

June 6, 2011

Dr. Thomas H. Newton
Interim 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. 50-020/2011-201

Dear Dr. Newton:

On May 10-12, 2011, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the Massachusetts Institute of Technology Research Reactor facility (Inspection Report No. 50-020/2011-201). The enclosed report documents the inspection results, which were discussed on May 12, 2011, 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 inspectors reviewed selected procedures and records, observed activities, and interviewed 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).

Should you have any questions concerning this inspection, please contact Craig Bassett at (301) 466-4495 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

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

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

Enclosure: NRC Inspection Report No. 50-020/2011-201
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

Mr. Robert Gallagher, Acting Director
Radiation Control Program
Department of Public Health
Schrafft Center, Suite 1M2A
529 Main Street
Charlestown, MA 02129

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

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

Docket No.: 50-020

License No.: R-37

Report No.: 50-020/2011-201

Licensee: Massachusetts Institute of Technology

Facility: Nuclear Reactor Laboratory

Location: Cambridge, Massachusetts

Dates: May 10-12, 2011

Inspectors: Craig Bassett
Jack Donohue

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

EXECUTIVE SUMMARY

Massachusetts Institute of Technology
Nuclear Reactor Laboratory
NRC Inspection Report No.: 50-020/2011-201

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 six 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. One non-cited violation was identified concerning the core purge blower and is discussed in Section 3 of the report.

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 being completed 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 generally 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 generally being completed as required.

REPORT DETAILS

Summary of Facility Status

The Massachusetts Institute of Technology (MIT, the licensee) Nuclear Reactor Laboratory (NRL) six megawatt (6 MW) research and test reactor continued to be operated in support of experiments, research and service irradiations, reactor operator training, and periodic equipment maintenance and surveillance activities. The reactor is typically operated approximately 300 days per year with operations running 24 hours a day, 7 days a week, for about four weeks followed by a shutdown varying from 8 hours to two weeks in length. During the inspection, the reactor was operated continuously to support ongoing experiments and material irradiation.

1. Organization and Staffing

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

The inspectors reviewed the following regarding the Massachusetts Institute of Technology Reactor (designated as MITR-II) organization and staffing to ensure that the requirements of Technical Specification (TS) Section 7.1, "Organization," Revision (Rev.) 6, implemented through renewed Facility Operating License R-37, issued November 1, 2010, were being met:

- Management responsibilities
- Qualifications of facility operations personnel
- MIT NRL Organization Chart, dated May 10, 2011
- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011
- Reactor Logbook #123, February 22, 2011 to present
- Staffing requirements for reactor operation stated in TS Section 7.1.3
- Procedure Manual (PM) 1.1, "Organization," which included:
 - PM 1.1.2, "Reactor Division," latest revision dated January 30, 1984
 - Table 1.1.2-1, "Reactor Division," latest revision dated April 13, 2009
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2009, to June 30, 2010," submitted to the NRC August 29, 2010
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period January 1, 2010, to December 31, 2010," submitted to the NRC March 31, 2011

b. Observations and Findings

The inspectors noted that the Director of Reactor Operations continued to report 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. The organizational structure and the responsibilities of the reactor staff had not changed since the last inspection. However, it was noted that the person who had occupied the position of Director of Reactor Operations for many years had been reassigned to the position of Senior Advisor. Another person on staff, the Associate Director of Reactor Engineering, had been appointed to be the Director of Reactor Operations on an interim basis. The inspector verified that the new appointee met the requirements specified in TS Section 7.1.4.1 for that position.

Staffing levels remained consistent with those noted during the last inspection of the 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 RO positions were full-time while the other three-fourths were part-time positions (mostly students). In addition to the operations staff, there were various support groups including a Research Staff, a Research Development group, a Reactor Engineering staff, Maintenance personnel, and a Reactor Radiation Protection group.

Through a review of selected reactor operations logs for the period from April 2010 through the present, and through interviews with operations personnel, the inspectors determined that the licensee continued to operate 24/7 with three crews and no shift rotation. Each operating crew was staffed with various personnel (with at least two people on duty at the MITR-II 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 during reactor operations met the minimum requirements for duty and on-call personnel specified in TS Section 7.1.3.

c. Conclusion

The licensee's organization and staffing were in compliance with the requirements specified in TS Section 7.1.

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 7.2.2 and 7.2.3 and to ensure that facility changes were reviewed and approved as required by TS Section 7.2.2 and in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, the inspectors reviewed selected aspects of:

- Annual Independent Audits conducted in 2009 and 2010
- Administrative Audits for the Calendar Months of October, November, and December 2009, January, February, and March; April, May and June; and July, August, and September 2010
- Charter of the MIT Reactor Safeguards Committee, latest approved revision dated January 20, 2010
- Memorandum addressed to the Reactor Safeguards Committee entitled, "Authority of Standing and Special Subcommittees," dated January 20, 2010
- MIT Reactor Safeguards Committee meeting minutes for 2009 through the present
- MIT Reactor Safeguards Committee Standing and Special Subcommittee meeting minutes for 2009 through the present
- PM 1.1, "Organization," which included Section 1.1.1 "MIT Administration and Committees," latest revision dated March 18, 1991
- PM 1.4, "Review and Approval of Plans, Procedures and Facility Equipment and Changes Thereto," which included
 - PM 1.4.1, "Plan, Procedure, and Equipment Change Classification," latest revision dated September 3, 1998
 - PM 1.4.2, "Class C Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.3, "Class B Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.4, "Class A Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.5, "Safety Review Form," latest revision dated June 22, 1988
 - PM 1.4.6, "Procedure Manuals," latest revision dated June 22, 1988
 - Safety Review Form (example), latest revision dated May 6, 2008
- PM 1.10, "Experiment Review and Approval," which included Section 1.10.2, "MIT Reactor Safeguards Committee," latest revision dated March 11, 1988
- PM 1.18, "Audits, which included:
 - Section 1.18.1, "Internal Audits," latest revision dated January 10, 1986
 - Section 1.18.2, "Independent Audits," latest revision dated September 18, 1984
- Safety Review Form No. O-10-5, Item: PM 3.6 "Waste Discharge Procedure" dated May 5, 2011
- Safety Review Form No. M-10-3, Item: M-2010-3 "External Core Tank Sampling/Recirculation Procedure", dated May 12, 2010
- Safety Review Form No. E-11-2, Item: PM 7.4.4.10, "Draining a Core Purge Filter Jar," dated March 8, 2010
- Safety Review Form No. O-10-3, Item: PM 7.4.3.1 "Cooling Tower Drain", and Special Procedure to Drain the Secondary System Piping", dated April 28, 2010

- “MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2009, to June 30, 2010,” submitted to the NRC August 29, 2010
- “MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period January 1, 2010, to December 31, 2010,” submitted to the NRC March 31, 2011

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 7.2.1.1. Minutes of MITRSC meetings and those of the MITRSC Standing and Special Subcommittees demonstrated that the committee typically met more often than the frequency required by the TS. Through records review the inspectors determined that safety reviews were conducted by the MITRSC or by designated Subcommittee representatives as specified in TS 7.2.2. 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 inspectors noted that the quarterly audits for 2010 and the annual independent audits for Fiscal Year (FY) 2009 and FY 2010 were adequate and audited the activities specified in TS 7.2.3 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. The licensee responded to each audit, if required, and took corrective actions as needed.

(2) Design Change Functions

To satisfy the regulatory requirements stipulated in 10 CFR 50.59, “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 inspectors verified that the procedure adequately incorporated criteria provided by the regulations with additional requirements mandated by local conditions.

The inspectors 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. Depending upon the nature of the change or modification, Class B changes might also 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, or the security system. They typically required a review by the Radiation Protection group, as well as all the reviews and approvals noted above. In addition, these types of changes also required the review and approval of the MITRSC before implementation. Class A changes also included those that required a change to the license or TS, and thus, would require review and approval by the NRC.

The inspectors reviewed the MITRSC review function per Section 7.2.2.1 of the TS and requested the licensee provide validation that Class A changes were submitted to the MITRSC for review prior to being initiated. The licensee indicated that this was done but it was not well documented. The licensee was informed that the issue of documenting the fact that Class A changes were submitted to the MITRSC prior to implementation would be considered by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-020/2011-201-01).

The inspectors reviewed selected Safety Review Forms and the associated safety evaluation documents of reviews conducted during 2010 and to date in 2011. 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 formal MITRSC approval was required. Also, none of the changes was determined to constitute a safety question or concern and none required a license or TS amendment.

c. Conclusion

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 inspectors reviewed selected portions of the following:

- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011

- Reactor Logbook #123, February 22, 2011 to present
- PM 3.1, "Startup Checklists," which included:
 - PM 3.1.1, "Full Power Start-up Checklist," latest revision dated March 10, 2011
 - PM 3.1.6, "Restart Following an Unanticipated or Brief Scheduled Shutdown" latest revision date March 10, 2011
 - PM 3.1.1.4, "Surveillance- Two Loop Restart Incorporating Monthly Startup Surveillance, dated April 13, 2011
- PM 3.2, "Shutdown Checklists," which included PM 3.2.1, "Shutdown from Operations at Power," latest revision dated December 21, 2010
- PM 3.5, "Daily Surveillance Check," latest revision dated February 8, 2011
- "MIT Reactor Operating Data Log," latest revision March 20, 2011
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2009, to June 30, 2010," submitted to the NRC August 29, 2010
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period January 1, 2010, to December 31, 2010," submitted to the NRC March 31, 2011

b. Observations and Findings

(1) Reactor Operation

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

(2) Staff Communication

During the inspection, the inspectors attended operations crew shift turnover meetings on Tuesday and Wednesday 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 inspectors 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 inspectors also attended the Daily Schedule Meeting (or Plan of the Day meeting) on Tuesday and Wednesday morning. The meetings were conducted by the Interim Director of Reactor Operations and the Superintendent of Operations. Licensed reactor operators were in

attendance, as well as representatives from the other support organizations at the facility. The Superintendent of Operations led a detailed discussion on the upcoming outage including maintenance items and tests to be performed as well as safety-significant issues. Concerns or schedule conflicts were resolved during the meeting. The inspectors noted that the Daily Schedule Meeting ensured that everyone was informed about current facility conditions and aware of the scheduled activities for that day.

