

September 15, 2003

Dr. John A. Bernard, Jr.  
Director of Reactor Operations  
Massachusetts Institute of Technology  
Research Reactor  
MITNRL-NW12  
138 Albany Street  
Cambridge, MA 02139

SUBJECT: NRC ROUTINE INSPECTION REPORT NO. 50-20/2003-201

Dear Dr. Bernard:

This letter refers to the inspection conducted on June 25 - 27 at your MIT Research Reactor facility. The inspection consisted of a review of the reactor operations program. The enclosed report presents the results of both parts of the 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. No safety concerns or noncompliances of NRC requirements were identified during the inspection.

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/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Thomas Dragoun at 610-337-5373.

Sincerely,

/RA/

Patrick M. Madden, Section Chief  
Research and Test Reactors Section  
New, Research and Test Reactors Program (RNRP)  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Docket No. 50-20  
License No. R-37

Enclosure: NRC Inspection Report No. 50-20/2003-201  
cc w/enclosure: Please see next page

Massachusetts Institute of  
Technology

Docket No. 50-20

cc:

City Manager  
City Hall  
Cambridge, MA 02139

Department of Environmental  
Quality Engineering  
100 Cambridge Street  
Boston, MA 02202

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

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

Docket No: 50-20

License No: R-37

Report No: 50-20/2003-201

Licensee: Massachusetts Institute of Technology

Facility: MIT Research Reactor

Location: 138 Albany Street  
Cambridge, Massachusetts

Dates: June 25-27, 2003

Inspector: Thomas F. Dragoun

Approved by: Patrick M. Madden, Section Chief  
Research and Test Reactors Section  
New, Research and Test Reactors Program (RNRP)  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY  
Massachusetts Institute of Technology  
Report No: 50-20/2003-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class 1 research reactor programs including: organization and staffing; reviews and audits; approval of experiments; operator requalification; limiting safety system settings, limiting conditions of operation, and surveillances related to the fission converter.

Organization and Staffing

- The licensee's organization and staffing remain in compliance with the requirements specified in Technical Specification Section 7.

Reviews and Audits

- Audits were being conducted in accordance with Technical Specification and licensee requirements.

Experiment Approvals

- The procedures and records demonstrated that approval of experiments satisfied the Technical Specification requirements.

Operator Requalification

- Operator requalification was conducted in accordance with the requirements.

Limiting Safety System Settings, Limiting Conditions for Operation, and Surveillances

- The Fission Converter was operated within the limits specified in the Technical Specification.

## REPORT DETAILS

### **Summary of Plant Status**

The reactor continues to be operated in support of student instruction and laboratory experiments, tours, reactor operator training, silicon ingot irradiation, and various types of research.

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

#### **a. Inspection Scope (Inspection Procedure [IP] 39745)**

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specification (TS) Section 7.1, Amendment No.13, dated August 15, 1977, were being met:

- organizational structure
- management responsibilities
- staffing requirements for safe operation of the research reactor facility
- shift manning recorded in the console log for the period September 22, 2002 to February 20, 2003

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

Discussions with supervisors indicated that a few permanent staff personnel indicated that they may leave. Management developed plans to accommodate these losses should they occur. Additionally, the Institute administration imposed a reduction in the facility budget of approximately 10 percent and elimination of overtime pay. Facility management indicated that these changes will result in a reduction in the operations schedule. However, the number of licenses reactor operators remained unchanged and adequate to satisfy the TS shift manning requirements. Records showed that manning during reactor operations met the TS requirements.

#### **c. Conclusions**

The licensee's organization and staffing remain in compliance with the requirements specified in the TS Section 7.

### **2. Review and Audits**

#### **a. Inspection Scope (IP 40745)**

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 7.5.2 and licensee administrative requirements were being completed:

- MIT Reactor Safeguards Committee (MITRSC) membership and qualifications

- Minutes of MITRSC meetings held January 17, 2003, May 7, 2002 and October 22, 2001
- Annual Independent Audits dated December 13, 2001 and March 12, 2003
- Quarterly Administrative Audits by the Quality Assurance Supervisor dated April 19, 2001, July 26, 2001, July-August-September 2002, October-November-December 2002, January-February-March 2003.

b. Observations and Findings

The MITRSC member qualifications met the TS requirements. Meetings were held with a quorum present and conducted reviews and oversight of the reactor program as specified in the TS. Annual independent audits did not report findings of programmatic weakness.

