow measuring channel has been completely replaced with an updated exact replacement.

F. CHANGES TO THE FACILITY UNDER 10 CFR 50.59

All facility changes to date do not pose an unreviewed safety question.

All procedural changes and changes which presented a situation not covered in the FSAR were submitted to the Reactor Safety Subcommittee for prior approval. Any procedural changes have been listed in section C.6. All other changes made throughout the year are listed under Changes in Facility Design or Major Maintenance.

G. ENVIRONMENTAL SURVEYS

Surveys of the environs external to the reactor building have shown no increase in levels or concentrations of radioactivity as a result of reactor operations. Air particulate samples collected at continuously monitored sites have shown no reactor produced activities. Grab

sampling of air downwind from the reactor has also shown no activity other than naturally occurring species.

Water samples collected from the Merrimack River upstream and downstream of the reactor location similarly have yielded no radioactivity associated with reactor operations.

H. RADIATION EXPOSURES AND FACILITY SURVEYS

1. Personnel Exposures

Attempts have been made to maintain personnel exposures at the lowest reasonable level, and doses received by individuals concerned either directly or indirectly with operation of the reactor were well within allowed limits. Six individuals received measurable whole body penetrating doses; four were operations personnel. A dose summary is presented below.

DOSE SUMMARY (mrem/Qtr.)

	<u>3rd</u> <u>Quarter</u>	<u>4th</u> <u>Quarter</u>	<u>1st</u> <u>Quarter</u>	<u>2nd</u> <u>Quarter</u>
1. Operative	-	10	-	-
2. Operative	20	10	-	-
3. Operative	-	20	-	-
4. Operative	-	-	-	10
5. Experimenter	-	10	-	-
6. Support	-	20	40	70

2. Radiation Surveys

Radiation levels measured in the reactor building have been typically less than 0.1 mrem/hr in general areas. A number of 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.

3. Contamination Surveys

General area contamination has not been a problem in the reactor building. Contamination has expectedly occurred at specific locations where samples are handled and particular experiments have been in progress. Surface contamination levels have generally been less than 10^{-6} Ci/100 cm². Handling tools and other specific items have exhibited contamination up to about 10^{-5} Ci/100 cm². Na²⁴ is the most commonly encountered contaminant. Air sampling in the reactor building has identified no significant quantities of reactor produced airborne radioactivity.

I. 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	Gross Beta Radioactivity Released (μCi)	Undiluted Gross Beta Activity Concentration ($\mu\text{Ci/ml}$)	Diluted Gross Beta Activity Concentration	
			Daily ($\mu\text{Ci/ml}$)	Monthly ($\mu\text{Ci/ml}$)
8/1/84	4.13	1.40×10^{-7}	1.39×10^{-8}	4.93×10^{-10}
8/13/84	1.96	6.90×10^{-8}	6.17×10^{-9}	2.33×10^{-10}
8/29/84	127.00	4.47×10^{-6}	4.25×10^{-7}	1.51×10^{-8}
8/30/84	19.80	6.96×10^{-7}	6.62×10^{-8}	2.35×10^{-9}
10/18/84	3.15	1.11×10^{-7}	1.06×10^{-8}	3.75×10^{-10}
12/14/85	87.72	3.9×10^{-6}	2.94×10^{-7}	1.04×10^{-8}
2/19/85	44.40	1.57×10^{-6}	1.49×10^{-7}	5.31×10^{-8}
4/17/85	34.15	1.20×10^{-6}	1.14×10^{-7}	4.06×10^{-8}
4/17/85	13.14	4.63×10^{-7}	4.41×10^{-8}	1.57×10^{-9}
5/14/85	55.39	1.95×10^{-6}	1.86×10^{-7}	6.59×10^{-9}
6/20/85	20.44	7.14×10^{-7}	6.79×10^{-8}	2.41×10^{-9}

2. Gaseous Wastes

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

Date	Amount Released (Ci)	Duration of Release (hrs)
June 1984	0.386	12
July 1984	1.490	44
August 1984	0.589	31.75

Date	Amount Released (Ci)	Duration of Release (hrs)
September 1984	0	0
October 1984	0.126	4
November 1984	0.035	1.25
December 1984	0	0
January 1985	0.456	17.75
February 1985	0.286	3.75
March 1985	0.541	9.25
April 1985	1.100	20.50
May 1985	0.635	33.25
June 1985	0.133	4.25

3. Solid Wastes

Solid wastes, primarily paper, disposable clothing along with miscellaneous items such as resin have been packaged in appropriate containers but no off-site shipments have been made during the reporting period.



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January 6, 1986

Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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

Gentlemen:

In accordance with Section 6.6, Subsection 5 of the Technical Specifications for the University of Lowell Reactor, we are submitting herewith 40 copies of the Operating Report for the period ending June 30, 1985.

Sincerely yours,

A handwritten signature in cursive script that reads "Thomas J. Wallace".

Thomas J. Wallace
Nuclear Reactor Supervisor

TJW:dmm

Enclosure(s)

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