(3) Core Purge Blower Problem

TS Section 3.3.2 states that in the event of isolation of the air space above the core for more than five minutes, reactor power shall be reduced to less than 100 kilowatts (kW).

At 10:30 p.m. on April 20, 2011, the reactor was operating at 5.5 Megawatts (MW). The on-duty shift personnel (a Senior Reactor Operator (SRO) and a Reactor Operator at the console) commenced testing the off-site alarm system in accordance with procedure. With the SRO stationed outside the reactor containment building to observe proper functioning of the test, the console operator was directed to turn down the high level trip on the sewer monitor in order to generate an alarm condition. Once activated, this alarm is transmitted off-site and its receipt can be used to verify the operability of the off-site alarm system.

The console operator inadvertently turned down the trip of the core purge radiation monitor instead of the sewer monitor. This generated a "Low Flow Core Purge" alarm, as well as a "High Radiation Core Purge" alarm but not the intended "High Level Radiation" alarm. The console operator acknowledged the two alarms but did not realize that they were not the one that had been requested. The "High Radiation Core Purge" alarm was subsequently cleared by resetting its trip. However, the console operator neglected to restart the core purge blower.

The SRO outside containment assumed that the console operator had turned down the sewer monitor's trip and that for some reason it had not generated the desired off-site alarm. Therefore, the SRO told the console operator to use an area radiation alarm to generate the "High Level Radiation" alarm. The console operator initiated and then acknowledged an area radiation monitor alarm. At this point, the SRO noted that the off-site alarm was received as expected. The console operator then reset the trip of the area radiation monitor and cleared the "High Level Radiation" alarm. The SRO continued with the rest of the procedure for testing off-site alarms. At 11:20 p.m., the procedure was completed and the SRO returned to the control room. Upon seeing the control panel, the SRO noted that the core purge blower was off and immediately restarted it. Licensee management was notified of the problem.

The licensee initiated an investigation and review of the event. They found that the core purge blower had been inoperable for a period greater than 5 minutes (isolating the air space above the core) but reactor power had not been reduced to less than 100 kW as required by TS 3.3.2. It was determined that the cause of the occurrence was human error. A related cause was that, while the core purge blower is equipped to alarm on low flow, there was no scram on a low flow core purge condition. The licensee also determined that, although the core purge blower had not been functioning for a total of 50 minutes, there was no abnormal release of radioactive particulates.

As a result of this event the licensee took various corrective actions as follows: 1) The console operator was retrained as to the proper actions to take during the off-site alarm test with emphasis on proper observation of control panel conditions. 2) A scram function was also installed on the core purge blower. The system had always alarmed on loss of flow. Now, if flow is not restored within two minutes, a second alarm will occur. If flow remains off for an additional two minutes, a scram will occur. 3) Training sessions for all staff members were held to review this problem and ensure that all operators were aware of the proper actions to take.

One other corrective action is still pending but it is a long-term item. The licensee is in the process of determining the possible maximum hydrogen concentration levels that could accumulate in the air space above the core under varying conditions.

The licensee made an initial report to the NRC by telephone on April 25, 2011. A written report was subsequently submitted to the NRC on April 29, 2011.

The inspectors reviewed the event and the corrective actions taken by the licensee. Through interviews and review of the Reactor Console Logbook and training records, the inspectors verified that the actions, with the exception of the hydrogen review, had been completed. The inspectors agreed that the root cause of the problem was human error.

The inspectors determined that the problem had been identified and reviewed by the licensee and reported to the NRC. The short-term corrective actions had been identified and completed as well. As a result, the licensee was informed that this non-repetitive, licensee-identified and corrected violation would be treated as a Non-Cited Violation (NCV), consistent with Section 2.3.2 of the NRC Enforcement Policy (NCV 50-020/2011-201-02).

The licensee was also advised that the long-term issue of determining the maximum concentration of hydrogen in the space above the core will be considered by the NRC as an Inspector Follow-up Item (IFI) and will be reviewed during future inspections (IFI 50-020/2011-201-03).

c. Conclusion

MITR-II reactor operations, as well as shift turnovers and operator cognizance of facility conditions during pre-startup and routine operation, were acceptable. Daily meetings were being held to ensure proper planning and preparation for operations activities. One NCV was identified concerning the core purge blower being shut off for a period greater than 5 minutes (isolating the air space above the core) but reactor power was not reduced to less than 100 kW as required by TS 3.3.2.

