

October 29, 2007

Dr. John A. Bernard, Jr.
Director of Reactor Operations
Massachusetts Institute of Technology
Research Reactor
MITNRL-NW 12
138 Albany Street
Cambridge, MA 021391

SUBJECT: NRC INSPECTION REPORT NO. 50-020/2007-202

Dear Dr. Bernard:

This letter refers to the inspection conducted on October 15 to 19, 2007, at your 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 concern or noncompliance with 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 Marcus H. Voth at 301-415-1210.

Sincerely,

/RA/

Johnny H. Eads, Branch Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-020
License No.: R-37

Enclosure: NRC Inspection Report No. 50-20/2007-202

cc:
Please see next page

Massachusetts Institute of Technology

Docket No. 50-20

cc:

City Manager
City Hall
Cambridge, MA 02139

Department of Environmental Protection
One Winter Street
Boston, MA 02108

Director
Radiation Control Program
Department of Public Health
90 Washington Street
Dorchester, MA 02121

Nuclear Preparedness Manager
Massachusetts Emergency Management Agency
40 Worcester Road
Framingham, MA 01702-5399

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

October 29, 2007

Dr. John A. Bernard, Jr.
Director of Reactor Operations
Massachusetts Institute of Technology
Research Reactor
MITNRL-NW 12
138 Albany Street
Cambridge, MA 021391

SUBJECT: NRC INSPECTION REPORT NO. 50-020/2007-202

Dear Dr. Bernard:

This letter refers to the inspection conducted on October 15 to 19, 2007, at your 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 concern or noncompliance with 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 Marcus H. Voth at 301-415-1210.

Sincerely,
/RA/
Johnny H. Eads, Branch Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-020
License No.: R-37
Enclosure: NRC Inspection Report No. 50-20/2007-202

cc:
Please see next page

DISTRIBUTION:
PUBLIC PRTB r/f RidsNrrDprPrtb RidsOgcMailCenter
BDavis(Ltr only O5-A4) AAdams

ACCESSION NO.: ML072990553

OFFICE	PRTB:RI	PRTB:LA	PRTB:BC
NAME	MVoth mv	EHylton egh	JEads jhe
DATE	10-29-07	10/29/07	10/29/07

OFFICIAL RECORD COPY

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

Docket No.: 50-20

License No.: R-37

Report No.: 50-020/2007-202

Licensee: Massachusetts Institute of Technology (MIT)

Facility: MIT Research Reactor

Location: Cambridge, Massachusetts

Dates: October 15-19, 2007

Inspector: Marcus H. Voth

Approved by: Johnny H. Eads, Branch Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Massachusetts Institute of Technology
Research Reactor Facility
NRC Inspection Report No.: 50-20/2007-202

The primary focus of this routine, announced inspection was the onsite review of selected aspects and activities at the Massachusetts Institute of Technology related to operation of the 5 Megawatt Class 1 research reactor. It included a review of the licensee's safety programs including: organization and operation and maintenance activities; review and audit and design change functions; procedures; radiation protection; effluent and environmental monitoring; and follow-up on previously identified items. The licensee's programs were found to be acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

Organization and Operations and Maintenance Activities

- The licensee's organization and the conduct of operations and maintenance remained in compliance with the Technical Specifications

Review and Audit and Design Change Functions

- The licensee was in compliance with the Technical Specification requirements for review and audit oversight. Changes to the facility were being done in accordance with the applicable regulations.

Procedures

- The licensee had prepared and maintained procedures that met the Technical Specification requirements.

Radiation Protection

- Radiation protection practices were found to be in compliance with regulatory requirements and in accordance with ALARA practices.

Effluent and Environmental Monitoring

- Effluent release analyses and environmental monitor measurements showed compliance with regulatory requirements.

Follow-up of Previously Identified Items

- One Inspector Follow-up Item was discussed but remains open:
IFI 50-020/2007-201-01 - Resolution of control blade bulging
- Two Inspector Follow-up Items were closed:
IFI 50-020/2004-202-01 - Record the results of MITRSC review of new experiments on the checklist
IFI 50-020/2006-202-01 - Follow-up to verify that the licensee implements the CIP

REPORT DETAILS

Summary of Facility Status

The licensee's 5 megawatt Massachusetts Institute of Technology Reactor - II (MITR-II) routinely operated 24 hours a day, 7 days a week, for 3 month cycles in support of educational experiments, research and service irradiations, reactor operator training, and periodic equipment surveillances. At the end of each of the first 2 months of a cycle the reactor was shut down for a short outage to perform surveillance testing. At the end of every 3rd month the reactor was shut down for approximately a week for maintenance, refueling, and surveillance testing. During the inspection, the reactor was operating continuously.

