

U. S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 50-223/94-01

Docket No. 50-223

License No. R-125

Licensee: University of Massachusetts- Lowell  
1 University Avenue  
Lowell, Massachusetts 01854

Facility Name: Lowell University Research Reactor

Inspection At: Lowell, Massachusetts

Inspection Conducted: March 7-11, 1994

Inspector: *Stephen W Holmes*  
Stephen Holmes, Radiation Specialist, Effluents  
Radiation Protection Section (ERPS), Facilities  
Radiological Safety and Safeguards Branch (FRSSB)

24 MAR 94  
date

Approved By: *J. Joustra for*  
Judith Joustra, Chief, ERPS, FRSSB,  
Division of Radiation Safety and Safeguards

3/24/94  
date

**Areas Inspected:** Status of a previously identified item, staffing, radiation worker training, postings, radiation surveys and analyses, instrument calibration, personnel dosimetry, effluent releases, reactor logs, operating procedures, operator requalification, surveillances, control of experiments, maintenance and design changes, fuel movement, oversight, and new 10 CFR 20 implementation.

**Results:** Radiation worker training, radiation surveys and analyses, and personnel dosimetry programs were being effectively implemented. The surveillance tracking program was excellent, as was the use of logs and checklists. Weaknesses regarding health physics staffing were identified.

## DETAILS

### 1.0 Persons Contacted

- \*W. Church, Radiation Safety Officer
- \*W. Hogan, Chancellor, University of Massachusetts - Lowell
- \*G. Kegel, Director, Radiation Laboratory
- \*D. Martineau, Chief Reactor Operator
- \*L. Bettenhausen, Reactor Supervisor

\* Attended the exit meeting on March 11, 1994.

### 2.0 Status of Previously Identified Items

(Closed) **Inspector Followup Item 50-223/93-02-01** Reactor operations staffing was below the minimum level described in the licensee's NRC-approved Updated Safety Analysis Report (USAR). The inspector verified that the licensee had hired additional qualified personnel and that reactor operations staffing meets the minimum USAR requirements. This item is closed.

### 3.0 Staffing

During the last four years, health physics (HP) and reactor operations staffing has been a continuing concern, both to the NRC (August 1990-Report No. 50-223/90-03, June 1992-Report No. 50-223/92-01, and April 1993-Report No. 50-223/93-02) and the University's safety committee. The concern centered around maintaining minimum staffing levels as required by Sections 8.3 and 10.1 of the USAR and the practice of using positions which were not state-funded, but sustained by grant money, and which were, therefore, subject to being eliminated.

At the time of the inspection, health physics staffing consisted of the Radiation Safety Officer (RSO) and a three-eighths time health physics technician (HPT) student, while the reactor operations staff consisted of a Reactor Supervisor (RS), Chief Reactor Operator (CRO), and six part-time student trainees. With the exception of the RSO and RS, all positions were sustained by grant money and therefore, subject to being eliminated.

HP staffing may not have met the USAR requirement of two full-time personnel. The inspector stated that the licensee would be requested to evaluate, based on direct staff support time and current operational work-load, the adequacy of the present staffing, and report the results and any actions taken or to be taken to improve staffing, or provide justification to show that the present staffing is adequate. This will be reviewed in a future inspection (IFI 50-223/94-01-01).

Reactor operations staffing satisfied the minimum USAR requirement of three full-time staff in that there were sufficient students to equal a third full-time staff position. This use of students was adequate based on the present workload. However, the licensee should continue to carefully monitor the program to assure safety and regulatory requirements are met should reactor staffing or operational load change.

#### 4.0 Radiation Worker Training

The licensee's program to provide training required by 10 CFR 19.12 was reviewed through discussions with the RSO, and review of records and training material. Training was given to all personnel entering the facility commensurate with their duties or activities within the reactor building. Training was recorded on standard training program sheets or, for reactor operators and authorized workers/experimenters, on specialized forms. The revised University of Lowell Radiation Safety Guide along with handouts adequately covered the training required by 10 CFR 19 and included the new 10 CFR 20 limits and requirements. The inspector concluded that the licensee had implemented a relevant training program appropriate for the potential hazards.

#### 5.0 Postings

The inspector conducted tours of the reactor controlled areas and accompanied staff on a general area walk-through. General housekeeping of the facility was good, with no unlabeled or unsecured radioactive materials evident. The radiation signs and postings properly reflected the radiological conditions in the facility, to include the cobalt irradiation area. Radioactive material storage areas were secured and properly posted. NRC Forms 3 were conspicuously posted in appropriate areas throughout the facility. The radiological posting program was adequate. No safety concerns or violations were identified.