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, TS Section 7.2.3.b), and Chapter 12, Sections 12.1 and 12.10 of the facility Safety Analysis Report, the inspectors reviewed selected aspects of:

- Current status of operator licenses
- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011
- Reactor Logbook #123, February 22, 2011 to present
- Results of the 2009 and 2010 Annual Written Examinations
- Reactor operator files maintained in the Operations Office
- 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, "Requalification and Qualification," which included:
 - Section 1.16.1, "Requalification Program for Licensed Personnel," latest revision dated March 11, 1988
 - Section 1.16.2, "MITR Operations Qualification Program for Senior Reactor Operators/Shift Supervisors," latest revision dated May 6, 2004
 - Section 1.16.3, "MITR Operations Qualification Program for Operators," latest revision dated May 6, 2004
 - Section 1.16.4, "Operator and Senior Operator Review Board Evaluation Form," latest revision dated September 19, 1979

b. Observation and Findings

(1) Requalification Program

There were 30 individuals licensed to operate the reactor at MIT. Of those personnel, 19 were qualified SROs and 11 were ROs. A review of

various Requalification Program records indicated that the program was generally maintained up-to-date and that RO and SRO licenses were current. MITR-II operator files and Reactor Logbooks also showed that 28 of the 30 operators maintained active duty status. A review of the MITRSC meeting minutes and independent audit results indicated that the program was being audited annually as required by TS Section 7.2.3.b.

A review of the pertinent 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, procedure changes, and other relevant information was routinely routed to all licensed operators for their review. The inspectors 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. The inspectors also noted that all operators were receiving biennial medical examinations within the time frame allowed as required by the program.

As indicated above, two SROs' licenses were "inactive." This was due to the fact that 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 the two operators completing the required number of manipulations and other activities under the supervision and observation of a Reactor Supervisor.

(2) Revised Requalification Program

The facility was issued a renewed Facility Operating License R-37, on November 1, 2010. The Operator Requalification Program was described in Chapter 12 of the accompanying Safety Analysis Report (SAR). That Chapter indicated that the program would consist of various portions including: 1) lectures and reviews, 2) on the job training (i.e., conduct of reactivity manipulations, participation in emergency drills and exercises, and emergency and abnormal procedures reviews), 3) a biennial written examination, 4) an annual walk-through examination, and 5) a biennial medical examination. During this inspection the licensee was still in the process of implementing some aspects of this revised program. The Director of Reactor Operations was informed that the issue of implementing the revised operator requalification program would be considered by the NRC as an Inspector Follow-up Item (IFI) and would be reviewed during a future inspection (IFI 50-020/2011-201-04).

c. Conclusion

Operator requalification was generally up-to-date and 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 and that maintenance was being conducted, the inspectors reviewed selected aspects of:

- MITR-II Job Workbook
- MITR-II Daily Operations Schedule
- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011
- Reactor Logbook #123, February 22, 2011 to 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, "Technical Specification Tests," which included PM 6.1.1, "Emergency Cooling System," latest revision dated March 28, 1997
- PM 6.1.2. "Containment Tests," which included PM 6.1.2.1, "Building Pressure Test," latest revision dated September 23, 1974
- PM 6.1.3, "Calibrations," which included: PM 6.1.3.6, "Building Overpressure Scram," latest revision dated April 17, 1979
- PM 6.1.4, "Response Times," which included PM 6.1.4.3 (Part B), "Damper Closing Time Shutdown," latest revision dated March 28, 2000
- PM 6.2, "Scram Tests," which included PM 6.2.2, "Basement Personnel Air Lock Gaskets," latest revision dated June 25, 1975
- PM 6.3, "Interlock Tests," which included PM 6.3.3, "Waste Tank System Alarm and Interlock," latest revision dated May 24, 1977
- PM 6.5, "Miscellaneous Tests and Calibrations," which included PM 6.5.14, "Calibration of Shim Blade Drop Timer Interlock," latest revision dated June 5, 1990
- PM 6.6, "Radiological Emergency Exercise," which included PM 6.6.2.4, "Inventory of Emergency Supplies and Equipment," April 13, 1999
- Surveillance activities and equipment maintenance documented in the 2010 Test and Calibration Tracker
- Surveillance activities and equipment maintenance documented in the 2011 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, 2009, to June 30, 2010,” submitted to the NRC August 29, 2010
- “MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period January 1, 2010, to December 31, 2010,” submitted to the NRC March 31, 2011

b. Observations and Findings

(1) Maintenance

The inspectors 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 as well as MITR-II “Systems, Tests, and Calibrations” notebooks to document completion of the various periodic maintenance and surveillance activities. The inspectors noted that all such tasks were tracked through this system. Also, 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 records of equipment, including the testing of various reactor systems, instrumentation, and auxiliary systems were reviewed by the inspectors. 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 inspectors 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 inspectors were noted to be within the TS and procedurally prescribed parameters.

c. Conclusion

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 Sections 3.1.4, 3.1.6, 4.1.5, and 5.4, the inspectors reviewed selected aspects of the following:

- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011
- Reactor Logbook #123, February 22, 2011 to present
- PM 1.15 "Refueling," which included PM 1.15.1 "Removal of Spent Fuel," latest revision dated October 27, 1989
- PM 3.3, "Movement of Fuel," which included PM 3.3.1, "General Conduct of Refueling Operations," latest revision dated January 10, 1994
- PM 3.3.1, "General Conduct of Refueling Operations," which included PM 3.3.1.1, "Fuel Element Transfers: Core/Storage Ring/Vault," latest revision dated April 22, 1980
- PM 3.3.2, "General Conduct of Removal of Spent Fuel," which included PM 3.3.2.1, "Fuel Element Transfers: Storage Ring/Storage Vault," latest revision dated July 28, 1981
- PM 3.3.3, General Conduct of Transfer of Spent Fuel to Fission Converter," which included PM 3.3.3.1, "Fuel Element Transfers: Storage Ring to Fission Converter," latest revision dated September 16, 2005
- Core Configuration No. 198 approved packet, including:
 - "Fuel Loading Permission" Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 11, 2011
 - "Fuel Removal Permission" Form – form revision dated July 21, 1981; and completed for the latest fuel element transfers on March 11, 2011
 - "Transfer Schedule" Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 9, 2011
 - "Core Configuration" Form – form revision dated October 27, 1989; and completed for the latest fuel element transfers on March 15, 2011
 - "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 9, 2011
 - "Fuel Loading Verification" Form – form revision dated September 19, 1979; and completed for the latest fuel element transfers on March 28, 2011
 - "Safety and Operating Limits for Core No. 198," no date listed
 - "Elements with a 30% Excess Loading over 20-22 inches for Core No. 198," no date listed

- "Elements with a 30% Excess Loading over 2-4 inches for Core No. 198," no date listed
- "Reactivity Change for Core No.198 – Form - form revision dated September 19, 1979, for latest core dated March 11, 2011

b. Observations and Findings

The inspectors 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 inspectors reviewed selected fuel movement sheets for 2010 and to date in 2011. They had been developed and used for each specific core refueling as required.

The inspectors reviewed the preparations for, and follow-up to, the refueling recorded in the reactor logbook that occurred on March 28, 2011. The resultant "new" core was designated as Core Number 198. 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 inspectors 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 3.1.4. The inspectors 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. Conclusion

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 and 7.5, and 10 CFR 50.59, the inspectors reviewed:

- Reactor Logbook #121, April 15, 2010, to October 15, 2010
- Reactor Logbook #122, October 15, 2010 to February 22, 2011
- Reactor Logbook #123, February 22, 2011 to present
- Experiment Review Process documented in PM 1.10, Experiment Review and Approval," which included:
 - PM 1.10.1, "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 1.10.4, "Radiation Protection Office," latest revision dated January 10, 1986
- PM 1.10.5, "Engineering and Design Section," latest revision dated September 19, 1979
- PM 1.10.6, "Electronics Section," latest revision dated September 19, 1979
- PM 1.10.7, "Records," latest revision dated March 11, 1988, including:
 - "MIT Part I – Irradiation Request Form"
 - "MIT Part II – Irradiation Information Form"
- PM 1.10.8, "Pneumatic Tube Irradiation Facilities," latest revision dated March 11, 1988
- PM 1.10.9, "Radioactive Material Governed by License R-37," latest revision dated January 31, 1985
- Quality Assurance Process documented in PM 1.13, "Quality Assurance Program," latest revision dated January 31, 1985
- MIT Part I – Irradiation Request Form, MITR Reference (Ref.) No. EPT-1 (now CBP-1), concerning irradiation of ultra high purity enriched boron 11 and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed during March and April, 2011
- MIT Part I – Irradiation Request Form, MITR Ref. No. 132-1, concerning irradiation of gold seeds encapsulated in platinum and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed from January through April, 2011
- MIT Part I – Irradiation Request Form, MITR Ref. No. 25-58, concerning irradiation of titanium compounds (alloy samples) and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed from February through April, 2011
- MIT Part I – Irradiation Request Form, MITR Ref. No. 25-59, concerning irradiation of hydride mini fuel rods and examples of the associated MIT Part II – Irradiation Information Forms for irradiations completed during March and April, 2011
- Safety Review Form No. O-11-4, concerning "Hydride Fuel Irradiation Experiment Test and Handling Procedures," dated February 15, 2011, approval dated March 15, 2011

b. Observations and Findings

The inspectors noted that the review and approval process described in PM 1.10 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. MIT Part II forms were used to document the irradiation data such as length of irradiation, etc.

The inspectors 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 under the cognizance of the Reactor Supervisor and in accordance with the specified requirements.

c. Conclusion

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 7.4, "Procedures," the inspectors reviewed selected aspects of:

- PM 1.1, "Organization," which included
 - PM 1.1.1, "MIT Administration and Committees," latest revision dated March 18, 1991
- PM 1.1.2, "Reactor Division," latest revision dated January 30, 1984, which included
 - PM 1.1.2.1, "Director of Reactor Operations," latest revision dated January 30, 1984
 - PM 1.1.2.2, "Operations Group," latest revision dated January 30, 1984
 - PM 1.1.2.3, "Mechanical Maintenance," latest revision dated January 2, 1981
 - PM 1.1.2.4, "Mechanical Engineering and Design," latest revision dated January 2, 1981
 - PM 1.1.2.5, "Business Office," latest revision dated January 2, 1981
 - PM 1.1.2.6, "Electronic Engineering and Maintenance," latest revision dated January 2, 1981
 - PM 1.1.2.7, "Reactor Utilization Supervisor," latest revision dated January 1, 1982
 - PM 1.1.2.8, "Other Nuclear Reactor Laboratory Groups," latest revision dated January 1, 1982

