January 17, 2002

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

SUBJECT: NRC ROUTINE, ANNOUNCED INSPECTION REPORT NO. 50-223/2001-201

Dear Dr. Kegel:

This refers to the inspection conducted on November 5-8, 2001 at the University of Massachusetts - Lowell Research Reactor. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. 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 to 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/***

Patrick M. Madden, Section Chief
Non-Power Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-223/2001-201
cc w/enclosure: Please see next page

cc:

Mayor of Lowell
City Hall
Lowell, MA 01852

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

Office of the Attorney General
Environmental Protection Division
19th Floor
One Ashburton Place
Boston, MA 02108

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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

| | |
|---|---|
| Docket No: | 50-223 |
| License No: | R-125 |
| Report No: | 50-223/2001-201 |
| Licensee: | University of Massachusetts |
| Facility: | Research Reactor at University of Massachusetts Lowell |
| Location: | Lowell, Massachusetts |
| Dates: | November 5-8, 2001 |
| Inspector: | Thomas F. Dragoun |
| Approved by: | Patrick M. Madden, Section Chief<br>Non-Power Reactors Section<br>Operating Reactor Improvements Program<br>Division of Regulatory Improvement Programs<br>Office of Nuclear Reactor Regulation |

# EXECUTIVE SUMMARY

University of Massachusetts
Report No: 50-223/2001-201

This routine, announced inspection included onsite review of selected aspects of the licensee's Class II research and test reactor operation including: organizational structure and functions program, radiation protection program, and environmental 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.

Organizational Structure and Functions

- The HP organization and management functions were consistent with Technical Specifications 6.1.3 and 6.2.2(f). Efforts to refill the RSO position were timely.

Radiation Protection

- The radiation protection program satisfied NRC requirements.

Environmental Protection

- The environmental protection program satisfied NRC requirements.

REPORT DETAILS

**Summary of Plant Status**

The reactor was not operated during the inspection. Switches and meters on the auxiliary equipment panel in the reactor control room were replaced by a video color display with a system diagram of equipment status and touch-screen control of equipment operation. A video monitor at the radiation monitoring panel simultaneously displayed the real time digitized readings of all monitors, supplementing the analog readouts. Two reactor beam tubes were removed and replaced with a large capacity fast neutron irradiation flux trap.

## 1. Organizational Structure and Functions

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed selected aspects of:

- Health Physics (HP) organization, staffing, and qualifications
- Radiation Safety Officer (RSO) replacement efforts

b. Observations and Findings

The RSO retired at the end of August 2001. A staff professor of radiological sciences and a Certified Health Physicist was appointed as interim RSO. The RSO duties and the organization structure had not changed. That is, the RSO provides oversight of the linear accelerator, campus byproduct license, and reactor programs.

The licensee stated that the Reactor Safety Subcommittee was actively involved in the selection of the replacement RSO from a field of many highly qualified applicants. Final selection will be by the Vice Chancellor - Academic Affairs. Efforts to meet the University's administrative and labor union requirements for filling the position had required a period of several weeks. However, a new RSO was expected on board before year end. The retired RSO continued to serve as a consultant and has agreed to orient his replacement.

c. Conclusions

The HP organization and management functions were consistent with Technical Specifications 6.1.3 and 6.2.2(f). Efforts to refill the RSO position were prompt.

## 2. Radiation Protection

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of:

- the Radiation Protection Program
- radiation worker training
- radiological signs and posting

- routine surveys and monitoring
- personnel dosimetry records
- maintenance and calibration of radiation monitoring equipment
- radiological control of work
- As Low As Reasonably Achievable (ALARA)

b. Observations and Findings

The RSO reviewed the radiation protection program semi-annually. This review satisfies the requirements of 10 CFR 20.1101(c). However, the inspector noted that certain procedurally controlled activities did not meet generally accepted practice. For example, "Liquid Waste Procedures" dated July 12, 1998, required that the liquid waste storage tank be re-circulated for one hour prior to sampling. An accepted practice is to re-circulate the contents of the tank such that several turnovers are caused. This practice ensures that the tank contents are uniformly mixed. However, the inspector noted that the capacity of the pump was limited and that the tank contents were turned over less than once during the hour. Also, procedure SP 10, "Reactor Water Analysis", dated September 1, 2000, required a gamma scan if a 3L boil down sample of reactor pool water exceeded 1E-7 µCi/gm of gross beta-gamma radioactivity. The basis for this criteria could not be established. In another example, the inspector noted that the surveyors name, instrument used, and its calibration date were hand written on some, but not all, routine survey records. In addition, "Swipe Counting Procedure" (undated) specified quality control checks of the proportional counter laboratory equipment to use a +/- 10% acceptance criteria rather than the more restrictive 3 sigma criteria. These examples do not constitute regulatory requirements. However, the licensee stated that the incoming RSO will be tasked by the University Radiation Safety Committee to review and update, as necessary, the radiation protection program procedures and policies. Action on this matter will be reviewed in a future inspection (Inspector Follow up Item 50-233/2001-201-01)

Basic training for radiation workers consisted of an interactive computer program, one-on-one discussions, and a written exam. The content of the training satisfied the requirements in 10 CFR 19.12. Training records showed that personnel were acceptably trained in radiation protection practices.

Caution signs, postings, and access controls for radiation areas were as required in 10 CFR 20, Subpart J. During plant tours the inspector noted licensee personnel complying with the indicated precautions for accessing the designated radiation areas.

