

May 12, 2009

Dr. John A. Bernard, Jr.
Director of Reactor Operations
Massachusetts Institute of Technology
Research Reactor
MITNRL-NW 12
138 Albany Street
Cambridge, MA 02139

SUBJECT: MASSACHUSETTS INSTITUTE OF TECHNOLOGY - NRC ROUTINE
INSPECTION REPORT NO. 50-020/2009-201

Dear Dr. Bernard:

On April 13-16, 2009, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the Massachusetts Institute of Technology Research Reactor facility (Inspection Report No. 50-020/2009-201). The enclosed report documents the inspection results, which were discussed on April 16, 2009, with you and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observation of activities, and interviews with personnel. Based on the results of this inspection, no findings of significance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, and requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

J. A. Bernard, Jr.

- 2 -

Should you have any questions concerning this inspection, please contact Craig Bassett at (404) 358-6515 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, 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. 50-020/2009-201

cc: See next page

Massachusetts Institute of Technology

Docket No. 50-020

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
400 Worcester Road
Framingham, MA 01702-5399

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

J. A. Bernard, Jr.

- 2 -

May 12, 2009

Should you have any questions concerning this inspection, please contact Craig Bassett at (404) 358-6515 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, 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. 50-020/2009-201

cc: See next page

DISTRIBUTION:

PUBLIC PRTB r/f
MNorris (MS T3B46M)

RidsNrrDprPrta Resource
BDavis (Ltr only O5-A4)

RidsNrrDprPrtb Resource
GLappert, NRR

ACCESSION NO.: ML09

TEMPLATE #: NRR-106

OFFICE	PRTB:RI	PRT:LA	PRTB:BC
NAME	CBassett	GLappert	JEads
DATE	4/23/2009	5/11/2009	5/12/2009

OFFICIAL RECORD COPY

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

Docket No.: 50-020

License No.: R-37

Report No.: 50-020/2009-201

Licensee: Massachusetts Institute of Technology

Facility: Nuclear Reactor Laboratory

Location: Cambridge, Massachusetts

Dates: April 13 – 16, 2009

Inspector: Craig Bassett

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

EXECUTIVE SUMMARY

Massachusetts Institute of Technology
Nuclear Reactor Laboratory
NRC Inspection Report No.: 50-020/2009-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Massachusetts Institute of Technology (the licensee's) Class I five megawatt research and test reactor safety program including: 1) organization and staffing, 2) review and audit and design change functions, 3) reactor operations, 4) operator requalification, 5) maintenance and surveillance, 6) fuel handling, 7) experiments, 8) procedures and procedural control, and 9) emergency preparedness since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements. No violations or deviations were identified.

Organization and staffing

- Organizational structure and staffing were consistent with Technical Specification (TS) requirements.

Review and Audit and Design Change Functions

- The Massachusetts Institute of Technology Reactor Safeguards Committee was meeting as required and reviewing the topics outlined in the TS.
- Quarterly and annual audits of facility programs were conducted as required.
- The design change program satisfied NRC requirements

Reactor Operations

- Reactor operations were conducted in accordance with procedure and the appropriate logs were being maintained.
- Various daily and weekly meetings were held to ensure proper communication of, and planning and preparation for, operations activities.

Operator Requalification

- Operator requalification was conducted as required by the Requalification Program and the program was being maintained up-to-date.

Maintenance and Surveillance

- The system for tracking and completing maintenance items and surveillance checks and calibrations appeared to be adequate and was being maintained as required.
- Maintenance and surveillance records, performance, and reviews satisfied TS and procedure requirements.

Fuel Handling

- Fuel movement and control was conducted in accordance with TS and procedural requirements.

Experiments

- The program for reviewing and conducting experiments satisfied procedural and TS requirements.

Procedures

- The procedure review, revision, control, and implementation program satisfied TS requirements.

Emergency Preparedness

- The emergency preparedness program was conducted in accordance with the Emergency Plan.
- Emergency response equipment was being maintained and inventoried as required.
- The Letters of Agreement between the licensee and the City of Cambridge Fire, Police, and Emergency Management Departments, as well as between the licensee and the Massachusetts General Hospital, were being maintained.
- Emergency drills were being conducted annually as required by the Emergency Plan.
- Emergency preparedness training for licensed operators and personnel from various support organizations was being completed as required.