- PM 1.4, "Review and Approval of Plans, Procedures and Facility Equipment and Changes Thereto," which included
 - PM 1.4.1, "Plan, Procedure, and Equipment Change Classification," latest revision dated September 3, 1998
 - PM 1.4.2, "Class C Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.3, "Class B Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.4, "Class A Review and Approval," latest revision dated June 22, 1988
 - PM 1.4.5, "Safety Review Form," latest revision dated June 22, 1988
 - PM 1.4.6, "Procedure Manuals," latest revision dated June 22, 1988
- PM 1.5, "Procedure Adherence and Temporary Change Method," latest revision dated September 19, 1979
- Safety Review Form No. E-11-2, Item: PM 7.4.4.10, "Draining a Core Purge Filter Jar," dated March 8, 2010
- Safety Review Form No. O-10-3, Item: PM 7.4.3.1 "Cooling Tower Drain", and Special Procedure to Drain the Secondary System Piping", dated April 28, 2010

b. Observations and Findings

The inspectors noted that procedures had been developed for reactor operations and safety as required by the TS Section 7.4. The licensee's procedures were found to be acceptable for the current facility status and staffing level. The inspectors noted that the administrative procedure specified the responsibilities of the various positions and for the MITRSC.

Operations procedures were typically reviewed by operators and support personnel prior to being used/implemented and were revised as needed. The inspectors noted that abnormal and emergency procedures were reviewed annually by all licensed operators as required and revised when needed. Major procedure revisions were reviewed and approved by the Director of Reactor Operations and submitted to the MITRSC for review. All procedure changes were routinely routed to all operators for review as well.

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 inspectors noted that adherence to procedures was adequate.

c. Conclusion

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

9. Emergency Preparedness

a. Inspection Scope (IP 69011)

The inspectors reviewed selected aspects of the following to verify compliance with TS Section 7.2.3.d) and the licensee's Emergency Plan and Procedures:

- Training records for MITR Support Personnel
- Review and Critique of the 2009 Medical Emergency Drill conducted July 23, 2009
- Review and Critique of the 2009 Radiological Emergency Exercise conducted February 25, 2010
- Review and Critique of the 2010 Medical Emergency Drill conducted August 20, 2010 (actual event)
- Review and Critique of the 2010 Radiological Emergency Exercise conducted August 19, 2010
- PM 4.0, "MITR-II Emergency Plan and Procedures," which included:
 - PM 4.3, "Organizations and Responses," latest revision dated January 31, 2006
 - 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 4.0, "MITR-II Emergency Plan and Procedures," Appendix A, "Agreements with Civil Authorities and Hospitals," letters dated March – May 2006
- PM 4.4.4, "Emergency Operating Procedures," which included:
 - PM 4.4.4.10, "Medical Emergency," latest revision dated July 27, 1984
 - PM 4.4.4.11, "NW12 Evacuation," latest revision dated April 30, 1997
 - PM 4.4.4.12, "Reactor Containment Evacuation," latest revision dated September 30, 1998
 - PM 4.4.4.13, "Reactor Reentry," latest revision dated November 29, 1993
 - PM 4.4.4.14, "Excess Radiation at the Exclusion Area (Site) Boundary Resulting from a Contained Source," latest revision dated April 30, 1997
 - PM 4.4.4.15, "Escape of Airborne Radioactive Material from the Containment Building," latest revision dated April 30, 1997

- 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," which included the "MIT Reactor Emergency Notification Lists," latest revision dated January 15, 2011
- PM 6.6.1, "Emergency Plan Exercises, Drills, and Tests," which included
 - 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 6.6.1.4, "Communication Link Test," latest revision dated January 9, 1984
- PM 6.6.2, "Emergency Plan Maintenance," which included
 - PM 6.6.2.1, "Fire Extinguishers," latest revision dated January 26, 2000
 - PM 6.6.2.2, "Self-Contained Breathing Devices," latest revision dated February 19, 1987
 - PM 6.6.2.3, "Calibration of Portable Health Physics Instruments and Dosimeters," latest revision dated January 9, 1984
 - PM 6.6.2.4, "Inventory of Emergency Supplies and Equipment," latest revision dated April 13, 1999

b. Observation and Findings

The inspectors reviewed the Emergency Plan (E-Plan) and Implementing (or Emergency) Procedures in use at the reactor and verified that the emergency procedures were reviewed annually by all licensed operators as noted above. The Implementing/Emergency Procedures were being 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 inspectors 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. Training for Cambridge City Fire Department (CCFD) personnel was completed periodically with the last training conducted in the October – November 2006 timeframe. The licensee indicated that an invitation had been extended to the CCFD on several occasions to attend training or to visit the facility. Because of their busy schedule, the CCFD had not been able to attend recently.

Emergency training for MIT Police Department (PD) personnel was required to be conducted annually by E-Plan Section 4.10.1.1. When the inspectors reviewed the training, it was noted that the most recent training was held during March and July 2010.

The inspectors verified that Letters of Agreement (LOA) with the City of Cambridge Fire Department and Police Department, as well as the LOA with the

Massachusetts General Hospital, were on file and being maintained. It was noted that the agreements with the Fire Department and Police Department were signed in January and February of 2011 respectively. The LOA with the hospital had last been signed in May 2006.