The Quarterly Administrative Audits included detailed reviews of: console log entries; staff sign-off of changes to procedures/checklists/manuals; job workbook records (status of equipment repairs); test and calibration records; radiation survey results; environmental monitoring results; radioactive effluent records; refueling data; operator requalification files; reactor system tag-outs; inbound radioactive material shipments; and, special nuclear material licensed activity. The inspector commended licensee management for continuing this comprehensive audit.

c. Conclusions

Audits were being conducted in accordance with TS and licensee requirements.

**3. Experiment Approvals**

a. Inspection Scope (IP 69005)

The inspector reviewed the following to ensure that the requirements of TS Sections 6.1 General Experiment Criteria and 7.9 Experiment Approval Procedures regarding the approval of experiments were being met:

- Procedure PM 1.10, "Experiment Review and Approval", Safety Review #O-79-23, effective September 19, 1979
- Annual Report, Docket No. 50-20, License R-37, Technical Specification 7.13.5, Section 2, "Experiments"
- MITR reference 25 - 48, "Irradiation of mice"
- MITR reference 131 - 5, "Irradiation of stents"
- MITR reference 25 - 49, "Irradiation of neutron detectors"
- MITR reference 41 - 5, "Irradiation of polymerization samples"
- MITR reference 22 - 116, "Irradiation of mice, rats, and hamsters"
- MITR reference 22 - 118, "Irradiation of chicken liver"

b. Observations and Findings

The experiments reviewed involved irradiation of samples in flux traps outside the reactor core or in the “old” medical treatment room beneath the reactor. This room was no longer used for human patients after completion of the fission converter facility. Approval of the irradiations met the TS requirements.

c. Conclusions

The procedures and records demonstrated that approval of experiments satisfied the TS requirements.

**4. Operator Requalification**

a. Inspection Scope (IP 69003)

The inspector reviewed the following to verify compliance with the requirements in 10 CFR Part 55 and Safety Analysis Report Appendix 13.c:

- Procedure PM 1.16.2, “Qualification Card Checkouts”
- subject matter quiz given after training sessions
- medical evaluation records
- records of read-and-sign review of procedure changes
- records of performance during emergency drills

b. Observation and Findings

Medical evaluation of the operators were conducted as required. The subject matter quizzes were technically challenging. Logs showed that operators reviewed procedure changes and participated in emergency drills as required.

c. Conclusion

Operator requalification was conducted in accordance with the requirements.

**5. Limiting Safety System Settings, Limiting Conditions for Operation, and Surveillances**

a. Inspection Scope (IP 61745)

The inspector reviewed the following to ensure that the Fission Converter (FC) was operated within the limiting conditions and safety settings specified in TS Sections 6.6.1 and 6.6.2 and periodic surveillances on safety systems were performed as stipulated in TS Section 6.6.3:

- Procedure PM 6.1.5.1, “Fission Converter Primary Flow Static Calibration” dated February 6, 2001. Data for January 29 and December 26, 2002 and March 8, 2001.