1. Organization and Operations and Maintenance Activities

a. Inspection Scope (Inspection Procedure (IP) 69006)

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Section 7 of the Technical Specifications (TS), Administrative Controls, were being met:

- MIT Nuclear Reactor Laboratory Organization Chart, October 15, 2007
- Reactor Logbook #112, April 7 to August 5, 2007
- MIT Research Reactor Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007, submitted October 11, 2007
- MITR-II Job Workbook, Entry #E2924, "Channel 9 Found Fluctuating," September 4, 2007
- MITR-II Job Workbook, Entry #E2925, "Channel 1 Fission Chamber Period," September 30, 2007
- MITR-II Job Workbook, Entry #E2926, "Low Flow Auxiliary Pump Alarm," October 12, 2007
- File of email originating from E. Lau documenting findings in Control Blade Investigation, January 2007 to present

b. Observations and Findings

Through discussions with licensee representatives and review of the reactor logbook, the inspector determined that the minimum staffing requirements had been met.

The inspector reviewed recent entries in the Job Workbook, a system designed for communicating and tracking resolution of equipment performance issues. An individual, generally a reactor operator, made entries into this workbook to identify the component in question or equipment performance considered questionable. Management reviewed entries and acted commensurate with the safety significance. Action ranged from performing maintenance to simply explaining to an individual some natural phenomena they did not understand. A signature by management was required to close out each issue identified. This was a manual system functioning in much the same way the computer-based

Continuous Improvement Process (CIP) is intended to work when implemented. (See Section 6 of this report for further related discussion.)

The inspector reviewed a recent reactor logbook and found operations to be conducted in accordance with TS requirements. In addition, he reviewed progress toward resolution of the control blade bulging issue and found that precautionary measures discussed in the previous inspection continue to be taken as investigation of the cause and corrective action remained under investigation. (See Section 6 of this report.)

c. Conclusions

The licensee's organization and the conduct of operations and maintenance remained in compliance with the Technical Specifications.

2. Review and Audit and Design Change

a. Inspection Scope (IP 69007)

The inspector reviewed selected portions of the following records to ensure that the requirements of TS Section 7.5.2, MIT Reactor Safeguards Committee (MITRSC) and NRC regulation 10 CFR 50.59 were being met:

- Minutes of Ninety-Fifth MIT Reactor Safeguards Committee Meeting, June 6, 2007
- MIT Research Reactor Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007, submitted October 11, 2007
- Safety Review Form No. 0-06-3, "Containment Building Pressure Test," T. Newton, E. Lau, and E. Block, March 20, 2006
- Safety Review Form No. 0-05-16, "AOP 5.1.8 Remote Scram Operability Test," J. Foster and E. Lau, November 8, 2005
- Procedure 5.1.8, "Remote Scram System," November 23, 2005
- Procedure 6.2.5, "Remote Scram Operability Test," November 23, 2005

b. Observations and Findings

The inspector determined from the review of records and discussions with licensee personnel that the Safeguards Committee met at the required frequency, had a makeup of committee members, had a quorum in attendance, maintained meeting minutes, and reviewed the subject matter designated as TS requirements.

The Annual Report summarized changes made pursuant to 10 CFR 50.59. The inspector reviewed selected safety review forms that accompanied each change and also procedures modified in accordance with the change process. In all cases reviewed the inspector concurred with the findings of the licensee.

c. Conclusions

The licensee was in compliance with the TS requirements for review and audit oversight. Changes to the facility were being done in accordance with the applicable regulations.