REPORT DETAILS

Summary of Facility Status

The Massachusetts Institute of Technology (MIT, the licensee) Nuclear Reactor Laboratory (NRL) five megawatt research and test reactor continued to be operated 24 hours a day, 7 days a week, for 3 month cycles in support of experiments, research and service irradiations, reactor operator training, and periodic equipment maintenance and surveillance activities. At the end of each of the first two months of a cycle the reactor was shutdown for a short outage to perform surveillance testing. At the end of every third month the reactor was shut down for approximately a week for maintenance, refueling, and surveillance testing and calibration. During first three days of this inspection, the reactor was shutdown for chemical cleaning of the heat exchanger and other maintenance activities. Following completion of these tasks, the reactor was started up and operated as usual.

1. Organization and Staffing

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

The inspector reviewed the following regarding the Massachusetts Institute of Technology Reactor (designated as MITR-II) organization, staffing, and management responsibilities to ensure that the requirements of Technical Specification (TS) Section 7, "Administrative Controls," (last revised by License Amendment Number [No.] 37, dated April 22, 2005), were being met:

- Management responsibilities
- Qualifications of facility operations personnel
- MIT NRL Organization Chart, dated April 30, 2008
- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- Staffing requirements for safe operation of the research reactor
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007," submitted October 11, 2007
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2007 to June 30, 2008," submitted August 27, 2008

b. Observations and Findings

The inspector noted that the Director of Reactor Operations reported to the Director of the MIT NRL, who in turn reported to the President of the university through the Vice President for Research. This organization was consistent with that specified in the TS. Also, the organizational structure and the responsibilities of the reactor staff had not changed since the last inspection.

Staffing levels remained consistent with those noted during the last inspection of this facility. The current reactor operations organization consisted of the Director of Reactor Operations, the Superintendent of Operations, and an Assistant Superintendent of Operations, a Quality Assurance Supervisor, a Training Coordinator, various Reactor Supervisors, and various Reactor Operators (ROs). The Director of Reactor Operations, the Superintendent of Operations, the Assistant Superintendent, the Quality Assurance Supervisor, the Training Coordinator, and the majority of the Reactor Supervisors were qualified Senior Reactor Operators (SROs). It was noted that about one-fourth of the Reactor Supervisor and Reactor Operator positions were full-time while the other three-fourths were part-time positions. In addition to the operations staff, there were various support groups including a Research Staff, a Research Development group, Reactor Engineering staff, Maintenance personnel, and a Reactor Radiation Protection group.

Through a review of selected reactor operations logs for the period from April 2008 through April 2009, and through interviews with operations personnel, the inspector determined that the licensee continued to operate 24/7 with three crews and no shift rotation. Each operating crew was staffed with at least two people per shift. Operations shifts were scheduled for a period of 8 hours. A review of the Reactor (Console) Logbooks and associated records confirmed that shift staffing met the minimum requirements for duty and on-call personnel. Staffing during the reactor operations shifts satisfied the requirements of TS Section 7.2.1.

c. Conclusions

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

2. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69007)

To verify that the required reviews and audits were being completed by the MIT Reactor Safeguards Committee as required by TS Sections 7.5.1 and 7.5.2 and to ensure that facility changes were reviewed and approved as required by TS Section 7.5.2 and in accordance with 10 CFR 50.59, the inspector reviewed selected aspects of:

- Annual Independent Audits conducted in 2007 and 2008
- Administrative Audits for the Calendar Months of January, February, and March; April, May and June; July, August, and September; and October, November, and December 2008
- Charter of the MIT Reactor Safeguards Committee dated December 10, 1985
- Memorandum addressed to the Reactor Safeguards Committee entitled, "Authority of Standing and Special Subcommittees," dated December 1, 2008

- MIT Reactor Safeguards Committee meeting minutes for 2008 through the present
- MIT Reactor Safeguards Committee Standing Subcommittee meeting minutes for 2008
- Procedure Manual (PM) 1.10.2, "MIT Reactor Safeguards Committee," latest revision dated September 19, 1979
- PM 1.4, "Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto," latest revision dated May 6, 2008
- PM 1.18.1, "Internal Audits," latest revision dated January 10, 1986
- PM 1.18.2, "Independent Audits," latest revision dated September 18, 1984
- Safety Review Form No. E-08-1, "Installation and Testing of New Blade Height Indicators," dated July 1, 2008
- Safety Review Form No. M-08-1, "Graphite Gasholder Bypass," dated July 23, 2008
- Safety Review Form No. O-05-11, "High Temperature Irradiation Facility," dated July 12, 2005
- Safety Review Form No. O-06-4, "Advanced Clad Irradiation Loop," dated April 3, 2006
- Safety Review Form No. O-07-3, "PM 1.4 – Safety Review Form," dated October 19, 2007
- Safety Review Form No. O-08-1, "PM 3.1.1.4 - Two Loop Restart Incorporating Required Monthly Startup Surveillance," dated January 23, 2008
- Safety Review Form No. O-08-2, "NTD Silicon Procedures for Unload, Load, and Entering Silicon Cells," dated July 9, 2008
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007," submitted October 11, 2007
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2007 to June 30, 2008," submitted August 27, 2008