- Procedure PM 6.1.5.2, "Fission Converter Inlet and Outlet Temperature Indication" dated February 6, 2001. Data for May 28, 2002 and July 24, 2001
- Procedure PM 6.1.5.3, "Fission Converter Ion Chamber Plateau Test" dated February 6, 2001. Data for October 1, 2002, October 26 and August 1, 2001
- Procedure PM 6.1.5.4, "Fission Converter Thermal Power Calibration" dated October 22, 2002. Data for January 22, 2003
- Procedure PM 6.1.5.5, "Measurement of Reactivity Worth of CCS" dated October 22, 2002. Data for January 22, 2003
- Procedure PM 3.14.2.7, "Determination of High Purity Ge or Ge(Li) Detector Efficiency" dated October 22, 2002. Data for March 18, 2003 and October 18, 2002
- Procedure PM 3.14.2.9, "B/H Calibration Check of High Purity Ge or Ge(Li) Detector for Prompt-Gamma Facility" dated October 22, 2002. Data for May 7, 2003 and October 24, 2002
- Procedure PM 3.14.3.2, "Use of Prompt-Gamma Facility for Boron Assay" dated October 22, 2002. Data for June 18, May 15, May 9, May 8, March 21 and March 20, 2003
- Procedure PM 3.15.1, "Fission Converter Startup Checklist" dated February 6, 2001. Data for June 18, 17, 16, 4, and 2, May 28, 16, 15, 12, and 9, 2003
- Procedure PM 3.15.2, "Test of Fission Converter Scram and Trip Points" dated July 28, 2000. Data for June 13, May 1, March 11, March 3, February 25, February 7, and January 17, 2003, December 26 and 18, 2002
- Procedure PM 3.15.4, "Test of Fission Converter PLC Scrams" dated October 22, 2002. Data for June 16, May 5 and March 18, 2003 and October 21, 2002
- Procedure PM 3.16.1.1, "Test of Requirements for Fission Converter Facility Listed in MITR Technical Specification 6.5" draft dated March 18, 2003. Data for June 16, May 7 and March 18, 2003
- Procedure PM 3.16.1.3, "Source Check and Alarm Operability Test of the FC Medical Therapy Radiation Monitor" dated October 22, 2002. Data for June 17 and 18, May 15 and 16, 2003

b. Observations and Findings

TS 6.6.2.1(8) is a limiting condition for FC operation and requires that the Fission Converter tank lid be in place for operation above 20 KW. In a letter to the NRC dated September 1, 2000, titled "Fission Converter Startup Report" Section 9 - Operating Requirements, refers to a table on page 10 which indicated that the lid was checked during performance of the FC startup using procedure PM 3.15.1. The inspector could not confirm that the check of tank lid was recorded as part of the procedure and advised the licensee. The licensee responded that this item was in error and that the lid position was checked and verified at step C.22 of the FC fuel loading using procedure PM 3.3.3, "General

Conduct of Transfer of Spent Fuel to Fission Converter" dated February 2, 2000. A review of the records confirmed that the check of the lid was done.

On March 25, 2003, the NRC issued Amendment No. 34 to the TS that eliminated or modified surveillance requirements. The changes have been implemented but not all procedure changes have been made since the changes impacted annual requirements.

Surveillance, test and LCO verifications and calibrations were completed on schedule and in accordance with licensee procedures. All the recorded results were within the TS and procedurally prescribed parameters. The records and logs reviewed were complete and were being maintained as required. Checks, tests, and calibrations were completed as required by TS.

c. Conclusions

The Fission Converter was operated within the limits specified in the TS.

6. **Exit Interview**

The inspection scope and results were summarized on June 27, 2003, 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**

J. Bernard, Director of Reactor Operations  
L. Desforge, Financial Officer  
A. Gast, Vice President for Research and Associated Provost  
E. Lau, Assistant Operations Superintendent  
F. McWilliams, Reactor Radiation Protection Officer  
T. Newton, Assistant Operations Superintendent  
S. Tucker, Quality Assurance Supervisor  
F. Wormsley, Training Coordinator

## **INSPECTION PROCEDURES USED**

|          |  |
|----------|--|
| IP 39745 | CLASS I NON-POWER REACTORS ORGANIZATION AND OPERATIONS AND MAINTENANCE ACTIVITIES    |
| IP 40745 | CLASS I NON-POWER REACTOR REVIEW AND AUDIT AND DESIGN CHANGE FUNCTIONS               |
| IP 61745 | CLASS I NON-POWER REACTOR SURVEILLANCE   |
| IP 69003 | CLASS I NON-POWER REACTOR OPERATOR LICENSES, REQUALIFICATION, AND MEDICAL ACTIVITIES |
| IP 69005 | CLASS I NON-POWER REACTOR EXPERIMENTS  |

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

### **Opened**

None

### **Closed**

None

## **LIST OF ACRONYMS USED**

|        |                                  |
|--------|----------------------------------|
| CFR    | Code of Federal Regulations      |
| FC     | Fission Converter                |
| IP     | Inspection Procedure             |
| LCO    | Limiting Condition for Operation |
| MITRSC | MIT Reactor Safeguards Committee |
| NRC    | Nuclear Regulatory Commission    |
| NRL    | Nuclear Reactor Laboratory       |
| TS     | Technical Specifications         |