3. Procedures

a. Inspection Scope (IP 69008)

The inspector reviewed the following to ensure that the requirements of TS Sections 7.8, Operating Procedures, and 4.3, Reactor Control, Safety, and Radiation Monitoring Surveillance, were being met concerning written procedures:

- MIT Research Reactor Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007, submitted October 11, 2007
- Procedure 5.1.8, "Remote Scram System," November 23, 2005
- Procedure 6.2.5, "Remote Scram Operability Test," November 23, 2005
- First Quarter 2007, Review of Monitor Calibrations
- Second Quarter 2007, Self Assessment of Monitor Calibrations
- Third Quarter 2007, Self Assessment of Monitor Calibrations
- RRP-4008, Rev. 5, Area Radiation Monitoring System – Quarterly
- RRP-4011, Rev. 4, Effluent and Process Radiation Monitoring System – Quarterly Calibrations
- RRP-4012, Rev. 4, Effluent and Process Radiation Monitoring System Annual Calibrations

b. Observations and Findings

When executing the inspection module pertaining to procedures, the inspector focused his activities on the licensee's program to systematically upgrade the radiation protection instrument calibration procedures. Early in the year a need to improve these procedures was identified. A program was defined, priorities were established, a tracking system was implemented, and quarterly reports were published. Revised procedures were reviewed by the inspector and considered to be a significant improvement.

c. Conclusions

The licensee had prepared and maintained procedures that met the TS requirements.

4. Radiation Protection

a. Inspection Scope (IP 69012)

The inspector toured the facility and also reviewed the following to verify compliance with 10 CFR Part 20 and TS Section 7.10, Radiation Protection Program, requirements:

- MIT Research Reactor Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007, submitted October 11, 2007
- CY 2006 Review of the Radiation Protection Program, F. McWilliams, May 4, 2007
- Electronic and hard copy files of the low background alpha/beta counter output
- Electronic and hard copy files of the beta/gamma spectrum analyzer output
- Third Quarter 2007 Personnel Dosimetry Record

b. Observations and Findings

The inspector toured the facility with the health physics technician performing a radiation survey and collecting water samples. He then observed the technician preparing the samples for counting, loading samples into the counter, and analyzing the numerical results. Throughout the tour the inspector observed the implementation of As Low As Reasonably Achievable (ALARA) practices; the presence of signage identifying the storage of radioactive materials, the level of radiation present, warnings for radioactive contamination and protective clothing requirements; the adequacy of the radiation survey; good laboratory practices in gathering, handling, preparing, counting standards, and counting samples; availability of survey meters for use by staff; calibration due dates on radiation monitoring equipment; and overall radiation protection practices of licensee staff members and visitors in the reactor area.

The licensee informed the inspector of enhancements under consideration which included a Small Article Monitoring System (SAMS) for verifying contamination-free tools and other small items; movement of the hand and foot monitor at the reactor entrance to minimize interference from Argon-41; and a re-evaluation of ventilation airflow throughout the reactor building.

During this routine inspection the licensee's personnel dosimetry monitoring service provider made available the results for the previous quarter. One individual was found to have received a higher than expected dose but below the annual limit. The license immediately restricted that individual from entering monitored areas and began an investigation. The NRC chartered a special inspection which will be the subject of a separate inspection report.

c. Conclusions

Radiation protection practices were found to be in compliance with regulatory requirements and in accordance with ALARA practices.

5. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

The inspector interviewed licensee representatives and reviewed the following to verify compliance with the requirements pertaining to discharges from the facility and environmental surveys pursuant to TS 7.13.5.f and h:

- MIT Research Reactor Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007, submitted October 11, 2007
- CY 2006 Review of the Radiation Protection Program, F. McWilliams, May 4, 2007

b. Observation and Findings

The inspector reviewed records for the June 2006 through July 2007 fiscal year releases of radioactive material to the environment, comparing them to regulatory release limits. The only gaseous effluent of significance relative to a 10 CFR Part 20 limits was Argon-41 which averaged 54 percent of limiting effluent concentration. The only liquid effluent of significance relative to a 10 CFR Part 20 limits was tritium which averaged two percent of limiting effluent concentration. There were no solid waste shipments made during the fiscal year.

The licensee discussed with the inspector that early in the current fiscal year approximately 1.2 curies of tritium was identified in the waste holdup tanks during the pre-release analysis. While it could have been released within the regulatory concentration limits, the licensee chose to package it in drums for disposal at a licensed radioactive waste disposal facility.

The licensee maintained environmental monitors in four directions within a quarter mile of the reactor. Real time recordings and integrated doses were monitored. Doses for the past fiscal year recorded at that point averaged 0.2 millirem relative to a 10 CFR Part 20 limitation of 10 millirem. The measured exposure was consistent with that measured in the 5 previous years.