#### 6.0 Radiation Surveys and Analyses

The licensee is required by 10 CFR 20 to perform routine surveys to evaluate potential radiation hazards. The inspector reviewed reactor pool water, CAM and SGM filter, liquid effluent, radioactive waste, and smear analyses records. The monthly radiation area surveys were also examined. The RSO and the HPT were interviewed by the inspector regarding HP procedures and surveys. Individual reactor staff who also perform some HP surveys were also interviewed by the inspector. The procedures contained limits and reporting requirements. Survey results were reviewed by the staff, and corrective actions taken when required. The staff was knowledgeable of appropriate survey techniques. Within the scope of this inspection, surveys were being performed in an appropriate manner to evaluate potential radiation hazards. All records reviewed by the inspector were complete and satisfied the requirements of 10 CFR 20.2103. No safety concerns or violations of regulatory requirements were identified.

## 7.0 Instrument Calibration

The inspector reviewed the use, availability and calibration of the portable survey and counting lab equipment. Also reviewed were quality control charts and test source certification records.

Sufficient amounts and appropriate types of portable survey equipment were available in the reactor containment (a low range beta/gamma meter and a high range ion chamber on each floor). However, as noted in a previous report (June 1992, Report No. 50-223/92-01), the availability of backup equipment and spares was still limited. There still was a large amount of out-of-commission equipment on hand that could be repaired to provide proper backup and spares. The RSO stated that this situation had not caused any difficulties. Calibration was being performed as required and in compliance with license requirements using NIST-traceable sources or intercomparison with a calibrated ionization chamber (R-chamber). Test source certifications were on file as required. Written procedures were being followed and the calibration records were in order. Portable survey equipment was being properly maintained and calibrated.

The facility routinely used an alpha/beta counter for evaluating smears or planchet samples and a gamma spectrometry system for analyzing pool water and other specific samples for gamma emitters. The systems had been calibrated, using NIST-traceable sources, quantitatively and qualitatively for the counting configuration and isotopes of concern applicable to the required surveys and analyses being performed. Calibration frequency and technique followed the manufacturers' recommendations. Although QC checks were performed before each analysis, charting of this and the standard check source data were inconsistent. The graduate student in charge stated that a new software control charting package would be instituted as soon as possible. The facility also participated in the Environmental Protection Agency Laboratory comparison program with good correlation of the spiked sample results. Counting lab equipment was being adequately maintained and calibrated.

No safety concerns or violations of regulatory requirements were identified.

## 8.0 Personnel Dosimetry

The inspector reviewed personnel radiation exposure records and dosimetry procedures, and interviewed members of the staff. The licensee uses a National Voluntary Laboratory Accreditation Program (NVLAP) vendor to process personnel dosimetry. The RSO maintains dosimetry records for both the reactor facility staff and the campus staff. A review of records indicated that all exposures were within NRC limits, with most showing no exposure above background. The licensee's program included investigation of significant exposure readings and lost or damaged personal monitoring devices, and implements the new 10 CFR 20 dose limits for declared pregnant workers, minors, occupational workers, and members of the public. Followup on elevated exposures and counseling /training staff on ALARA principles was notable. The

licensee had implemented an effective personnel monitoring program. No safety concerns or violations of regulatory requirements were identified.

#### 9.0 Effluent Releases

Tables two and three of Appendix B, of the new 10 CFR 20 provide the limits for release of liquid and gaseous radioeffluents. The inspector reviewed the release records and instrumentation calibrations for both liquids and gases. He interviewed the staff, and toured related facility areas. Releases were within the regulated limits and documented. Calibration of related instrumentation was acceptable as were the written procedures. The present stack gas monitor (SGM) is in the process of being replaced with a new Nuclear Measurement Corporation instrument. This will allow a more precise calculation of gaseous effluent by accumulated net counts rather than the present graphic method using the present SGM paper chart. The inspector noted that analysis of water from the water treatment plant downstream of the facility detected only environmental background radiation levels. Within the scope of this inspection no safety concerns or violations of regulatory requirements were identified.

#### 10.0 Reactor Logs

Reactor operating records are required by Section 6.7.1 of the Technical Specifications (TS). The inspector audited these records, interviewed operators, and observed the entry of data in logs during reactor check-out, start-up, power run, and shut-down operations. Records of power level, operating periods, unusual events, calibration and maintenance procedures, installed experiments, and start-up and shut-down checks were being kept. Pre-printed forms/checklists were used for recording operational and surveillance data. Reactor operating records and logs contained excellent information and were being well maintained as required by TS and written procedures. Within the scope of this inspection, no safety concerns or violations of regulatory requirements were identified.