b. Observations and Findings

(1) Review and Audit Functions

The composition of the MIT Reactor Safeguards Committee (MITRSC) and qualifications of MITRSC members were as specified in TS 7.5.2. Minutes of MITRSC meetings and those of the MITRSC Standing Subcommittee demonstrated that the committee met at the frequency required. Through records review the inspector determined that safety reviews were conducted by the MITRSC or by designated Subcommittee representatives specified in TS 7.5.1 and 7.5.2. Topics of those reviews were as required by the TS and provided sufficient guidance, direction, and oversight to ensure acceptable use of the reactor.

Quarterly Administrative Audits and Annual Independent Audits were conducted by management and independent auditors respectively. The inspector noted that the quarterly audits for 2008 and the annual independent audits for Fiscal Year (FY) 2007 and FY 2008 were adequate and reviewed the activities specified in TS 7.5.1 and 7.5.2 including various aspects of the reactor facility operations and programs. It was noted that the audits had been completed by qualified individuals as required. The audits appeared to be adequate and included recommendations concerning potential improvements to the program.

(2) Design Change Functions

To satisfy the regulatory requirements stipulated in Part 50.59 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Changes, tests, and experiments," the licensee had implemented facility procedure, PM 1.4, "Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto." The inspector verified that the procedure adequately incorporated criteria provided by the regulations with additional requirements mandated by local conditions.

The inspector noted that all proposed facility plans, procedures, and equipment changes were classified into three categories, Class A, Class B, or Class C. Class C changes were those of less significance and were required to be reviewed and approved by Senior Shift Supervisors and a Group Supervisor. Class B changes were those that required the review and approval of two licensed SROs and the Director of Reactor Operations before implementation. They could require a review by the Radiation Protection group and were typically submitted to the MITRSC for information. Class A changes were significant changes involving procedures and/or equipment related to the reactor and related systems, the Emergency Plan, the Operator Requalification Program, and the security system. They typically required a review by the Radiation Protection group, as well as all the reviews and approvals noted above. These types of changes also required the review and approval of the MITRSC before implementation. In addition, Class A changes included those that required a change to the license or TS and thus would require review and approval by the NRC.

The inspector reviewed selected Safety Review Forms and the associated safety evaluation documents of reviews conducted during 2007 and 2008. The completed forms showed that the proposals were acceptably reviewed in accordance with the procedure. It was noted that all the recent proposals were designated as Class B and therefore no MITRSC formal approval was required. Also, none of the changes was determined to constitute a safety question or concern and consequently none required a license or TS amendment.

c. Conclusions

The MITRSC was meeting as required and reviewing the topics outlined in the TS Quarterly and annual audits of facility programs were conducted as required. The design change program satisfied NRC requirements.

3. Reactor Operations

a. Inspection Scope (IP 69006)

To verify that the licensee was conducting reactor operations in accordance with TS Sections 2 and 3 and procedural requirements, the inspector reviewed selected portions of the following:

- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- PM 3.1.1, "Full Power Start-up Checklist," latest revision dated August 28, 2006
- PM 3.2.2, "Shutdown from Less than 100 kW Operations," latest revision dated April 25, 1997
- PM 3.5, "Daily Surveillance Check," latest revision dated January 29, 2008
- PM 3.9, "Transfer of D₂O Between Storage and Dump Tanks," latest revision dated July 24, 1975
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007," submitted October 11, 2007
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2007 to June 30, 2008," submitted August 27, 2008

b. Observations and Findings

(1) Reactor Operation

The inspector observed facility activities on various occasions during the week including maintenance work and later reactor operations. Written procedures and checklists were used for each activity as required. It was noted that the maintenance personnel and reactor operators followed the appropriate procedures, were knowledgeable of the required actions, and professional in the conduct of their duties.

The inspector observed as licensee personnel initiated a reactor start-up following the maintenance shutdown. Due to a malfunctioning instrument, the start-up was cancelled while the licensee reviewed the situation and decided on a course of action to address the problem. Within a short

period the licensee had corrected the problem and the start-up was completed. The reactor power level was increased to 4.5 MW without any further interruptions. No deficiencies were noted.

