

December 16, 2004

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 INSPECTION REPORT NO. 50-20/2004-202

Dear Dr. Bernard:

This letter refers to the inspection conducted on June 7-11, 2004 at the MIT Research Reactor Facility. The inspection included a review of activities authorized for your facility. 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 concerns or noncompliance with NRC requirements were 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>.

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

Sincerely,

/RA/

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

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

Enclosure: NRC Inspection Report No. 50-20/2004-202
cc w/enclosure: 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 Nos: 50-20

License Nos.: R-37

Report No: 50-20/2004-202

Licensee: Massachusetts Institute of Technology

Facility: MIT Research Reactor

Location: 138 Albany Street
Cambridge, Massachusetts

Dates: June 7-11, 2004

Inspector: Thomas F. Dragoun

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

EXECUTIVE SUMMARY

Massachusetts Institute of Technology
Report No: 50-20/2004-201

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: operator requalification, experiment approval, organization, review and audit, fuel movement, and surveillance.

Operator Requalification

- The implementation of the requalification program satisfied the regulatory requirements.

Experiment Approval

- Experiment approvals were conducted in accordance with regulatory requirements and licensee procedural requirements. A checklist used to record reviews and approval of new experiments will be revised to include the results of the Massachusetts Institute of Technology Reactor Safeguards Committee review.

Organization

- The licensee's organization and shift manning for reactor operations were consistent with the Technical Specifications.

Review and Audit

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

Fuel Movement

- Reactor fuel was moved and inspected in a manner consistent with the requirements in the Technical Specifications and licensee procedures. Licensee corrective actions for exceeding the license limit for U-235 were complete and satisfactory.

Surveillance

- The conduct of surveillances satisfied the requirements in Technical Specifications Section 4.0.

REPORT DETAILS

Summary of Plant Status

The reactor was operating on a normal schedule. The facility was preparing for a shutdown while the Democratic National Convention was held in Boston.

1. Operator Requalification

a. Inspection Scope (Inspection Procedure [IP] 69003)

The inspector reviewed the following to verify compliance with the requirements of 10 CFR Parts 55.59 and 55.21 and TS Sections 7.4 and 7.12.1(g):

- active license status
- requalification records for selected operators
- Procedure PM 1.16.1 "Requalification Program for Licensed Personnel" dated July 11, 1978
- Procedure PM 1.16.2 "MITR Operations Qualification Program for Senior Operators/Shift Supervisors" dated May 6, 2004
- Procedure PM 1.16.3 "MITR Operations Qualification Program for Operators" dated May 6, 2004
- Procedure PM 1.16.4 "Operator and Senior Operator Review Board Evaluation" dated September 1979

b. Observations and Findings

The inspector reviewed the Training File Check Off List for 2002, 2003, 2004. There are 23 active licenses of which only one will expire during 2004. The requalification program was completed annually by all operators instead of the normal two year cycle allowed by 10 CFR Part 55 and practiced at most research reactor facilities. This constitutes a program strength. Medical evaluations are completed biennially as required by 10 CFR 55.21. The on-the-job training requires 10 reactivity manipulations, participation in the emergency drill, review of procedure and facility changes, supervisory observation of performance, a written exam, and aural evaluation by a review board of senior staff. The program was under the direction of the Operations Superintendent as required. He monitors the progress of each operator every calendar quarter and issues reminders and schedules training sessions. Management oversight of the program was effective.

c. Conclusions

The implementation of the requalification program satisfied the regulatory requirements.

2. Experiment Approval

a. Inspection Scope (IP 69005)

The inspector reviewed the following to verify compliance with 10 CFR 50.59, TS 6.1 "General Experiment Criteria" and TS 7.9 "Experiment Approval Procedures":

