October 8, 2010

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

SUBJECT: MASSACHUSETTS INSTITUTE OF TECHNOLOGY - NRC ROUTINE INSPECTION REPORT NO. 50-020/2010-202

Dear Dr. Bernard:

On September 13-16, 2010, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at the Massachusetts Institute of Technology Research Reactor facility (Inspection Report No. 50-020/2010-202). The enclosed report documents the inspection results, which were discussed on September 16, 2010, with Professor David Moncton, Director, Nuclear Reactor Laboratory, Louis DiBerardinis, Director, Environment, Health, and Safety Office, and various members of the reactor facility 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, 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. 50-020/2010-202
cc: See next page

cc:

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Mr. Robert Gallagher, Acting Director
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400 Worcester Road
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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.:	50-020/2010-202
Licensee:	Massachusetts Institute of Technology
Facility:	Nuclear Reactor Laboratory
Location:	Cambridge, Massachusetts
Dates:	September 13-16, 2010
Inspector:	Craig Bassett
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.: 50-020/2010-202

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) radiation protection; 4) environmental monitoring, 5) procedures, and 6) transportation of radioactive materials 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

Radiation Protection

- Surveys were completed and documented as outlined in the Annual Report.
- Postings and notices met regulatory requirements.
- Staff personnel were wearing dosimetry as required and recorded doses were within the NRC's regulatory limits.
- Radiation survey and monitoring equipment was being maintained and calibrated as required.
- Radiation protection training was being conducted and was acceptable.
- The Radiation Protection and As Low As Reasonably Achievable Programs satisfied regulatory requirements.

Effluent and Environmental Monitoring

- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits.

Procedures

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

Transportation

- The licensee continued to ship radioactive material in accordance with regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The Massachusetts Institute of Technology (MIT's, the licensee's) Nuclear Reactor Laboratory (NRL) five megawatt research and test reactor continued to be operated 24 hours a day, seven days a week, for three-month cycles in support of educational experiments, research and service irradiations, reactor operator training, and periodic equipment surveillances. At the end of each of the first two months of a cycle the reactor was shutdown for a short outage to perform surveillance testing. At the end of every third month of the cycle the reactor was shut down for approximately one week for maintenance, refueling, and surveillance testing. During the inspection, the reactor was operated and shut down as needed to support various activities.

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 License Amendment Number [No.] 38, dated April 24, 2009), were being met:

- Management responsibilities
- Qualifications of facility radiation protection personnel
- MIT NRL Organization Chart, dated October 27, 2009
- Staffing requirements for 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, 2008 to June 30, 2009," submitted August 28, 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 August 29, 2010

b. Observations and Findings

The inspector noted that the Director of Reactor Operations was responsible for the safe operation of the facility and reported to the Director of the MIT NRL. The Director, MIT NRL in turn reported to the President of the university through the Vice President for Research. The inspector also noted that the MITR-II Radiation Protection Officer (RPO) was responsible for radiation protection and advised the Director of Reactor Operations in all matters pertaining to radiation protection. This organization was consistent with that specified in the TS. Also, the organizational structure and the responsibilities of the reactor staff and the radiation protection staff had not changed since the last inspection.

The radiation protection organization staffing levels at the facility remained consistent with those noted during the last inspection of this facility. However, it

was noted that one person had left and that the licensee had hired a Assistant Officer. The current reactor radiation protection organization consisted of the Reactor RPO, a staff Officer, the Assistant Officer noted above, a Project Technician, and an Administrative Assistant. The RPO, who also had the title of Deputy Director, Environment, Health, and Safety, reported to the MIT Director of the Environment, Health, and Safety (EHS) Office. The RPO was also a member of the facility Reactor Safeguards Committee. It was noted that the radiation protection personnel provided assistance and job coverage for work done by Operations Group personnel.

c. Conclusion

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 (Inspection Procedure (IP) 69007)

To verify compliance with TS Sections 7.5.1 and 7.5.2 and Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, the following documents were reviewed:

- Charter of the MIT Reactor Safeguards Committee, dated December 10, 1985 with a revised version January 10, 2010
- Minutes of the MIT Reactor Safeguards Committee, meeting No. 99, held May 22, 2009
- Minutes of the MIT Reactor Safeguards Committee, meeting No. 100, held January 10, 2010
- Memorandum entitled “Authority of Standing and Special Subcommittees” dated January 19, 2010
- Minutes of the Special Subcommittee for Security of the MIT Reactor Safeguards Committee, one meeting held May 22, 2009, and another held January 11, 2010
- Minutes of the Special Subcommittee for In-Core Experiments of the MIT Reactor Safeguards Committee, one meeting held September 22, 2009, and another held June 2, 2010
- MIT Administrative Procedure 1.4, “Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto,” latest revision dated May 6, 2008
- MIT Administrative Procedure 1.8, “Audits,” latest revision dated January 10, 1986
- Administrative Audit for the Calendar Months of April, May, and June 2009, completed July 29, 2009
- Administrative Audit for the Calendar Months of July, August, and September 2009, completed November 25, 2009
- Administrative Audit for the Calendar Months of October, November, and December 2009, completed February 25, 2010
- MITR Annual Independent Audit Report for FY 2009 (June 2008 – June 2009), conducted by D. Rorer on December 10-11, 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, 2008 to June 30, 2009," submitted August 28, 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 August 29, 2010