#### 11.0 Operating Procedures

Written procedures are required by Section 6.3 of the TS, and such procedures are required to be reviewed and approved prior to use. The inspector reviewed the operational procedures, interviewed staff members, and observed a reactor check-out, start-up, power run, and shut-down. The procedures were completed in accordance with the written procedures with careful attention to specifics. Implementation of and adherence to the procedures were good. Written procedures were available for all items required by TS. The procedures were straightforward and easily understood. Procedure changes had been reviewed and approved by the Reactor Safety Subcommittee (RSS) as required by TS. However, a recently updated procedure had not been posted in the procedure manual reviewed by the inspector. The inspector determined that all other manuals had been posted. The CRO stated that updates to the procedure manuals would be controlled in the future. Within the scope of this

inspection, no safety concerns or violations of regulatory requirements were identified.

#### 12.0 Operator Requalification Program

An examination of the training records and exams, and interviews with operators indicated that all currently licensed operators were successfully completing the emergency procedure and abnormal events training, the operator manipulations, and participating in the ongoing training program as required by the NRC-approved requalification plan. Both present Senior Reactor Operators were within their first requalification period and had not yet taken the biennial written and oral operations exams. Review of records indicated that past exam questions demonstrated good technical depth. The inspector found that the requalification program was being implemented adequately to ensure appropriate training of the operators.

#### 13.0 Surveillances

The inspector reviewed selected records, data sheets, and procedures for the conduct of surveillances required by TS Section 4.0. A computer program was used to track, on a month by month basis, required surveillances. All surveillances, including those only required biennially, were completed on schedule or more frequently than required and in accordance with the associated procedure. The computer tracking of required surveillances was excellent. Surveillance records were filed in the same order as the TS sections requiring them, which allowed for easy retrieval and review of surveillance actions. Within the scope of this review, the licensee's program for surveillances was found to be very effective.

#### 14.0 Control of Experiments

The licensee's program for the control of experiments was reviewed. The RSS review and approval for experiments was good, controls and limitations were imposed, and safety was the primary goal. New experiments or changes to routine experiments that involve safety consideration of a different kind or of a greater magnitude were reviewed by the RSS as required. During a recent operation a power level change was made to an ongoing experiment by the RS, with support of the RSO, as allowed by TS Section 6.8.4. The RSS subsequently reviewed this action and contacted NRC representatives to confirm this application of the TS section. This proactive action demonstrated the RSS commitment to providing experimental

oversight as required by TS. Within the scope of this review, no safety concerns or violations of regulatory requirements were identified.

#### 15.0 Maintenance and Design Changes

The inspector examined maintenance and design change records. Maintenance, other than the required TS surveillances, was considered "unscheduled maintenance" and was recorded and filed as such. The inspector determined that maintenance was being performed and tracked as required by TS and administrative procedures. Design changes were separated into Class A, B, and C changes, based upon what level of approval, RS, RSS, or NRC, would be required. A more formal tracking and review process for these modifications and changes to equipment had been developed as committed to during Inspection No. 50-223/93-02. No design changes had been made since the last inspection. Review of records indicated that maintenance had been performed and logged as required. No safety concerns or violations of regulatory requirements were identified.

#### 16.0 Fuel Movement

The inspector reviewed fuel movement records and procedures, individual core loading records, the reactor log book, and interviewed staff members. Individual core loading records matched reactor log records. Data recorded were clear, concise and relevant. Fuel movement, inspection, log keeping and recording followed the facility's procedures. The staff was knowledgeable of fuel movement procedures and recording requirements. Movement of the fuel could be reconstructed easily from the available records, including inspections, maintenance, and radiological and security controls used. Fuel handling, record maintenance and documentation was accomplished as required. No safety concerns or violations of regulatory requirements were identified.

#### 17.0 Oversight

Radiation Safety Committee (RS) and the RSS minutes for the past year were reviewed by the inspector. The RSS meeting schedule and membership satisfied the requirements of TS 6.2. Review of the minutes indicates the committees provided appropriate guidance, direction and oversight to the reactor safety program and insures proper followup on audit recommendations. As noted in Section 14 of this

report, the RSS was actively involved in reactor operations. Oversight by the safety committees was good. No violations of regulatory requirements were identified.

#### 18.0 New 10 CFR 20 Implementation

In general, the implementation of the new 10 CFR 20 requirements had not been functionally difficult for the facility to implement. Dosimetry, surveys, postings, calibrations, and training continued to be performed as normal. Personnel exposures, effluent releases, and area radiation levels at the facility were extremely low or consistent with background. No internal exposures or planned special exposures would normally occur. The new public and fetal exposure limits were already being complied with. The actual impact was on written procedures and program guidance. As mentioned in Section 4.0 of this report, a revised Radiation Safety Guide had been promulgated to comply with the new regulatory requirements. The licensee was performing an ongoing review of the procedures to insure they adequately implemented the new 10 CFR 20 requirements. No safety concerns or violations of regulatory requirements were identified.

#### 19.0 Exit Interview

The inspector met with the licensee representatives listed in Section 1.0 of this report on March 11, 1994, and discussed the scope and findings of this inspection. The licensee acknowledged the inspection findings and commitments.