- Procedure PM 1.4 attached form "Safety Review Form No." dated October 21, 1980
- Procedure PM 1.4.1 "Plan, Procedure, and Equipment Changes Classification" dated September 19, 1979
- Procedure PM 1.4.2 "Class C Review and Approval" dated June 22, 1988
- Procedure PM 1.4.3 "Class B Review and Approval" dated June 22, 1988
- Procedure PM 1.4.4 "Class A Review and Approval" dated June 22, 1988
- Safety Review O-02-8 "Annular Fuel Irradiation Experiment" dated December 23, 2002. Documents in file include:
 - completed form PM 1.4
 - results of 10 CFR 50.59 screening
 - "Nuclear Fuel Cycle Technology and Policy Program Nuclear Energy Research Initiative - Project 01-005" dated November 2002
 - Manufacture, Inspection, Test Plan for VI PAC A Fuel Test Specimens dated July 2002
 - Extracts of MITSRC minutes of meeting dated January 17, 2003
- Safety Review O-04-7 "Lithium Filter for Fission Converter Beam" dated May 5, 2004. Documents in file include:
 - results of 10 CFR 50.59 screening
 - ALARA Determination for SR O-04-7
 - Safety considerations for the lithium filter to be used in the fission converter beam line dated March 25, 2004
 - Neutron Capture Therapy/Medical Beams Subcommittee minutes of meeting dated February 19, 2003
 - Minutes of MITSRC 89th Meeting held October 29, 2003, included a review and approval of the proposed experiment.
 - Memo from S. Tucker to MITSRC "Lithium Filter for Fission Converter Beam" dated March 26, 2004
- Safety Review O-04-4 "EPRI ECP Test Loop" dated April 27, 2004. Documents in file include:
 - results of 10 CFR 50.59 screening
 - ALARA Determination
- Safety Review O-04-9 "U-235 Inventory Projection and Verification" dated May 20, 2004. Documents in file include:
 - results of 10 CFR 50.59 screening
 - ALARA Determination

b. Observations and Findings

The inspector reviewed the records for selected experiments and determined that the procedural requirements were satisfied.

The procedure for approval of new experiments requires the Reactor Director to select two technical reviewers. The results of both technical reviews are attached to the checklist form "Safety Review Form No." which also records the completion of the various regulatory and administrative requirements. However, the results of the review by the MIT Reactor Safeguards Committee (MITRSC) was not included in the checklist. This review was required by TS 7.5.2(i). The Director of Reactor Operations stated that the checklist will be revised to include the meeting date and minutes of meeting that documents the review and approval by the MITRSC. This matter will be reviewed in a future inspection (Inspector Follow up Item 50-20/2004-202-01).

c. Conclusions

Experiment approvals were conducted in accordance with regulatory requirements and licensee procedural requirements. A checklist used to record reviews and approval of new experiments will be revised to include the results of the MITRSC review.

3. Organization

a. Inspection Scope (IP 69006)

The inspector reviewed the following to verify compliance with the staffing requirements in TS 7.2 "Reactor Staff Organization" and TS 7.3 "Reactor Staff Qualifications":

- C organizational structure
- C management responsibilities
- C staffing requirements for safe operation of the research reactor facility
- list of candidates to the NRC for reactor operator licenses

b. Observations and Findings

Last year there were 32 active licensed reactor operators. Currently there are 18 operators. Staff losses since the last inspection include four permanent staff engineers. The routine reactor operations schedule of three shifts for 7 consecutive days requires 336 man-hours effort by licensed operators to satisfy TS requirements. There was 400 man-hours available from the current staff. This indicated that the staffing level was critical at this time. The reactor operations supervisor indicated that the current situation occurred during the extended shutdown imposed by the institutes administration. There was no change in the management structure, personnel, or responsibilities.

Steps taken to recover from the losses included hiring replacement engineers and enhanced recruitment of student operators. Two of the four new engineers were on site. There are 14 candidates scheduled to take the NRC operator examination in September 2004.

c. Conclusion

The licensee's organization and shift manning for reactor operations were consistent with the TS.

4. Review and Audit

a. Inspection Scope (IP 69007)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 7.5.1 "Safety in Reactor Operations" and Section 7.5.2 "MIT Reactor Safeguards Committee" were being completed:

- C Minutes of MITRSC meetings held October 29, 2003 and May 6, 2004

- C Annual Independent Audit conducted January 15 - 16, 2004, in accordance with procedure PM 1.18.2
- C Quarterly Administrative Audits by the Quality Assurance Supervisor for third and fourth quarters of 2002 and all four quarters of 2003

b. Observations and Findings

The MITRSC meetings were held with a quorum present and conducted reviews and oversight of the reactor program as specified in the TS. The committee decided to meet more frequently (biannually instead of annually) than the schedule specified in TS 7.5.2(f). The position of Recording Secretary was adopted and filled by a faculty member. Annual independent audit and Quarterly Administrative Audits were completed as required.

