

June 11, 2002

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, ANNOUNCED INSPECTION REPORT NO. 50-20/2002-201

Dear Dr. Bernard:

This refers to the inspection conducted on May 6-10, 2002, at your 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 noncompliances of NRC requirements were 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>.

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
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-20/2002-201

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: 50-20/2002-201

Licensee: Massachusetts Institute of Technology

Facility: MIT Research Reactor

Location: 138 Albany Street
Cambridge, Massachusetts

Dates: May 6-10, 2002

Inspector: Thomas F. Dragoun

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

EXECUTIVE SUMMARY
Massachusetts Institute of Technology
Report No: 50-20/2002-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class I non-power research reactor operation including: organization and staffing, surveillance and limiting conditions of operations, experiment approvals, change control, operator requalification, and emergency preparedness.

Organization and Staffing

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

Surveillance and Limiting Conditions of Operations

- The reactor was operated within the limits specified in TS Section 3.0. Periodic surveillances satisfied the requirements in TS Section 4.0.

Experiment Approvals

- The implementing procedures and records demonstrated that reactivity limits on experiments satisfied the TS requirements.

Change Control

- The safety review of changes to procedures satisfied the requirements specified in TS Section 7.0 and the NRC regulations.

Operator Requalification

- Operator requalification was conducted in accordance with the requirements in 10 CFR Part 55 and commitments in the Safety Analysis Report.

Emergency Preparedness

- The emergency preparedness program was maintained and implemented in accordance with the Emergency Plan and emergency procedures.

REPORT DETAILS

Summary of Plant Status

The licensee's five megawatt (5Mw) research reactor continues to be operated in support of student instruction and laboratory experiments, reactor operator training, silicon ingot irradiation, and various types of research. During the inspection, the reactor was shut down for the annual verification of the integrity of the reactor building containment and the biennial discharge test of the emergency batteries. Housekeeping inside the reactor containment was exceptional.

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 13, dated August 15, 1977, were being met:

- organizational structure
- management responsibilities
- staffing requirements for safe operation of the research reactor facility

b. Observations and Findings

Through discussions with licensee representatives, the inspector determined that management responsibilities and the organization at the facility had not changed since the previous NRC inspection of this area in January 2001 (Inspection Report No. 50-20/2001-201). The inspector noted that efforts to recruit new student reactor operators to replace losses from graduations were successful. The non-TS position of Instrumentation Supervisor was filled by an experienced person. This individual was issued a Senior Reactor Operator license on September 24, 2001.

The Assistant Superintendent stated that some reactor supervisors were on rotational assignments within the reactor organization. This was done to provide cross training and the development of the staff.

The inspector determined, after reviewing operating records and logs for the period July 28, 2001 to December 12, 2001, that the minimum crew complement specified in TS 7.2.1 for reactor operation was satisfied.

c. Conclusions

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

2. Surveillance and Limiting Conditions of Operations (LCO)

a. Inspection Scope (IP 61745)

The inspector reviewed the following to ensure that the reactor was operated within the limiting conditions specified in TS Section 3.0 and periodic surveillances on safety systems were performed as stipulated in TS Section 4.0:

- Procedure PM 6.5.16.2, "MITR-II Shim Blade Calibration Procedure", dated November 14, 1979. Results of the calibration performed on May 31, 2000.
- Procedure "2002 Reactor Building Pressure Test Checklist" effective April 25, 2002. Performed May 7 - May 8, 2002.
- Procedure PM 6.1.1, "Emergency Cooling System", Safety Review SR#O-97-5, effective March 28, 1997. Data for February 1, 2002, January 31, 2001, March 3, 2000, February 24, 1999, October 19, 1998.
- Procedure PM 6.1.2.4, "Vacuum Relief Breakers", Safety Review SR#O-73-15, effective August 20, 1973. Data for July 19, 2001, August 1, 2000.
- Procedure PM 6.1.2.5, "Charcoal Filter Efficiency Test", Safety Review SR#-O-98-2, effective May 28, 1998. Data for July 20, 2001 and August 3, 2000.
- Procedure PM 3.1.1.1, "Startup Checklists, Two Loop Mechanical", Safety Review SR#-O-97-6, effective April 25, 1997.
- Procedure PM 6.1.3.2, "Period Channel Calibration", Safety Review SR#-O-97-9, effective May 5, 1997. Data for April 10, 2000, May 31, 2001, and March 20, 2002.
- Procedure PM 6.1.3.10, "Emergency Battery Discharge Test", Safety Review SR#-O-99-9, effective December 13, 1999. Performed May 9, 2002.