Communications capabilities with support groups were acceptable and were verified annually through a communications check with the various organizations. 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 inspectors also verified that emergency equipment was being inventoried quarterly as required.

The inspectors verified compliance with the E-Plan 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 to identify areas of strength and weakness. Drills and critiques were documented in writing as referenced above. The drills appeared to be challenging and provided a good indication of each organization's responsiveness and capabilities.

The inspectors and the MITR Superintendent of Operations visited the MIT Medical Center where reactor staff personnel with minor injuries would be treated. (Those with major medical emergencies would be directed to one of the main hospitals in the area.) The inspectors 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 inspectors noted that the MIT Medical Center also had its own ambulance service typically with 24/7 student Emergency Medical Technician coverage.

c. Conclusion

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

10. Follow-up on Previously Identified Items

a. Inspection Scope (IP 92701)

The inspector reviewed the actions taken by the licensee in response to various previously identified Inspector Follow-up Items (IFIs) including: IFI 50-020-99-201-01, IFI 50-020/2001-201-01, IFI 50-020/2002-202-01, IFI 50-020/2010-201-01 and IFI 50-020/2010-02.

b. Observations and Findings

- (1) IFI 50-020/99-201-01 - Follow-up on the actions taken by the Licensee to conduct a safety review and a 50.59 review for the cooling tower replacement project.

During an inspection of the MITR-II facility in June-July 1999, it was noted that records and observations indicated that changes at the facility were acceptably reviewed in accordance with 10 CFR 50.59, the TS, and applicable licensee administrative procedures. Completed reviews were comprehensive and submitted to the Reactor Safeguards Committee as specified in the TS. However, records of the safety review and the 50.59 review for the cooling tower replacement had not been completed. The Director of Reactor Operations stated that the records required by procedure, PM 1.4, would be completed by July 14, 1999.

During this inspection, the licensee provided the inspector with the completed safety and 50.59 reviews required by procedure. Safety Review Form No. M-99-1, documenting the safety review of the cooling tower replacement project was completed July 6, 1999. Accompanying the safety review was a 50.59 review that made the determination that there were no unreviewed safety questions involved. This IFI is considered closed.

- (2) IFI 50-020/2001-201-01 - Follow-up on the licensee's actions to complete an update to the Physical Protection Plan and submit the changes to the NRC in accordance with 10 CFR 50.54(p)(2).

During an inspection of the MITR-II facility in January 2001, the inspector noted that some physical protection systems (barriers and alarms) had recently been changed to eliminate spurious alarms. The inspector also noted that one other detector was not routinely tested. The licensee indicated that the Physical Protection Plan would be updated and changes submitted to the NRC in accordance with 10 CFR 50.54(p)(2).

During this inspection, the inspectors were provided with Safety Review Form No. O-01-6, dated May 7, 2001. The form documented the review of the changes to the physical protection system. The licensee also produced a letter from MIT to the NRC, dated August 15, 2001, which documented and submitted the changes that had been made in accordance with 10 CFR 50.54(p)(2). This IFI is considered closed.

- (3) IFI 50-020/2002-202-01 - Follow-up on the actions taken by the licensee to review the specifications of waste water pump and mechanical filter associated with the waste water tank and discharge system.

During the inspection in July 2002, the inspector accompanied a technician during the sampling and analysis of the waste water tank contents prior to discharge. The tank had been recirculated for greater

than six hours as required by procedure. The technician properly prepared the samples for counting and conducted liquid scintillation, gas flow proportional detection of beta/gamma on a boil down sample, and gamma spectroscopy. Liquid scintillation samples were also sent to the campus laboratory for confirmation. Results were provided to the RRPO for approval. This discharge to the sanitary sewer satisfied the radionuclide concentration requirements in 10 CFR 20.2003(a)(3) and 10 CFR 20 Appendix B table 3. Dilution by cooling tower blowdown was incorporated into the calculation. No other dilution was assumed. This was conservative.

However, the sample appeared murky and the inspector verified that the sample point was downstream of the in-line mechanical filter. Filtration was a method described in NRC Information Notice 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewage Under the Revised 10 CFR Part 20", dated January 28, 1994, to satisfy the requirements in 10 CFR 20.2003(a)(1). The filter's particle removal specifications were not readily available and neither was the flow rate of the recirculation/discharge pump. The licensee stated that this data would be obtained and reviewed.

During this inspection, the licensee provided the inspector with the particle removal specifications of the filters that are used in the waste water tank and discharge system. The flow rate of the recirculation/discharge pump were also made available through documentation of forms used when completing PM 3.6, "Waste Tank Discharge Procedure," latest revision dated May 5, 2011. The specifications for the filter and the flow rate of the pump appeared to be appropriate for use with the waste water system. This IFI is considered closed.

- (4) IFI 50-020/2010-201-01 - Follow-up on the actions taken to ensure that annual written examinations and quizzes required by the Requalification Program are completed in a timely manner.