(2) **Staff Communication**

During the inspection, the inspector attended operations crew shift turnover meetings on Wednesday morning and evening. The status of the reactor and the facility was discussed on each occasion as required. The Reactor Supervisors of the relief shifts reviewed the appropriate logs and records and were briefed on the upcoming shift activities and scheduled events before assuming the operations duty. Through direct observation and records review, the inspector verified that the content of shift turnover briefings held during each shift change was appropriate and that shift activities and plant conditions were discussed in sufficient detail.

The inspector also attended the Daily Schedule Meeting (or Plan of the Day meeting) on Tuesday and Wednesday morning. The meetings were conducted by the Superintendent of Reactor Operations and reactor operators were in attendance, as well as representatives from the other support organizations at the facility. Safety-significant issues, if any, were discussed and maintenance or operating needs were presented. Any concerns or schedule conflicts were resolved during the meeting. The inspector noted that the Daily Schedule Meeting ensured that everyone was informed about current facility conditions and aware of the scheduled activities for that day.

c. **Conclusions**

MITR-II reactor operations, as well as shift turnovers and operator cognizance of facility conditions during startup and routine operation, were acceptable. Daily meetings were being held to ensure proper planning and preparation for operations activities.

4. Operator Licensing, Requalification and Medical Activities

a. **Inspection Scope (IP 69003)**

To verify that the licensee was complying with the requirements of 10 CFR Part 55 and licensee's operator requalification program, the inspector reviewed selected aspects of:

- Current status of operator licenses
- Reactor operator files maintained in the Operations Office
- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- Results of the 2006 and 2007 Annual Written Examinations
- Medical examination records for selected operators for the past three years

- “On-the-Job-Training Notebook, Book 1,” documenting activities of those operators whose last names began with A – Le
- “On-the-Job-Training Notebook, Book 2,” documenting activities of those operators whose last names began with Lu – Y
- PM 1.16.1, “Requalification Program for Licensed Personnel,” latest revision dated March 11, 1988
- PM 1.16.2, “MITR Operator Qualification Program for Senior Reactor Operators/Shift Supervisors,” latest revision dated May 6, 2004
- PM 1.16.3, “MITR Operator Qualification Program for Operators,” latest revision dated May 6, 2004
- PM 1.16.4, “Operator and Senior Operator Review Board Evaluations,” latest revision dated September 1979

b. Observation and Findings

There were 23 qualified SROs and 9 ROs on staff at the facility. The licensee indicated that there were five people in training to become operators. A review of various Requalification Program records indicated that the program was maintained up-to-date and that RO and SRO licenses were current. MITR-II operator files and Reactor Logbooks also showed that operators maintained active duty status as required.

A review of the logs and records also showed that training was being conducted in accordance with the licensee’s requalification and training program. A series of lectures were given to new operator trainees. Information regarding facility changes and other relevant information had been routed to licensed operators for their review. The inspector verified that the required reactor operations, reactivity manipulations, other operations activities, and Reactor Supervisor activities were being completed and the appropriate records were being maintained. Records indicating the completion of annual supervisory observations and evaluations for each operator were also maintained. Annual written examinations were being completed by the operators as required. The inspector also noted that all operators were receiving biennial medical examinations within the time frame allowed as required by the program.

It was noted that two SROs’ licenses were “inactive” because those individuals had limited time to complete the reactivity manipulations and other required activities. However, the operators were still completing the annual written exams and having biennial medical examinations as required. By completing the written exams and by having the biennial medical examinations, the licenses could be reinstated to “active” if needed by completing the required number of manipulations and other activities under the supervision and observation of a Reactor Supervisor.

c. Conclusions

Operator requalification was up-to-date and was being completed as required by the MIT Reactor Operator Requalification Program.

5. Maintenance and Surveillance

a. Inspection Scope (IP 69006, 69010)

To verify that the licensee was meeting the surveillance requirements specified in TS Section 4, the inspector reviewed selected aspects of:

- MITR-II Job Workbook
- MITR-II Daily Operations Schedule
- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- MITR-II Notebook, "Systems, Tests, and Calibrations, Volume 1 of 3," containing documentation of tests and/or calibrations associated with PM 6.1.1 through 6.1.5.5
- MITR-II Notebook, "System Tests and Calibrations, Volume 2 of 3," containing documentation of tests and/or calibrations associated with PM 6.2.1 to 6.4.2.4,
- MITR-II Notebook, "System Tests and Calibrations, Volume 3 of 3," containing documentation of tests and/or calibrations associated with PM 6.5.1 to 7.4.4.2
- PM 6.1.1, "Emergency Cooling System," latest revision dated March 28, 1997
- PM 6.1.2.1, "Building Pressure Test," latest revision dated September 23, 1974
- PM 6.1.3.7, "Calibration of Core Tank Level Scram Point and Level Indications," latest revision dated November 19, 1979
- PM 6.1.3.11, "Emergency Power Transfer Test," latest revision dated March 5, 2008
- PM 6.1.4.4, "Primary Coolant Flow Scram Time," latest revision dated April 17, 1997
- PM 6.2.4, "Period Level Indication Offscale Scram," latest revision dated June 25, 1975
- PM 6.3.3, "Waste Tank System Alarm and Interlock," latest revision dated August 14, 2001
- PM 6.4.5, "Low Flow Auxiliary Pump," latest revision dated May 24, 1977
- PM 6.5.1, "Cathodic Protection System Test," latest revision dated June 6, 1996
- PM 7.1.1.2, "Regulating Rod Drive Mechanism Disassembly and Reassembly Procedures," latest revision dated June 30, 1975
- PM 7.2.4, "Electrical Power Shutdown Checklist," latest revision dated May 6, 1976
- PM 7.4.3.7, "Flushing of Heat-Exchangers by HM-1 and HM-1A," latest revision dated June 28, 1985
- Surveillance activities and equipment maintenance documented in the 2008 Test and Calibration Tracker
- Surveillance activities and equipment maintenance documented in the 2009 Test and Calibration Tracker

- “MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2006 to June 30, 2007,” submitted October 11, 2007
- “MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2007 to June 30, 2008,” submitted August 27, 2008

b. Observations and Findings

(1) Maintenance

The inspector reviewed the system that the licensee had developed to track and complete maintenance activities. The system was designed to ensure that all maintenance activities were planned and completed as scheduled, that post maintenance testing was conducted, and that the entire process was documented appropriately. The licensee used a locally developed system called the “Test and Calibration Tracker” which listed all the tests, checks, and calibrations that were due on a monthly basis. Along with the “Tracker,” the licensee used a “Daily Schedule” which listed all the events that were planned for that day and a “Schedule Book” (which was an “At-A-Glance” 12-Month Calendar) listing activities scheduled for the entire year. The inspector noted that periodic surveillance activities were also scheduled and tracked through this system. All these activities were discussed and coordinated through the morning meeting held each day (as discussed above). The program appeared to be effective.

(2) Surveillance

Various periodic surveillance verifications and calibration of equipment, including the testing of various reactor systems, instrumentation, and auxiliary systems were reviewed by the inspector. TS surveillance items were completed on schedule as required by TS and in accordance with licensee procedures. As noted above, the “Test and Calibration Tracker” system was used to track completion of the various required surveillances and verifications. The inspector noted that completion of these surveillance activities was documented in one of the three MITR-II “Systems, Tests, and Calibrations” notebooks. These notebooks listed who completed the surveillances and could be used to reference the checklists and associated forms used for the reactor operational tests and surveillances. The results of selected tests, checks, and calibrations reviewed by the inspector were noted to be within the TS and procedurally prescribed parameters. The inspector observed as the licensee conducted the Emergency Power Transfer Test. The inspector also observed a portion of the flushing of the heat exchangers. The proper procedures were followed for each job and each step of the procedure was completed as required.

c. Conclusions

The system for tracking and completing maintenance items and surveillance checks and calibrations appeared to be adequate and was being maintained as required. Maintenance and surveillance records, performance, and reviews satisfied TS and procedure requirements.

6. Fuel Movement and Handling

a. Inspection Scope (IP 69009)

To ensure that the licensee was following the requirements of TS Section 3.10, "Fuel Element and Core Component Handling and Storage," the inspector reviewed selected aspects of the following:

- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- PM 1.15 "Refueling," latest revision dated September 19, 1979
- PM 1.15.1 "Removal of Spent Fuel," latest revision dated July 21, 1981
- PM 3.3.1, "General Conduct of Refueling Operations," latest revision dated January 10, 1994
- PM 3.3.1.1, "Fuel Element Transfers: Core/Storage Ring/Vault," latest revision dated April 22, 1980
- PM 3.3.2.1, "Fuel Element Transfers: Storage Ring/Storage Vault," latest revision dated July 28, 1981
- PM 3.3.3.1, "Fuel Element Transfers: Storage Ring to Fission Converter," latest revision dated September 16, 2005
- Core Configuration No. 189 approved packet, including:
 - "Fuel Loading Permission" Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 9, 2009
 - "Fuel Removal Permission" Form – form revision dated July 21, 1981; and completed for the latest fuel element transfers on March 6, 2009
 - "Transfer Schedule" Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 8, 2009
 - "Core Configuration" Form – form revision dated October 27, 1989; and completed for the latest fuel element transfers on March 10, 2009
 - "Transfer Schedule: Fuel Storage Ring/Fuel Storage Pool" Form – form revision dated January 10, 1986 and completed for the latest fuel element transfers on March 10, 2009
 - "Safety and Operating Limits for Core No. 189," no date
 - "Elements with a 30% Excess Loading over 20-22 inches for Core No. 189," no date
 - "Elements with a 30% Excess Loading over 2-4 inches for Core No. 189," no date

- “Fuel Loading Verification” Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 16, 2009

b. Observations and Findings

The inspector reviewed the fuel movement process and verified that fuel moves were designed according to established procedure and documented on specific fuel movement sheets developed by the Associate Director, Reactor Engineering. The inspector reviewed selected fuel movement sheets for 2008. They had been developed and used for each specific core refueling as required.

The inspector reviewed the preparations for, and follow-up to, the refueling recorded in the reactor logbook that occurred on March 9 and 10, 2009. The resultant “new” core was designated as Core Number 189. The new core design and fuel moves to achieve the new configuration were developed in a systematic manner using an approved computer code. The core configuration package was approved and subsequently used by reactor operators, in addition to the routine procedures, for completing the fuel moves. The inspector noted that fuel moves had been completed as specified and that fuel removed from the core was placed in specified locations meeting the requirements of TS 3.10.3. The inspector also compared the location of fuel elements in the reactor core as indicated on the fuel movement/transfer forms for the latest core with the information maintained on the MITR-II Fuel Status/Location Board in the Control Room. No problems or anomalies were noted.

c. Conclusions

Fuel movements were performed in accordance with approved procedures and TS requirements.

7. Experiments

a. Inspection Scope (IP 69005)

To verify compliance with the licensee’s procedures, TS Sections 6.1, 7.5.1, and 7.9, and 10 CFR 50.59, the inspector reviewed:

- Reactor Logbook #115, April 6, 2008 to August 6, 2008
- Reactor Logbook #116, August 6, 2008 to December 5, 2008
- Reactor Logbook #117, December 5, 2008 to the present
- PM 1.4, “Review and Approval of Plans, Procedures and Facility Equipment and Changes Thereto,” latest revision dated May 6, 2008
- PM 1.10.1, “Experiment Review and Approval – General,” latest revision dated September 19, 1979
- PM 1.10.2, “MIT Reactor Safeguards Committee,” latest revision dated September 19, 1979
- PM 1.10.3, “MITR Operations,” latest revision dated January 10, 1986
- PM 1.10.7.1, “Sample Irradiations,” latest revision dated March 11, 1988, which included instructions on completion of “MIT Part I – Irradiation

- Request Form” and “MIT Part II – Irradiation Information Form”
- MIT Part I – Irradiation Request Form, MITR Reference (Ref.) No. 132-1, concerning irradiation of gold seeds and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed in February 2009
- MIT Part I – Irradiation Request Form, MITR Ref. No. 55-26 and Addendum, concerning irradiation of zinc oxide and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed in February and July of 2008
- MIT Part I – Irradiation Request Form, MITR Ref. No. 22-102 (updated), concerning irradiation of neutron detectors with various shielding materials and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed in February and March of 2009

b. Observations and Findings

The inspector noted that the review and approval process described in PM 1.10.1 through 1.10.6 referred to experimental facilities and equipment installed in the reactor. This was an extensive process and typically involved the completion of a Safety Review Form with accompanying documentation. These were reviewed by Reactor Operations personnel (typically the Superintendent of Reactor Operations) and by the Reactor Radiation Protection Officer and ultimately submitted to the MITRSC for review and approval. The review and approval of samples or material to be irradiated using these facilities or equipment were required to be completed by the Reactor Supervisor and the Reactor Radiation Protection Officer. These reviews were documented on the MIT Part I – Irradiation Request Forms (IRFs). Typically the Superintendent of Reactor Operations also reviewed these forms.