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 accounted for. This is a good practice. During performance of the test, the inspector noted the use of a new coriolis effect gas flow meter which provided improved test data. The inspector questioned the calibration of this device and was shown the manufacturer's specifications which claimed a lifetime calibration. The pressure test was completed in accordance with the procedure. The documentation also recorded the lessons learned from this test for incorporation into the procedure for subsequent tests. The test of the emergency battery capacity was conducted by two SROs in accordance with the procedure.

Data from the shim blade calibration on May 31, 2000, demonstrated that the Safety Analysis Report section 3.3.2.1.5, dated July 16, 1984, and requirements in TS 3.2, "Maximum Safe Step Reactivity Addition" (undated) were satisfied.

In an undated memo to files, a staff engineer reported the results of measurements of hydrogen buildup in the air space above the core from radiolytic decomposition of water on loss of the purge blower. Data was taken with steady state reactor power at 1 Mw and 2 Mw and extrapolated to 5 Mw. Analysis of this data showed that the standing order requiring the control operator to shut down the reactor within 5 minutes if the core purge blower trips provided adequate protection for the reactor. The Director of Operations decided not to measure the hydrogen concentration in the heavy water reflector or the fission converter tank since these areas are kept oxygen free with a helium gas purge. Therefore, a flammable mixture of hydrogen and oxygen cannot occur. Licensee action regarding Inspector Follow-up Item (IFI) 50-20/2000-201-01 is complete and satisfactory.

Within the scope of this review, records indicated that surveillances and LCO verifications 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 reactor was operated within the limits specified in TS Section 3.0. The conduct of surveillances satisfied the requirements in TS Section 4.0.

3. Experiment Approvals

a. Inspection Scope (IP 69005)

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

- Procedure PM 1.10, "Experiment Review and Approval", Safety Review #O-79-23, effective September 19, 1979
- Procedure PM 1.8, "Reactor Operating Logs"
- Irradiation request forms: 128-1, 130-1, 131-1, 131-3, 131-4, 131-5, 132-1, 132-2, and 133-1
- Irradiation request forms Part II: 8-13-206 dated September 2000 through 8-13-229 dated February 2002
- Calculation of reactivity worth for experiment "Loop Insertion" dated September 8, 2000

b. Observations and Findings

Step 1.8.2.6 of procedure PM 1.8 requires the logging of the insertion and removals of experimental samples in the console log. This task was assigned to the midnight shift operators. A review of console log entries between July 28, 2001 and December 12, 2001 confirmed that this was done. However, the reactivity worths of the samples were not recorded. The inspector also noted that the space on the Irradiation Request forms for the reactivity worth were all marked "OK". The Assistant Operations Superintendent stated that since the reactor was enclosed in a tank, only experiments inserted into the active core region through the reactor head had an effect on reactivity. This was usually negative and installation required the reactor to be shut down. Records for the last experimental loop confirmed that this was done. These experiments required review and approval by the Director of Operations and the MIT Reactor Safeguards Committee. Experiments installed in flux traps outside the core or at a beam port had no effect on reactivity and were controlled by the Irradiation Request forms which are approved by the Assistant Operations Superintendent. Records confirmed that this was done.

c. Conclusions

The implementing procedures and records demonstrated that reactivity limits on experiments satisfied the TS requirements.

