

September 12, 2000

Dr. Gunter Kegel
Director - Radiation Laboratory
University of Massachusetts - Lowell
1 University Avenue
Lowell, MA 01854

SUBJECT: NRC ROUTINE, ANNOUNCED INSPECTION REPORT NO. 50-223/2000201

Dear Dr. Kegel:

This refers to the inspection conducted on August 1-4, 2000 at the University of Massachusetts-Lowell Research Reactor. The enclosed report presents the results of that inspection.

Areas examined during the inspection included startup of a new low enrichment core and elements of the radiation protection program. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, no safety concern or noncompliance with NRC requirements was identified. No response to this letter is required.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/NRC/ADAMS/index.html>. If you have any questions concerning this inspection, please contact Mr. Thomas Dragoun at 610-337-5373.

Sincerely,

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-223/2000201
cc w/enclosures: See next page

University of Massachusetts Lowell

Docket No. 50-223

cc:

Mayor of Lowell
City Hall
Lowell, MA 08152

Mr. Leo Bobek
Reactor Supervisor
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854

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Environmental Protection Division
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Reactor Newsletter
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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-223
License No: R-125
Report No: 50-223/2000201
Licensee: University of Massachusetts
Facility: Research Reactor at University of Massachusetts Lowell
Location: Lowell, Massachusetts
Dates: August 1-4, 2000
Inspector: Thomas F. Dragoun
Approved by: Ledyard B. Marsh, Director
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

This routine, announced inspection included onsite review of selected aspects of the conversion of the reactor core from high enriched to low enriched uranium fuel and the radiation protection program since the last NRC inspection of this program.

The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

HEU-LEU CORE CONVERSION

The LEU core was loaded in a safe manner and in accordance with licensee commitments made in letters dated May 16 and June 6, 1997.

RADIATION PROTECTION PROGRAM

The radiation protection program satisfied NRC requirements.

Report Details

Summary of Plant Status

The high enrichment uranium fuel was off loaded from the core and placed in storage racks in the reactor pool. The low enrichment uranium fuel was receipt inspected and placed in the pool storage racks. The core loading schedule was temporarily delayed by concerns that bedrock blasting on campus could cause a seismic scram. Initial criticality with the new low enrichment core was achieved on August 4, 2000.

1. HEU-LEU CORE CONVERSION

a. Scope (IP 60745)

The inspector reviewed selected aspects of:

- operator training
- fuel handling and inspection
- core loading procedures
- record keeping
- core calculations
- control of changes
- reactor safety subcommittee oversight

b. Observations and Findings

Operator training in the conversion tasks was completed on July 28, 2000. The new LEU fuel arrived the next day. Receipt inspection and fuel identification records were satisfactory. Approved procedures for fuel movement and core loading were available. The Reactor Supervisor stated that procedures for temperature and void coefficient of reactivity and core neutron flux measurements would be drafted and reviewed by the Reactor Safety Subcommittee before use. These activities are scheduled to occur later.

The licensee used the inverse neutron multiplication ($1/m$) technique to load the core to criticality. An additional neutron detector (BF₃) was installed in the core for supplemental $1/m$ measurements. Fuel assemblies were added conservatively and in accordance with procedural requirements. Records of fuel assembly core position were properly recorded. Communications between the fuel handler, console operator, and work coordinator were satisfactory. Criticality was achieved with a reference core configuration (19 full and 2 partial fuel assemblies).

The inspector noted differences in the predicted excess reactivity for the LEU core between Argonne National Laboratory and the licensee's staff. The licensee (Prof. J White) stated that the VENTURE computer model used for the calculations was verified and validated against performance of the original HEU core. For the LEU core, the VENTURE predictions compared favorably with predictions from the Monte Carlo N-Particle (MCNP) transport computer code. Preliminary results from the LEU core startup indicated that the licensee's calculations were conservative.

The original LEU core design required relocating the regulating rod to increase its reactivity worth. This required modifications including bending the rod and adding a guide bearing. To avert this modification, the licensee developed a reference core that allowed the position of the regulating rod to remain unchanged. This change was approved by the Reactor Safety Subcommittee (RSS).

The RSS met at the required intervals and provided review and oversight of the reactor programs.

c. Conclusions

The LEU core was loaded in a safe manner and in accordance with licensee commitments made in letters dated May 16 and June 6, 1997.

2. RADIATION PROTECTION

a. Scope (IP 69001)

The inspector reviewed selected aspects of:

- the Radiation Protection Program
- organization and staffing
- dosimetry records
- radiological signs and posting
- routine surveys and monitoring
- maintenance and calibration of radiation monitoring equipment
- liquid waste disposal

b. Observations and Findings

The radiation protection program covering all campus radiation sources is described in the UML Radiation Safety Guide as revised July 2000. There were no changes to the the reactor program since the last inspection. The RSO stated that he reviews the program content and implementation at six month intervals. This satisfies the requirement in 10 CFR 20.1101. The RSO was in discussion with Massachusetts state personnel regarding conversion of NRC licenses to State licenses, except for the reactor license.

The HP technician position has been changed from a temporary position and filled by a student to a permanent staff position. The position has been filled by a qualified and experienced individual. This change constitutes a program improvement.

Personnel dosimetry is provided by a NVLAP accredited vendor and is processed monthly. Finger ring dosimeters were available for use by reactor operators who handle radioactive samples. Neutron dosimetry was not provided. The RSO stated that neutron exposures from use of the thermal column for radiography are assigned based on survey meter measurements. Exposure records indicated that no NRC limits were exceeded.

NRC Form 3, "Notice to Employees," was posted in accordance with 10 CFR 19.11. Caution signs, postings and controls to radiation areas were as required in 10 CFR 20, Subpart J. Licensee personnel observed the indicated precautions for access to the radiation areas.

Radiation monitoring and survey activities were as specified in the Radiation Safety Guide. Equipment used for these activities were maintained, calibrated, and used acceptably. A new hand and foot monitor was installed inside the reactor containment and used for exit frisking. Several new GM and ion chamber survey meters were purchased due to difficulty in maintaining some of the older equipment. These constitute program improvements. However, the RSO stated that the new ion chamber meters were adversely affected by humidity and he was working with the manufacturer to resolve the problems.

Liquid waste was properly stored, sampled, and analyzed prior to batch release to the sanitary sewer. In addition to satisfying NRC's radiological criteria, the licensee must now satisfy additional criteria imposed by the local authorities.

The licensee did not require a respiratory protection program or planned special exposure program.

c. Conclusions

The radiation protection program satisfied NRC requirements.

3. EXIT INTERVIEW SUMMARY

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on August 4, 2000. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek, Reactor Supervisor
W. Church, Radiation Safety Officer
J. Clark, SRO
P. Cornetta, HP Technician
G. Kegel, Radiation Laboratory Director
T. Regan, SRO
R. Tooker, Chief Reactor Operator
R. Wagner, Provost
J. White, Professor, Nuclear Science

INSPECTION PROCEDURES

IP 69001 CLASS II NON-POWER REACTORS

IP 60745 CLASS I NON-POWER REACTOR FUEL MOVEMENT

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

none

Closed

none

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
HEU	High enriched uranium fuel
IP	Inspection procedure
LEU	Low enriched uranium fuel
NRC	Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
RSO	Radiation Safety Officer
RSS	Reactor Safety Subcommittee
SRO	Senior Reactor Operator
UML	University of Massachusetts Lowell