Use of dosimeters and exit frisking practices were in accordance with radiation protection requirements. The licensee used a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendor to process personnel dosimetry. An examination of the records for the past year showed that annual exposures were within 10 CFR Part 20 limits.

Radiation level and surface contamination monitoring surveys were conducted as required by procedure HHP "Guidelines for Laboratory Surveys" dated March 24, 1999. The portable, battery operated survey meters used for these activities were maintained, calibrated as required by 10 CFR 20.1501(b), and operationally checked prior to their use. The calibration technique for these meters was as recommended by ANSI N323. Equipment calibration records for 1998 to the present were complete and documented the calibration results and the NIST certification of the calibration radiation sources used. The area radiation monitors and continuous air monitors inside the reactor confinement building were calibrated semi-annually during 2000 and 2001 in accordance with procedure SP-1 "Calibration of Radiation Monitoring Systems" revision 5, dated October 31, 2001 and checked daily per procedure RO-13 "Radiation Monitoring Equipment Checkout" dated February 16, 1984. This surveillance on permanently installed radiation monitors satisfied the requirements in TS 4.3.

In August 2000, the licensee staff removed the reactor ends of two beam tubes and installed a fast neutron flux trap (Fast Neutron Irradiator) in the area vacated adjacent to the reactor core. The modification was reviewed in accordance with 10 CFR 50.59 and approved by the Reactor Safety Subcommittee as required by TS 6.2(2). Radiological and ALARA controls were implemented in accordance with licensee procedure HP 20 "Procedure for Special Work Permits" (undated). Protection of the workers included use of the following:

- Alarming electronic dosimeter
- Stay time limitations based on pre-job radiation surveys
- Working in chest deep water for shielding

The nuts and bolts removed from the beam tube flange were allowed to sink to the pool floor for later retrieval to save time and worker dose. However, some of the nuts became lodged in the leg bottoms of the waders of one of the workers. An extremity dose of 1.4 rem was assigned to the workers foot based on mockup measurements. Other dose records indicated that the highest hand exposure was 0.55 rem and highest whole body exposure was 0.35 rem. These doses are below the limits specified in 10 CFR 20.1202.

On January 4, 2001, the licensee conducted a post-job review and concluded that no changes were needed to the radiological and ALARA controls that were used.

c. Conclusions

The inspector determined that, because: 1) surveys were being completed and documented acceptably to permit evaluation of the radiation hazards that might exist; 2) postings met regulatory requirements; 3) personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and the NRC's regulatory limits; and, 4) radiation monitoring equipment was being maintained and calibrated as required, the Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.

## 3. Effluent and Environmental Protection

a. Scope (IP 69001)

The inspector reviewed selected aspects of:

- the environmental monitoring program
- release records
- counting and analysis program

b. Observations and Findings

There are 22 dosimeters around the outside periphery of the reactor confinement that monitor doses in areas accessible to the public. Records for 2000 show the annual doses to be less than the limit specified in 10 CFR 20.1301.

Quarterly water samples are collected from both municipal sewage treatment plants and analyzed in the licensee's laboratory. Data for 2001 to date indicated that the radioactivity was less than minimum detectable.

Continuous airborne particulate monitoring on the roof of the Pinanski building indicated no activity above background. Calculations using the EPA COMPLY computer program at level 4, which requires the largest amount of site specific data, indicated that the accumulated dose to the nearest member of the public during 2000 from airborne effluents was 0.1 mrem. This was well below the 10.0 mrem per year constraint specified in 10 CFR 20.1101(d).

Laboratory analytical equipment used to measure radioactivity in water samples, airborne activity filters, and smear samples taken from surfaces were calibrated annually using NIST traceable standards in the same geometry as the samples. This was a generally acceptable technique. Monthly quality control checks with a check source confirmed that the equipment continued to perform acceptably during 2001. Quality control charts of daily background counts are maintained to confirm that the equipment was performing normally.

Liquid discharges to the sewer were within the limits specified in 10 CFR 20 Appendix B for tritium, Co-60, Mn-54, and Zn-65. The inspector noted that the licensee assumes a dilution factor of 10 for sewer discharges. The RSO stated that this was based on 1991 water discharge from campus which was 1.8 million gallons per month. Assuming (worst case) that one full waste tank (7500 gallons) was discharged each month, the actual dilution factor was 244. The use of a factor of 10 was therefore conservative.

c. Conclusions

Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory limits.

## 4. Exit Interview

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on November 8, 2001. The licensee acknowledged the findings presented.

## PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Bobek, Reactor Supervisor
W. Church, (Previous) Radiation Safety Officer
P. Cornetta, HP Technician
C. French, Professor, Radiological Sciences
W. Hogan, Chancellor
G. Kegel, Radiation Laboratory Director

## INSPECTION PROCEDURES

IP 69001 Class II Non-power Reactors

## ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-233/2001-201-01 IFI Review and update radiation protection policies and procedures.

Closed

None

## LIST OF ACRONYMS USED

| | |
|---|---|
| ALARA | As Low As Reasonably Achievable |
| CFR | Code of Federal Regulations |
| IFI | Inspector Follow up Item |
| IP | Inspection procedure |
| NIST | National Institute of Standards and Technology |
| NRC | Nuclear Regulatory Commission |
| NVLAP | National Voluntary Laboratory Accreditation Program |
| RSO | Radiation Safety Officer |
| TS | Technical Specification |