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.

c. Conclusions

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

5. **Fuel Movement**

a. Inspection Scope (IP 69009)

To verify compliance with TS 3.11 "Limiting Core Operating Conditions", TS 7.8 "Operating Procedures" and licensee procedural requirements, the inspector reviewed the following:

- Procedure PM 7.1.2-2 "Acceptance Procedure to Reactor Fuel" dated March 5, 1975. Data from inspection of fuel elements MIT 311, 312, and 313 on February 24, 2004
- Procedure PM 7.4.4.2 "In service Inspection of Primary Core Tank and Fuel" dated December 26, 1978. Data for January 9, 2004, September 18, June 9, and February 24, 2003
- Procedure PM1.15 "Fuel Loading Permission" dated September 19, 1979. Data for core loading configuration 160 on February 25, 2004, and configuration 159 on January 7, 2004
- Procedure PM 1.19.2 "U-235 Inventory Projection and Verification" dated May 20, 2004
- Reportable Occurrence 50-20/2004-1, "Exceeding U-235 Possession Limit in R-37 License, Paragraph 2.B(2)" dated May 20, 2004
- Letter from the Director of Reactor Operations to NRC, "SNM Possession Limit, License R-37, Docket 50-20" dated May 20, 2004

b. Observations and Findings

The documentation and certifications from the vendor that accompanied each fuel element were verified by the licensee. The licensee measured the radiation levels of the fuel elements as an indication of the enrichment of the fuel. However, these checks were not recorded.

The Reactor Engineer calculated the core parameters such as excess reactivity, shutdown margin, and fission density in advance of each routine shutdown and specified the addition of new fuel and the fuel shuffle for the remainder of the core load.

On May 20, 2004, the licensee reported to the NRC that the U-235 Possession Limit in license R-37 was exceeded. The inspector reviewed the status of the corrective actions described by the licensee to prevent a recurrence. These actions included a new procedure for inventory control, a request to the NRC for a temporary increase in the possession limit, and a hold on new fuel acquisition. The inspector found these actions to be complete and satisfactory.

c. Conclusions

Reactor fuel was moved and inspected in a manner consistent with the requirements in the TS and licensee procedures. Licensee corrective actions for exceeding the license limit for U-235 were complete and satisfactory.

6. Surveillance

a. Inspection Scope (IP 69010)

The inspector reviewed the following to ensure that TS Section 4 "Surveillance Requirements" for safety systems were effectively performed and documented:

- C Procedure PM 6.1.1 "Emergency Cooling System" dated March 28, 1997. Satisfies TS Section 4.1. Data for February 23, 2004, February 24, 2003, and February 1, 2002
- C Procedure PM 6.1.2.1 "Reactor Building Leak Rate" dated September 23, 1972. This procedure is temporarily updated prior to use. Satisfies TS Section 4.2. Data for May 18, 2004 and June 13, 2003
- C Procedure PM 6.1.2.4 "Test of Vacuum Breaker Set Points" dated August 20, 1973. Satisfies TS Section 4.2.2. Folder records test done August 6, 2003
- C Procedure PM 6.1.2.5 "Charcoal Filter Efficiency Test" dated May 28, 1998. Satisfies TS Section 4.2.3

b. Observations and Findings

The procedure for the reactor building pressure test was updated prior to each use to ensure that changes to the building penetrations (electrical or mechanical) are incorporated.

Within the scope of this review, records indicated that surveillances were completed on schedule and in accordance with licensee procedures. All the recorded results were within the TS prescribed parameters. The records were being maintained as required.

c. Conclusions

The conduct of surveillances satisfied the requirements in TS Section 4.0.

7. Exit Interview

The inspection scope and results were summarized on June 11, 2004, 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
E. Lau, Assistant Operations Superintendent
T. Newton, Assistant Operations Superintendent

INSPECTION PROCEDURES USED

IP 69003	Class I Research and Test Reactors Operator Licenses, Requalification, and Medical Activities
IP 69005	Class I Research and Test Reactors Experiments
IP 69006	Class I Research and Test Reactors Organization and Operations and Maintenance Activities
IP 69007	Class I Research and Test Reactor Review and Audit and Design Change Functions
IP 69009	Class I Research and Test Reactor Fuel Movement
IP 69010	Class I Research and Test Reactor Surveillance

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-20/2004-202-01	IFI	Record the results of MITRSC review of new experiments on the checklist.
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Closed

None

LIST OF ACRONYMS USED

CFR	Code of Federal Regulation
IFI	Inspector Follow up Item
IP	Inspection Procedure
MITRSC	MIT Reactor Safeguards Committee
NRC	Nuclear Regulatory Commission
TS	Technical Specifications