The inspector noted that the licensee had engaged in a significant amount of trending of data such as releases to the environment, exposure to individuals and exposure to groups of individuals. This work was summarized in the annual report, in facility documents, and on postings in areas frequented by facility staff members. The trending data identified results of dose reduction initiatives.

c. Conclusions

Effluent release analyses and environmental monitor measurements showed compliance with regulatory requirements.

6. Follow-up on Previously identified Items

a. Inspection Scope (IP 92701)

To verify that appropriate action was taken in response to previously identified items referenced below, the following records were reviewed:

- MIT Reactor Safeguards Committee File
- MITR-II Job Workbook

b. Observations and Findings

- (1) IFI 50-020/2004-202-01 - Record the results of MITRSC review of new experiments on the checklist

The inspector noted that an addition had been made to the cover sheet documenting the review of an experiment by the MITRSC. This Inspector Follow-up Item (IFI) is therefore closed.

- (2) IFI 50-020/2006-202-01 - Follow-up to verify that the licensee implements the CIP

The licensee continued to work on the CIP but was resolving interface problems between the software provider and the MIT system. While working toward implementation of the CIP, which will address safety as well as non-safety issues, the licensee noted that the Job Workbook was a manual method serving the same function for safety-related equipment as well as other operator concerns. (See Section 1 of this report.) On this basis the IFI is closed.

- (3) IFI 50-020/2007-201-01 - Resolution of control blade bulging

This issue was discussed but awaits full closure. (See Section 1 of this report.) The IFI therefore remains open.

c. Conclusions

One Inspector Follow-up Item was discussed but remains open:

IFI 50-020/2007-201-01 - Resolution of control blade bulging

Two Inspector Follow-up Items were closed:

IFI 50-020/2004-202-01 - Record the results of MITRSC review of new experiments on the checklist

IFI 50-020/2006-202-01 - Follow-up to verify that the licensee implements the CIP

7. Exit Interview

The routine inspection scope and results were summarized on October 18, 2007, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. The licensee did not state any dissenting opinions or identify any information considered proprietary.

The inspector returned on October 19, 2007, to continue the inspection related to the unexpected high exposure matter. A second exit meeting was conducted to summarize the status of that investigation at which time arrangements for a potential special inspection were discussed.

PARTIAL LIST OF PERSONS CONTACTED

Licensee:

J. Bernard	Director of Reactor Operations
E. Block	Maintenance Supervisor
P. Drooff	Assistant Health Physicist
J. Foster	Assistant Superintendent for Operations
L. DiBerardinis	Director of Environmental Health and Safety (EHS)
D. Kelly	Reactor Operator
E. Lau	Superintendent for Reactor Operations
F. McWilliams	Reactor Radiation Protection Officer and Deputy Director, EHS
D. Moncton	Director of the MIT Nuclear Reactor Laboratory
T. Newton	Associate Director, Reactor Engineering
B. Rice	Project Technician, EHS
S. Tucker	Quality Assurance Supervisor

INSPECTION PROCEDURES USED

IP 69004	Class 1 Research and Test Reactor Effluent and Environmental Monitoring
IP 69006	Class 1 Research and Test Reactors Organization, Operations, and Maintenance Activities
IP 69007	Class 1 Research and Test Reactors Review and Audit and Design Change Functions
IP 69008	Class 1 Research and Test Reactor Procedures
IP 69012	Class 1 Research and Test Reactor Radiation Protection
IP 92701	Follow-up

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED:

None

CLOSED:

50-020/2004-202-01	IFI	Record the results of MITRSC review of new experiments on the checklist
50-020/2006-202-01	IFI	Follow-up to verify that the licensee implements the CIP

DISCUSSED:

50-020/2007-201-01	IFI	Resolution of control blade bulging
--------------------	-----	-------------------------------------

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
CFR	<i>Code of Federal Regulations</i>
CIP	Continuous Improvement Program
EHS	Environmental Safety and Health
IFI	Inspector Follow-up Item
IP	Inspection Procedure
MIT	Massachusetts Institute of Technology
MITR	Massachusetts Institute of Technology Reactor
MITRSC	MIT Reactor Safeguards Committee
NRC	Nuclear Regulatory Commission
PARS	Publicly Available Records
Rev.	Revision
SAMS	Small Article Monitoring System
TS	Technical Specification