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed the revised Reactor Safeguards Committee (RSC) charter and minutes of the MIT Reactor Safeguards Committee (MITRSC) and the Special Subcommittees for the past year to verify compliance with TS requirements. Members were appointed and designated in writing as stipulated in the TS. A quorum was present for the various meetings and the meeting minutes indicated that a thorough review of the appropriate topics was conducted. Meeting frequency met the minimum requirements. The RSC appeared to be appropriately focused on performing both routine reviews and promptly attending to non-routine emerging issues.

As part of its safety oversight program, the licensee and an outside contractor performed audits of the operations and the radiation protection programs. The inspector reviewed the report of recent internal audits and the report of the external audit. No problems were identified.

(2) Design Change Functions

No design changes of equipment related to radiation protection had been made recently. However, the inspector noted that the licensee had established a design change review function. It included the screening and safety review of changes, tests, or experiments to determine if, pursuant to 10 CFR 50.59, a change required U. S. Nuclear Regulatory Commission (NRC) prior approval or if it was within the umbrella of the existing Safety Analysis Report. The inspector found procedures in place to control such a review process and evidence of adherence to the procedures.

c. Conclusion

The review and audit program was being conducted in compliance with the TS. The design change evaluation program was being implemented in accordance with the TS requirements and NRC regulations.

3. Radiation Protection

a. Inspection Scope (IP 69012)

To ensure that the licensee was following the requirements of TS Section 7.10, Radiation Protection Program and 10 CFR Parts 19 and 20, the inspector reviewed selected aspects of the following:

- Quarterly Landauer dosimetry reports for 2008, 2009, and 2010 to date
- Observations of facilities, equipment, operations, and postings during facility tours
- Memorandum from the RPO to the Reactor Safeguards Committee documenting the annual review of the radiation protection program for 2009, undated
- Reportable Occurrence Reports, Unusual Occurrence Reports, and Operator Lessons Learned reports related to radiation protection for the past two years
- MIT Administrative Procedure 1.11, “Radiation Protection Office,” latest revision dated September 19, 1979
- MIT Administrative Procedure 1.12, “Radiological Training and Dosimetry Classification,” latest revision dated November 9, 2004
- MIT Reactor Radiation Protection Procedure 0150, “Personnel Contamination Monitoring and Decontamination,” Revision (Rev.) 5, dated November 2002
- MIT Reactor Radiation Protection Procedure 0600, “Use of Protective Clothing,” Rev. 5, dated December 2005
- MIT Reactor Radiation Protection Procedure 3001, “Radiological Surveys,” Rev. 5, dated March 2003
- MIT Reactor Radiation Protection Procedure 3005, “Neutron Gamma Survey,” Rev. 2, dated April 2000
- MIT Reactor Radiation Protection Procedure 4203, “Quarterly Operational Check of Hand and Foot Monitoring Equipment,” Rev. 4, dated June 2001
- MIT Reactor Radiation Protection Procedure 4802, “Calibration Procedure for the Eberline RO-2 and RO2A Ion Chambers,” Rev. 4, dated November 2002
- MIT Reactor Radiation Protection Procedure 4805, “Calibration Procedure for the Ludlum Model 2 and 3 GM Meters,” Rev. 4, dated April 2002
- MIT Reactor Radiation Protection Procedure 4806, “Calibration Procedure for the Bicron RSO-5 and RSO-50 Ion Chambers,” Rev. 4, dated November 2002
- MIT Reactor Radiation Protection Procedure 4814, “Calibration Procedure for the Ludlum Model 14C GM Survey Meter,” Rev. 2, dated June 2001
- MIT Reactor Radiation Protection Procedure 5002, “Primary Water Sampling and Analysis Procedure,” Rev. 5, dated June 2007
- MIT Reactor Radiation Protection Procedure 6006, “Breathing Zone Air (BZA) Sampling,” Rev. 1, dated February 2000
- MIT Reactor Radiation Protection Procedure 8010, “Respiratory

Protection Training," Rev. 1, dated September 2000

- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2008 to June 30, 2009," submitted August 28, 2009
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b. Observations and Findings

(1) Surveys

(a) Routine Surveys

Daily, weekly, monthly, and other periodic contamination and radiation surveys, outlined in the licensee's procedures were generally completed in a timely manner by radiation protection staff members. Any contamination detected in concentrations above established action levels was noted and the area or item was decontaminated. Results of the surveys were typically documented on survey maps and posted at the entrances of the various areas surveyed so that facility workers and visitors would be aware of the radiological conditions that existed therein.