The inspector reviewed selected Safety Review Forms and IRFs for experiments that were currently active. The experimental facilities and/or equipment had been evaluated in accordance with TS requirements and the associated data sheets indicated that the experiments would be within the specified limits. The analysis for each had been performed and the reviews and approvals completed. The appropriate reviews and approvals had also been completed for the samples and/or materials to be irradiated and the experiments were conducted with the cognizance of the Reactor Supervisor and in accordance with the specified requirements. The inspector also noted that the materials produced were handled and transferred as required.

c. Conclusions

Conduct and control of experiments met the requirements of the TS and the applicable facility procedures.

8. Procedures

a. Inspection Scope (IP 69008)

To verify that the licensee was meeting the requirements of TS Section 7.8, "Operating Procedures," the inspector reviewed selected aspects of:

- PM 1.4, "Review and Approval of Plans, Procedures and Facility Equipment and Changes Thereto," latest revision dated May 6, 2008
- PM 1.5, "Procedure Adherence and Temporary Change Method," latest revision dated September 19, 1979
- Safety Review Form No. E-08-1, "Installation and Testing of New Blade Height Indicators," dated July 1, 2008
- Safety Review Form No. M-08-1, "Graphite Gasholder Bypass," dated July 23, 2008
- Safety Review Form No. O-08-4, "PM 6.5.5, Backup Reactor Steam Supply Availability," dated October 8, 2008
- Safety Review Form No. O-08-6, "PM 7.3.2, D₂O Ion Column Dedeuterization/Deuterization," dated October 8, 2008

b. Observations and Findings

The inspector noted that operations procedures were reviewed annually by all licensed operators as required and revised as needed. Major procedure revisions were reviewed and approved by the Director of Reactor Operations and submitted to the MITRSC for review. It was also noted that management and supervisory oversight was focused on proper implementation and adherence to procedures. Through observation of various activities in progress during the inspection, the inspector noted that adherence to procedures was adequate.

c. Conclusions

Procedures were properly prepared and implemented in compliance with license requirements.

9. Emergency Preparedness

a. Inspection Scope (IP 69011)

The inspector reviewed selected aspects of the following to verify compliance with TS Sections 7.8.1.i and 7.8.4 and the licensee's Emergency Plan and Procedures:

- Review and Critique of the 2007 Medical Emergency Drill conducted August 22, 2007
- Review and Critique of the 2007 Radiological Emergency Exercise conducted March 11, 2008
- Review and Critique of the 2008 Medical Emergency Drill conducted March 31, 2008

- Review and Critique of the 2008 Radiological Emergency Exercise conducted October 28, 2008
- PM 4.0, "MITR-II Emergency Plan and Procedures," latest revision dated April 30, 1997
- PM 4.0, "MITR-II Emergency Plan and Procedures," Appendix A, "Agreements with Civil Authorities and Hospitals," letters dated March – May 2006
- PM 4.3, "Organizations and Responses," latest revision dated April 30, 1997
- PM 4.4, "Emergency Classification System," latest revision dated April 30, 1997
- PM 4.5, "Emergency Action Levels," latest revision dated April 30, 1997
- PM 4.6, "Emergency Planning Zone," latest revision dated April 30, 1997
- PM 4.7, "Emergency Response," latest revision dated April 30, 1997
- PM 4.8, "Emergency Facilities and Equipment," latest revision dated April 30, 1997
- PM 4.9, "Recovery," latest revision dated April 30, 1997
- PM 4.10, "Maintenance of Emergency Preparedness," latest revision dated April 30, 1997
- PM 4.4.4, "Emergency Operating Procedures," including PM 4.4.4.10, "Medical Emergency," latest revision dated July 27, 1984, through PM 4.4.4.16, "Instructions to the MIT Campus Police During MIT Reactor Radiological Emergencies," latest revision dated April 4, 1994
- PM 4.4.4.14, "Excess Radiation at the Exclusion Area (Site) Boundary Resulting from a Contained Source," latest revision dated April 30, 1997, which included the "MIT Reactor Emergency Notification Lists," latest revision dated April 16, 2009
- PM 6.6.1.1, "Radiological Emergency Exercise," latest revision dated October 11, 1984
- PM 6.6.1.3, "Medical Emergency Drill," latest revision dated January 9, 1984
- PM 6.6.2.4, "Inventory of Emergency Supplies and Equipment," latest revision dated January 9 1984

b. Observation and Findings

The inspector reviewed the Emergency Plan (E-Plan) in use at the reactor and verified that the E-Plan was reviewed annually by all licensed operators as noted above. The Emergency Procedures Manual (containing E-Plan implementing procedures) was also reviewed and revised as needed to ensure effective implementation of the E-Plan.

