

April 21, 2006

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

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 50-223/2006-201

Dear Dr. Kegel:

This letter refers to the inspection conducted on March 6 - 9, 2006, 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 2.390 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/reading-rm/adams.html>. If you have any questions concerning this inspection, please contact Mr. Thomas Dragoun at 610-337-5373.

Sincerely,

**/RA/**

Brian E. Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-223  
License No. R-125  
Enclosure: NRC Inspection Report No. 50-223/2006-201

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  
19<sup>th</sup> Floor  
One Ashburton Place  
Boston, MA 02108

Test, Research, and Training  
Reactor Newsletter  
University of Florida  
202 Nuclear Sciences Center  
Gainesville, FL 32611

April 21, 2006

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

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 50-223/2006-201

Dear Dr. Kegel:

This letter refers to the inspection conducted on March 6 - 9, 2006, 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 2.390 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/reading-rm/adams.html>. If you have any questions concerning this inspection, please contact Mr. Thomas Dragoun at 610-337-5373.

Sincerely,

**/RA/**

Brian E. Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-223  
License No. R-125  
Enclosure: NRC Inspection Report No. 50-223/2006-201

cc w/enclosure: Please see next page

**Distribution**

PUBLIC            PRTBr/f            AAdams            CBassett            Plsaac            MMendonca            PDoyle  
                         TDragoun            DHughes            EHylton  
BDavis (cover letter only)(O5-A4)  
NRR enforcement coordinator (Only IRs with NOV, O10-H14)

**ACCESSION NO.: ML061080668**

**TEMPLATE #: NRR-106**

OFFICE	PRTB:RI	PRTB:PM	PRTB:LA	PRTB:SC
NAME	MMendonca for TDragoun *	MMendonca*	EHylton*	BThomas:tls*
DATE	4/20/06	4/20/06	4/20/06	4/21/06

**OFFICIAL RECORD COPY**

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  
19<sup>th</sup> Floor  
One Ashburton Place  
Boston, MA 02108

Test, Research, and Training  
Reactor Newsletter  
University of Florida  
202 Nuclear Sciences Center  
Gainesville, FL 32611

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

Docket No: 50-223

License No: R-125

Report No: 50-223/2006-201

Licensee: University of Massachusetts

Facility: Research Reactor at University of Massachusetts Lowell

Location: Lowell, Massachusetts

Dates: March 6 - 9, 2006

Inspector: Thomas F. Dragoun

Approved by: Brian E. Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

University of Massachusetts - Lowell  
Report No. 50-223/2006-201

The focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class II non-power research reactor operation including: organization and staffing; logs and records procedures; requalification training; health physics; committees, audits, and reviews; and emergency planning.

### Organization and Staffing

- The licensee's organization and staffing remain in compliance with the requirements specified in Technical Specifications Section 6.

### Logs and Records

- Within the scope of this review, the licensee's record keeping program conformed to Technical Specifications requirements.

### Procedures

- The procedural control and implementation program satisfied Technical Specification requirements.

### Requalification Training

- Operator requalification was conducted as required by the Requalification Program.

### Health Physics

- The Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.

### Committees, Audits, and Reviews

- The Reactor Safety Subcommittee provided the oversight required by the Technical Specifications.

### Emergency Planning

- The emergency planning was conducted in accordance with the NRC approved Emergency Plan. Some unique activities were identified as enhancing the emergency response.

## REPORT DETAILS

### **Summary of Plant Status**

The licensee's one megawatt open pool reactor is used for neutron activation analysis (NAA), neutron radiography, isotope production, radiation hardening studies, undergraduate instruction and demonstrations for high school students. During the inspection, the reactor was operated for short periods. Since the last inspection, the licensee replaced all analog displays and equipment controls in the reactor control room with touch screens and programable logic controls.

#### **1. Organization and Staffing**

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

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specification (TS) Section 6.1, "Organization and Management", were being met:

- C organizational structure
- C qualifications of new personnel
- C responsibilities and authorities of key personnel

##### **b. Observations and Findings**

Management responsibilities and organization structure was unchanged but the title of the office of the Vice - Chancellor Academic Affairs was changed to UML Provost.