4. Change Control

a. Inspection Scope (IP 40745)

The inspector reviewed the following to verify compliance with 10 CFR Part 50.59 and TS Sections 7.5 Review:

- Procedure PM 1.4, "Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto", Safety Review SR#-O-79-23.
- Change reviews: O-00-8, O-00-11, O-00-12, O-00-13, O-00-14, and E-01-1

b. Observations and Findings

The licensee continues to implement the 10 CFR 50.59 requirements in effect prior to October 4, 1999. This is conservative. The changes selected during this inspection involved the issuance of new, or modifications to, existing procedures. The detailed results of each review were adequately documented. No unresolved safety questions were reported.

c. Conclusions

The safety review of changes to procedures satisfied the requirements specified in TS Section 7.0 and the NRC regulations.

5. 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 for three operators selected at random:

- active license status
- medical evaluation records
- content of a written examination dated September 4, 2001, and operator grades
- reactor control manipulation records for the 2001 calendar year and January to April 2002
- records of read-and-sign review of procedure changes
- records of performance during emergency drills

b. Observation and Findings

Operator licenses were current. Medical evaluation of the operators were conducted as required. Privacy of these records was maintained by limited access controlled by the Assistant Operations Superintendent. The written examination was technically challenging and acceptably conducted. Logs showed that operators performed the required console manipulations, reviewed procedure changes, and reviewed emergency procedures as required.

c. Conclusion

Operator requalification was conducted in accordance with the requirements.

6. Emergency Preparedness

a. Inspection Scope (IP 82745)

The inspector reviewed the following to verify that emergency preparedness was maintained:

- Procedure PM 4.0, "Emergency Plans and Procedures", updated January 2002
- Letters of Agreement with the City of Cambridge Fire Department, City of Cambridge Police Department, and the Commonwealth of Massachusetts Department of State Police.
- Procedure PM 6.6.2.4, "Inventory of Emergency Supplies and Equipment" Safety Review SR#-O-99-3, effective April 13, 1999. Inventory data for January 28, 2002, July 10, 2001, January 2001
- Procedure PM 6.6.1.3, "Medical Emergency Drill" Safety Review SR#-O-84-2, effective January 9, 1984. Drill records for April 30, 2002, July 24, 2000, and January 27, 2000
- Procedure PM 6.46.1.1, "Radiological Emergency Exercise" Safety Review SR#-O-84-10, effective October 11, 1984. Drill records for May 1, 2002, January 11, 2001, and December 19, 1999

b. Observations and Findings

The Emergency Plan (E-Plan) was audited annually but no substantive changes have been made since April 1997. Letters of agreement for emergency support from local agencies were current. Facilities, supplies, instrumentation and equipment were being maintained, controlled and inventoried as required in the E-Plan. Emergency drills had been conducted as required by the E-Plan. Drill scenarios were realistic and participation by the staff was satisfactory. Critiques were held following the drills to discuss the strengths and weaknesses identified during the exercise. The results of these critiques were documented. The staff was required to read-and-sign the lessons learned in the critique. Emergency preparedness and response training was being completed as required.

c. Conclusions

The emergency preparedness program was maintained and implemented in accordance with the Emergency Plan and emergency procedures.

7. Exit Interview

The inspection scope and results were summarized on May 10, 2002, 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
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

IP 82745 CLASS I NON-POWER REACTOR EMERGENCY PREPAREDNESS

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-20/2000-201-01 IFI Measure hydrogen concentration in reactor head on loss of purge blower

LIST OF ACRONYMS USED

CFR Code of Federal Regulations
IFI Inspector Follow-up Item
IP Inspection Procedure
LCO Limiting Condition for Operation
NRC Nuclear Regulatory Commission
NRL Nuclear Reactor Laboratory
TS Technical Specifications