Through records reviews and interviews with facility emergency personnel (i.e., licensed operators or emergency responders), the inspector determined that they were knowledgeable of the proper actions to take in case of an emergency. Training for staff members had been conducted annually as required and documented acceptably. Emergency training for MIT Police officer was conducted annually as required. Training for Cambridge City Fire Department personnel was completed periodically with the last training conducted in the October – November 2006 timeframe. This was consistent with the specifications of the E-Plan.

The inspector verified that Letters of Agreement with the City of Cambridge Fire Department, Police Department, and Emergency Management Department, as well as the Letter of Agreement with the Massachusetts General Hospital, were on file and being maintained. It was noted that the agreements had last been signed in the period from March – May 2006. The licensee acknowledged this and indicated that these support organizations should be contacted in the near future to initiate updated agreements. The inspector agreed although it was noted that the E-Plan did not specify a time frame for renewing the letters.

Communications capabilities with support groups were acceptable and had been periodically checked. Emergency Call Lists had been revised and updated as needed and were available in various areas of the facility, including in controlled copies of the Emergency Procedures Manuals. The inspector also verified that emergency equipment was being inventoried quarterly as required. During the inspection, the inspector accompanied a licensee representative while an inventory of an emergency locker was conducted. The inspector verified that all the required items were available in case of an emergency as required.

The inspector verified compliance with the TS Section 7.8.4 requirement for annual Emergency Plan drills. The licensee met this requirement by conducting radiological emergency and medical emergency drills each year. Following each drill a critique was conducted, identifying areas of strength and weakness with action plans to address weaknesses. Drills and critiques were documented in writing as referenced above. The drills appeared to be adequate.

The inspector visited the MIT Medical Center where reactor staff personnel with minor injuries would be treated. (Those with major medical emergencies would be directed to go the Massachusetts General Hospital.) The inspector observed as the MIT Medical Center Associate Medical Director demonstrated where a victim could be taken directly from an ambulance into a treatment or decontamination (decon) room that adjoined the Walk-in Clinic. The decon room was equipped with a radiation survey instrument, instructions on receiving and handling radiation accident victims, decon supplies, and shower facilities. The inspector noted that the MIT Medical Center also had its own ambulance service with 24/7 student Emergency Medical Technician coverage.

c. Conclusions

The licensee was maintaining acceptable emergency preparedness in accordance with TS and E-Plan requirements.

9. Exit Interview

The inspection scope and results were summarized on April 16, 2009, with members of licensee management. The inspector described the areas inspected and discussed the preliminary inspection findings. The licensee did not offer any dissenting opinions or identify any information to be withheld from public disclosure.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel:

J. Bernard	Director of Reactor Operations
T. Bork	Irradiation Services Coordinator
E. Block	Maintenance Supervisor
P. Drooff	Environmental Health and Safety (EHS) Senior Officer
J. Foster	Assistant Superintendent of Operations
E. Lau	Superintendent of Reactor Operations
W. McCarthy	Reactor Deputy Director of EHS and Reactor Radiation Protection Officer
D. Moncton	Director, Nuclear Reactor Laboratory
T. Newton	Associate Director, Reactor Engineering
S. Tucker	Quality Assurance Supervisor
F. Warmasley	Reactor Supervisor and Training Supervisor

Other Personnel:

D. Diamond	Associate Medical Director, MIT Medical Center
J. Puibello	Nurse Practitioner and Coordinator, Urgent Care, MIT Medical Center

INSPECTION PROCEDURES USED

IP 69003	Class 1 Research and Test Reactor Operator Licenses, Requalification, and Medical Examinations
IP 69005	Class 1 Research and Test Reactor Experiments
IP 69006	Class 1 Research and Test Reactors Organization and 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 Reactors Procedures
IP 69009	Class 1 Research and Test Reactor Fuel Movement
IP 69010	Class 1 Research and Test Reactor Surveillance
IP 69011	Class 1 Research and Test Reactor Emergency Preparedness

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED:

None

CLOSED:

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Documents Access and Management System
CFR	<i>Code of Federal Regulations</i>
EHS	Environmental Safety and Health
IP	Inspection Procedure
IRF	Irradiation Request Form
MIT	Massachusetts Institute of Technology
MITR-II	Massachusetts Institute of Technology Reactor
No.	Number
NRC	Nuclear Regulatory Commission
NRL	Nuclear Reactor Laboratory
PARS	Publicly Available Records
QA	Quality Assurance
Ref.	Reference
RO	Reactor Operator
RSC	Reactor Safeguards Committee
SRO	Senior Reactor Operator
TS	Technical Specification
Vol.	Volume