The Health Physics Technician (non-TS position) transferred to another job and was replaced early in 2005. The training and experience of the replacement technician was appropriate for the responsibilities of the position.

The reactor operations staff consists of four full-time Senior Reactor Operators (SRO), two part-time SRO and one part time Reactor Operator (RO). One trainee was expected to be licensed soon. This number of licensed personnel is able to support the scheduled tours for students, routine university course work, and experimenter requests for reactor utilization.

##### **c. Conclusions**

The licensee's organization and staffing remain in compliance with the requirements specified in TS Section 6.

#### **2. Operations Logs and Records**

##### **a. Inspection Scope (IP 69001)**

The inspector reviewed the following logs and records to determine if the requirements in TS 6.7 "Plant Operating Records" were satisfied:

- Form RF-4 "Daily Routine Check Sheet"

- Form RF-5 "Radiation Monitoring System Daily Checks"
- Form RF-RO-9A "Reactor Operator Instruction Form"
- Form RF-RO-7B "Pre-Startup Checksheet/Forced Convection"
- Console log book entries for the period April 2, 2003 to February 7, 2005
- Inspector reviewed 50 completed forms selected at random from the period March 29, 2005 to December 21, 2005

b. Observations and Findings

Plant operating records were found to be neat, readable, and easily accessible. Major events, such as the shipment of spent HEU fuel, were appropriately noted. Records of facility radiation surveys and environmental monitoring for the period January 2004 to December 2005 were also well kept.

c. Conclusions

Within the scope of this review, the licensee's record keeping program conformed to TS requirements.

**3. Procedures**

a. Inspection Scope (IP 69001)

The inspector reviewed selected procedures to ensure that the requirements of TS Section 6.3 "Operating Procedures" and administrative procedure AP-2 were being met:

- Procedure RO1, "Critical Experiments" dated February 16, 1984
- C Procedure RO1A, "Critical Experiments With Known Configuration" dated May 23, 1994
- C Procedure RO2, "Reloading the Core to Known Configuration" dated May 9, 1991
- C Procedure RO4, "Addition and Removal of Samples" dated July 15, 1991
- Procedure RO5, "Reactor Operations" dated April 15, 2003
- Procedure RO6, "Moving and Positioning the Core" dated February 16, 1984
- Procedure EO1, "Radiation Emergency" dated March 31, 2004
- Procedure EO2, "Major Fire or Explosion" dated March 31, 2004
- Procedure EO3, "Severe Storm" dated March 31, 2004
- Procedure EO4, "Attack Warning or Civil Disorder" dated March 31, 2004
- Procedure EO5, "Sabotage Threat to Radiation Laboratory" dated March 31, 2004
- Procedure EO6, "Rapid Loss of Pool Water" dated March 31, 2004
- Procedure EO7, "Stuck Rod or Blade" dated March 31, 2004
- Procedure EO8, "Loss of Electrical Power" dated March 31, 2004
- Procedure EO9, "Personnel Injury" dated March 31, 2004
- Procedure AP0, "Authority" Revision 3 dated March 3, 2004
- Procedure AP1, "Procedure Control and Distribution" Revision 1, dated September 18, 2003
- Procedure AP2, "Procedure Development" Revision 1, dated September 18, 2003



b. Observations and Findings

The Director stated that the facility procedures were recently audited by the staff for content, format, and consistency. The results of this audit were documented in a spread sheet that identified procedures for revision and changes needed. This effort was similar to the overhaul of the health physics procedures noted during the last NRC inspection. The inspector noted that almost all procedures needed to be reformatted but only a small number required revision of the contents. Revised procedures were identified for submittal to the Reactor Safety Subcommittee for review and approval as required by TS 6.2.2.

The inspector determined that the activities required to be conducted in accordance with an approved procedure as specified in TS 6.3 "Operating Procedures" were available. The content and quality of the procedures reviewed by the inspector were satisfactory. The current licensee effort to improve the procedures is commendable.

c. Conclusions

The procedural control and implementation program satisfied Technical Specification requirements.

