OPERATING REPORT

FOR THE

UNIVERSITY OF LOWELL REACTOR

FOR THE PERIOD

JULY 1, 1981 to JUNE 30, 1982

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 institutions, 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 and offices were in use by 1970, and the Van de Graaff accelerator was put into service in that year. Reactor License R-125 was issued by the Nuclear Regulatory Commission on December 24, 1974 and initial criticality achieved January, 1975.

In the spring of 1980, the name of the Nuclear Center was officially changed to the "Pinanski Energy Center." The purpose of this change was to reflect the change in emphasis of work at the center from strictly nuclear studies. Presently, the Energy Center performs and/or coordinates research in many fields such as solar, wind, geothermal, alternative fuels and fusion.

B. Function

The Energy Center is a major research focal point of the University. More than 170 graduate students have used or are using the Center's services; the comparable number for the faculty is in excess of 25. Much research here is correlated with safety and efficiency in the nuclear and radiation industries, including public utilities, pharmaceuticals, medical applications, health effects, etc.; however, much research also is done by workers in other fields who use the unique facilities as analytical tools.

In addition, the Energy Center facilities are used in the course work of various departments of the University. The Energy Center 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

In this fiscal year, two operators have resigned leaving a staff of two operators, one Senior operator and one supervisor.

2. Experiments

During the report period, the major uses of the reactor were activation analysis, dosimetry studies, teaching and for training of new personnel.

Activation analysis techniques were used to study clay, glass, sea shell, soil, rubber, water, geological rocks, resins, coal and charcoal, electronic components and aerosol collecting filter paper.

The properties of aggregate recoil particles continues to be an active research area as is the efficacy of various filter media.

A thesis has been completed this reporting interval in the area of Radiolytic Oxygen Depletion and Gas Evolution in ion Exchange Media.

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 other counting classes and labs. Control rod calibrations, an approach to criticality, measurements of positive and negative periods and prompt drops, temperature coefficients and calorimetric measurements of power were included in a Reactor Operations course and students in Radiological Sciences measured radioactive effluents, did some fuel activations and performed standard surveys.

3. Operations Summary

During the course of the year 1981-1982 the reactor was critical a total of 340 hours. The utilization is broken down as follows:

Operating Hours	340.15
Hours at scheduled power	250.32
Accumulated Megawatt hours	245.76
Experimental Utilization	
Sample hours	298.17
Number of irradiations	137
Number of hours for training	450

4. Changes in Facility Design

Circuitry was installed in the Process Control cabinet to provide the capability of automatically cycling the reactor ventilation system during non-working hours in lieu of continuous operation. The modification was installed as part of a university-wide campaign to reduce energy consumption.

5. Performance Characteristics

The Reactor's performance has been normal over the past year. Electrical noise reaching the instrumentation through the power lines continues to be a problem as is evident by the number of short period scrams. Following is a breakdown of all scrams and their explanation.

(a)	Noise spike on Period meter	6
(b)	Noise spike while range switching	1
(c)	Trying to recompensate Log-N detector during startup	1
(d)	Improper range switching on linear power channel	4
(e)	Loss of normal power	2

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. Some deterioration was noted in the ventilation system components due to the large amount of condensation over the more humid months. Components were rebuilt or replaced as necessary to maintain normal operation of this system. There were no abnormalities discovered which would violate the Technical Specification or good practice.

D. Energy Generated

Energy generated during report period (MWD)	10.24
Number of Hours Reactor was Critical	340.15
Total Cumulative Energy Output (MWD)	95.89

E. Major Maintenance

The connectors to the Log-N Chamber were replaced when the existing chamber and cables produced low resistance readings during an attempt to isolate noise problems in the channel.

Various valves were replaced or rebuilt during the annual ventilation system inspection.

The Sola transformer for the nuclear instrumentation cabinet was replaced when the existing transformer open circuited.

A component (chopper) in the automatic servo system for the regulating rod was replaced when the system failed to maintain automatic control.

The magnet engaged limit switch for control blade #3 was refurbished during inspection.

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 A.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. Sixteen individuals received measurable whole body penetrating doses; six were operations personnel. A dose summary is presented below.

DOSE SUMMARY (mrem/Qtr.)

		3rd Quarter 81	4th Quarter 81	1st Quarter 82	2nd Quarter 82
1.	Operative	30	--	--	--
2.	"	20	30	10	20
3.	"	20	20	10	--
4.	"	20	10	--	--
5.	"	20	--	--	--
6.	"	30	--	--	--
7.	Support	--	40	80	--
8.	"	--	30	--	--
9.	"	20	20	20	40
10.	"	60	60	--	20
11.	"	20	--	--	--
12.	Experimenter	--	40	--	--
13.	"	--	10	--	--
14.	"	40	40	--	--
15.	"	40	40	30	--
16.	"	20	40	40	--

2. Radiation Surveys

Radiation levels measured in the reactor building have been typically less than 0.1 mrem hr^{-1} 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^{-1}. 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^{-4}Ci/100 cm^2,. Handling tools and other specific items have exhibited contamination up to about 10^{-2} Ci/100cm^2. ^{24}Na 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 (μCi/ml)	Diluted* Gross Beta Activity Concentration (μCi/ml) Daily	Monthly
9/9/81	106.63	3.756×10^{-6}	3.573×10^{-7})	1.547×10^{-8}
9/22/81	19.13	6.739×10^{-7}	6.411×10^{-8})	
12/17/81	54.79	1.903×10^{-6}	1.836×10^{-7}	6.740×10^{-9}
1/18/82	51.58	1.817×10^{-6}	1.729×10^{-7}	6.349×10^{-9}
3/3/82	49.68	1.750×10^{-6}	1.665×10^{-7})	6.461×10^{-9}
3/25/82	2.84	1.000×10^{-7}	9.514×10^{-9})	
5/2/82	20.92	7.369×10^{-7}	7.011×10^{-8}	2.574×10^{-9}
6/17/82	46.47	1.637×10^{-6}	1.557×10^{-7}	5.438×10^{-10}

2. Gaseous Wastes

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

Total Activity Released (Ci)	Time Averaged Released Rated ($\mu Ci\ sec^{-1}$)	Time Averaged Release Concentration ($\mu Ci\ cm^{-3}$)	Saturation Quantity of ^{41}Ar in total Env. Based on time Averaged Rel. Rate (Ci)
14.03	0.445	6.285×10^{-8}	4.328×10^{-3}

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.