During the inspection in March 2010, it was noted that annual written examinations were being completed by the operators as required. However, it was noted that the annual written examinations for 2009 and some quizzes had not been completed until February or March 2010. The inspectors spoke with the licensee about this apparent problem. The licensee acknowledged that there had been a problem with the administration of the annual examination. The licensee indicated that the schedule had slipped as a result of some personnel issues and the fact that they had, until recently, been heavily involved in security system upgrades. The Director of Reactor Operations indicated that this was not a recurring problem and that more attention would be given to maintaining the Requalification Program up-to-date in the future.

During this inspection, the inspector reviewed the dates of the administration of the 2010 annual written examinations. The exams had

been scheduled during the last week of December but, due to vacations and inclement weather, the exams had to be postponed. However, all the exams were completed by January 14, 2011. This appeared to be acceptable. The licensee was encouraged to continue to concentrate on conducting the exams in a timely manner. This IFI is considered closed.

- (5) IFI 50-020/2010-201-02 - Follow-up on the licensee's actions to complete the 2009 annual training for MIT Police Department personnel during March/April 2010.

During the inspection in March 2010, it was also noted that emergency training for MIT Police Department (PD) personnel was required to be conducted annually by E-Plan Section 4.10.1.1. When the inspectors reviewed the training for the previous three years, it was noted that the last training provided the MIT PD had been completed in November 2008. The licensee explained that the training for 2009 had been intentionally postponed. Through an agreement between the Superintendent of Reactor Operations and the MIT Police Chief, training had been delayed pending the completion of various security upgrades at the facility. It was determined that training the MIT police officers on the "old" system would be counterproductive since additional training would be needed following completion of the changes to the system. It was noted that the training was rescheduled and was to begin on March 19, 2010.

During this inspection, the inspectors determined that the training for the MIT Police Department was conducted from March 19 through March 31, 2010, for police personnel. Those few individuals who could not attend in March attended a make-up session offered on July 21, 2010. The training covered the various security upgrades that had been completed at the facility. This IFI is considered closed.

c. Conclusion

As a result of the inspection, five IFIs were closed.

11. Exit Interview

The inspection scope and results were summarized on May 12, 2011, with members of licensee management. The Non-Cited Violation was discussed via telephone call with licensee management on May 18, 2011. The inspectors 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	Senior Advisor
T. Bork	Irradiation Services Coordinator
E. Block	Maintenance Supervisor
J. Foster	Assistant Superintendent of Operations
E. Lau	Superintendent of Reactor Operations
W. McCarthy	Reactor Radiation Protection Officer and Deputy Director, Environment, Health, and Safety Office, MIT
D. Moncton	Director, Nuclear Reactor Laboratory, MIT
T. Newton	Interim Director of Reactor Operations and Associate Director, Reactor Engineering
S. Tucker	Quality Assurance 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
IP 92701	Follow-up on Previously Identified Items

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED:

50-020/2011-201-01	IFI	Follow-up on the issue of the licensee documenting the fact that Class A changes were submitted to the MITRSC prior to implementation.
50-020/2011-201-02	NCV	The core purge blower had been inoperable for a period greater than 5 minutes (isolating the air space above the core) but reactor power had not been reduced to less than 100 kW as required by TS 3.3.2.

- 50-020/2011-201-03 IFI Follow-up on the licensee's long term issue of determining the maximum concentration of hydrogen in the space above the core
- 50-020/2011-201-04 IFI Follow-up on the licensee's actions to implement the revised operator requalification program.

CLOSED:

- 50-020/99-201-01 IFI Follow-up on the actions taken by the Licensee to conduct a safety review and a 50.59 review for the cooling tower replacement project.
- 50-020/2001-201-01 IFI Follow-up on the licensee's actions to complete an update to the Physical Protection Plan and submit the changes to the NRC in accordance with 10 CFR 50.54(p)(2).
- 50-020/2002-202-01 IFI Follow-up on the actions taken by the licensee to review the specifications of waste water pump and mechanical filter associated with the waste water tank and discharge system.
- 50-020/2010-201-01 IFI Follow-up on the actions taken to ensure that annual written examinations and quizzes required by the Requalification Program are completed in a timely manner.
- 50-020/2010-201-02 IFI Follow-up on the licensee's actions to complete the 2009 annual training for MIT Police Department personnel during March/April 2010.
- 50-020/2011-201-02 NCV The core purge blower had been inoperable for a period greater than 5 minutes (isolating the air space above the core) but reactor power had not been reduced to less than 100 kW as required by TS 3.3.2.

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Documents Access and Management System
CCFD	Cambridge City Fire Department
CPM	counts per minute
E-Plan	Emergency Plan
EHS	Environmental Safety and Health
FY	Fiscal Year
IFI	Inspector Follow-up Item
IP	Inspection Procedure
IRF	Irradiation Request Form
MIT	Massachusetts Institute of Technology
MITR-II	Massachusetts Institute of Technology Reactor
MITRSC	Massachusetts Institute of Technology Reactor Safeguards Committee

No.	Number
NRC	U. S. Nuclear Regulatory Commission
NRL	Nuclear Reactor Laboratory
PD	Police Department
PM	Procedure Manual
Ref.	Reference
RO	Reactor Operator
RRPO	Reactor Radiation Protection Officer
RSC	Reactor Safeguards Committee
SRO	Senior Reactor Operator
TS	Technical Specification
Vol.	Volume