**4. Requalification Training**

a. Inspection Scope (IP 69001)

The inspector reviewed selected records regarding the Requalification Program including:

- operator license status
- operator training records
- operator physical examination records
- operator examination records
- operator active duty status

b. Observations and Findings

There was one change to this program since the last NRC inspection. The Reactor Supervisor now performs an audit of the status of each reactor operator each quarter. The last audit was done on October 31, 2005. No major deficiencies were found. Seven reactor operator licenses were active at this facility. The inspector reviewed the records of the physical exams, annual evaluations, biennial written exams, and reactivity manipulations for three of the operators. All were up-to-date with the requirements of the program.

c. Conclusions

Operator requalification was conducted as required by the Requalification Program.

**5. Health Physics**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and licensee administrative requirements:

- C University of Massachusetts Lowell Research Reactor (UMLRR) annual report dated August 29, 2005
- C Audits of the UMass Lowell Research Reactor Radiation Safety Program by D.C. Medich - Radiation Safety Officer dated November 1, 2005 and October 3, 2004.
  - Memoranda documenting the corrective action for audit findings dated November 8, October 20, 27, 17, 13, 4, 2005, August 2, 2002, May 5, 6, March 20, 2003, November 13, and December 4, 2002
  - RSO memo to training file, "RSO Review of Radiation Safety Procedures" dated May 23, 2003
- C UMass Lowell Radiation Safety Guide (revised) dated August 2005
  - Procedure HPP-7, "Radiation Survey Procedures" Revision A, dated October 10, 2002. Data for March 2 and February 2, 2006, December 21, November 23, October 27, September 26, August 18, July 6, June 14, May 24, April 13, March 30, February 28, Monthly surveys done September 14, August 24, July 27, June 23, May 20, April 28, March 22, February 19, and January 21, 2004
  - Personnel Radiation dose monitoring reports from the vendor (Global Dosimetry Solutions) for 2004, 2005, and 2006 to date
  - Procedure SP9, "Reactor Water Analysis" dated June 5, 2003. Data for liquid effluent to the sewer February 27, 2006, January 19, 2005, March 31, 2005, and August 29 and 30, 2005. The radioactivity in each sample was below the minimum detectable
  - Quarterly reports to the "Lowell Regional Waste Water Utility" dated December 23 and September 29, 2004, March 31, June 30, September 30, and December 30, 2005
  - Environmental water samples collected October 13, July 8, and April 8, 2004, and subjected to gross beta analysis
  - An inventory dated March 8, 2006, of all radiation detectors on campus identified room location, serial number, and calibration due date

b. Observations and Findings

The inspector toured the facility accompanied by the RSO and independently measured and verified the posted radiation levels. The inspector noted that there were a large number of radiation survey meters available for use by the reactor staff and the experimenters covered by the byproduct license issued by the State. The RSO has continued the effort he initiated in 2003 to improve the HP policies and procedures. The RSO was responsible for both licenses.

The new hire HP Technician was appointed in June 2005 to replace the Technician who transferred to another program. The new technician was developing improved laboratory analysis of samples, improvement in record keeping and policies in support to the RSO. The need for replacement of the analytical laboratory equipment has been identified as a priority issue at this time.

The routine radiation surveys were completed on schedule and in the areas specified in Section 10 of the Radiation Safety Guide. Results were recorded on floor plan maps of the area. The inspector noted that the surveyor used a sensitive micro-REM per hour (Bicron) meter to measure the general radiation level during the surveys in some but not all areas. Normally an ion chamber detector is used due to its ability to avoid swamping. The RSO stated that this survey meter was selected due to the low radiation levels in the facility and the need to use sensitive instruments. In addition, there were very few radiation areas.

A NVLAP certified vendor (Global Dosimetry Solutions) processed the environmental and personnel dosimeters monthly. Results are posted with the majority of the staff receiving no detectable exposure. The licensee's administrative limits were not exceeded. One Principal Investigator received routine exposures of non-penetrating radiation to the extremities in 2004 and 2005. The RSO stated that ALARA reviews of these exposures were completed on two occasions but no substantial reductions were achieved.

The RSO reviewed the radiation safety program annually as required by 10 CFR 20.1101 on November 1, 2005, October 3, 2004, and May 14, 2003. Each program weakness was documented and formally closed in subsequent memos by the RSO. This attention to the followup of audit findings is a commendable practice by the licensee.

c. Conclusions

The Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.

**6. Committees, Audits, and Reviews**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the reviews stipulated in the requirements of TS Section 6.2, "Review and Audit" were being completed:

- C Reactor Safety Subcommittee (RSS) membership
- C RSS minutes of meetings held September 21, June 15, and December 8, 2005, March 16, December 2, August 10, August 4, and February 26, 2004.
- Radiation Safety Committee minutes of meeting held February 24, June 23, September 21, and November 17, 2005, September 23, November 30, and August 4, 2004

b. Observations and Findings

The composition of the RSS was as specified in TS Section 6.2. The conversion of the reactor fuel from Highly Enriched Uranium (HEU) to Low Enriched Uranium (LEU) occurred earlier and required that HEU be temporarily stored on site. The shipment of HEU to the DOE facility finally occurred in August 2005 with oversight provided by the RSS. The RSS also reviewed RSO audit findings regarding the reactor radiation protection program and the corrective actions taken in response to

the findings.

c. Conclusions

The Reactor Safety Subcommittee provided the oversight required by the Technical Specifications.

**7. Emergency Planning**

a. Scope (69001)

The inspector reviewed the following to determine if emergency planning was conducted in accordance with the NRC approved plan:

- “Emergency Preparedness Plan for the University of Massachusetts Lowell Research Reactor” Revision 5 dated April 2002
- Records of drills conducted on April 28, 2005, and March 18, 2003
- Procedure EO1, “Radiation Emergency”
- Procedure EO2, “Major Fire or explosion”
- Procedure EO3, “Severe Storm”
- Procedure EO4, “Attack Warning or Civil Disorder”
- Procedure EO5, “Sabotage Threat to the Radiation Laboratory”
- Procedure EO6, “Rapid Loss of Pool Water”
- Procedure EO7, “Stuck Rod or Blade”
- Procedure EO8, “Loss of Electrical Power”
- Procedure EO9, “Personnel Injury”
- (Note: all emergency procedures in the “EO” series were last revised on March 31, 2004)

b. Observations and Findings

The licensee’s approach to emergency procedures is to specify the initial response to stabilize the situation in short, easy to read procedures ( nine procedures in the “EO-” series) and the longer term actions and recovery in procedures that are included in the Emergency Plan ( fifteen procedures in the “EP” series. The inspector noted that this is a unique and commendable approach to emergency response procedures. Additionally, the inspector noted that the RSO conducted a training session immediately following the critique of the last drill while all players and observers were still in the area. This training was part of the actions designed to correct some of the weaknesses observed during the drill while the issues were still fresh. The inspector considered this action to be unique and an effective approach to improving emergency response.

c. Conclusions

The emergency planning was conducted in accordance with the NRC approved Emergency Plan. Some unique activities were identified as enhancing the emergency response.

**8. Exit Interview**

The inspection scope and results were summarized on April 7, 2006, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.



## **PARTIAL LIST OF PERSONS CONTACTED**

### **Licensee**

W. Hogan, Chancellor  
D. Prideaux-Brune, Chancellor of Facilities  
L. Bobek, Reactor Supervisor  
D. Medich, Radiation Safety Officer  
T. Regan, Chief Reactor Operator  
G. Kegel, Radiation Laboratory Director

## **INSPECTION PROCEDURES**

IP 69001      Class II Non-power Reactors

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### **Opened**

None

### **Closed**

## **LIST OF ACRONYMS USED**

CFR	Code of Federal Regulations
IP	Inspection procedure
NRC	Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
RSO	Radiation Safety Officer
RSS	Reactor Safety Subcommittee
TS	Technical Specification