The inspector accompanied a radiation protection technician during completion of the daily radiation surveys. Appropriate survey techniques were used and no problems were noted.

(b) Lead Bricks Removed From the Restricted/Controlled Area

Regulation 10 CFR Section 20.1501 requires that (a) Each licensee shall make or cause to be made, surveys that—(1) May be necessary for the licensee to comply with the regulations in this part; and (2) Are reasonable under the circumstances to evaluate—(i) The magnitude and extent of radiation levels; and (ii) Concentrations or quantities of radioactive material; and (iii) The potential radiological hazards.

The inspector reviewed the licensee's procedures for removing items from the facility radiologically Restricted/Controlled Area. During this review the inspector inquired if there had been any instances when items had been inadvertently removed from the Restricted/Controlled Area without being surveyed. The facility RPO indicated that there had been a problem last year (in 2009) during the summer.

One morning an individual from the Reactor Radiation Protection Officer (RRPO) noticed a stack of lead bricks on a pallet in the shipping and receiving portion of the facility. The shipping and receiving area is a radiologically clean area. Two of the lead bricks were noted to be painted yellow indicating that they were possibly contaminated. RRPO personnel subsequently surveyed all the lead bricks and only the two painted bricks were found to have fixed contamination on them at a level of two hundred counts per minute above background. No other bricks were found to be contaminated and no contamination was found in the pathway from the Restricted/Controlled Area to the shipping and receiving area. The painted lead bricks were contained and returned to the Restricted/Controlled Area.

When the RRPO investigated the problem, it was noted that, on the previous evening, an operator had been instructed to have the bricks ready to be picked up the next morning. The inspector asked to interview the operator involved but found that that individual no longer worked at the facility. The inspector asked the Superintendent for Reactor Operations about the matter and was told that the operator was acting under his directions. The operator had been told to survey the lead bricks and load them onto the pallet and move them from the Restricted/Controlled Area to the shipping and receiving area. The Superintendent for Reactor Operations did not observe the bricks being surveyed but had no reason to believe that a survey had not been performed. The RPO notified the Director, Environment, Health, and Safety (his immediate supervisor) of the problem. No further actions were taken by the licensee.

The licensee was informed that failure to complete a survey of the lead bricks was a violation of the 10 CFR 20.1501. However, since the lead bricks were noted to be in the uncontrolled area the morning after they were placed there, they were subsequently surveyed by RRPO personnel and only two bricks were found to be contaminated, the contaminated bricks were placed back in the Restricted/Controlled Area, and no other contamination was detected, it was determined that there was minimal safety or environmental significance. Therefore, this failure constitutes a non-repetitive minor violation that is not subject to formal enforcement action and is being treated as a violation of minor significance, consistent with Section IV of the NRC Enforcement Policy.

(2) Postings and Notices

Copies of current notices to workers were posted in appropriate areas in the facility. The copies of NRC Form-3 noted at the facility were the latest issue, as required by 10 CFR Part 19, and were posted in various areas

throughout the facility such as on the main bulletin board, in main hallways, and at the entrance to the Reactor Building. The inspector determined that radiological signs and, as noted above, survey maps were typically posted at the entrances to controlled areas. Other postings also showed the industrial hygiene hazards that were present in various areas as well.

(3) Dosimetry Use and Results

Through direct observation the inspector determined that dosimetry was acceptably used by facility and contractor personnel. The inspector determined that the licensee used optically stimulated luminescent (OSL) dosimetry for whole body monitoring and thermoluminescent dosimeters (TLDs) in the form of finger rings for extremity monitoring. The dosimetry was supplied and processed by a National Voluntary Laboratory Accreditation Program accredited vendor (Landauer).

An examination of the OSL results indicating radiological exposures at the facility for the past two years showed that the highest occupational doses, as well as doses to the public, were within 10 CFR Part 20 limits. The records showed that approximately half of the facility personnel received occupational exposures of zero (0) to only a few millirem (mr) above background. The highest annual whole body exposure received by a single individual for 2008 was 383 mr deep dose equivalent (DDE). The highest annual extremity exposure for 2008 was 1380 mr and the highest shallow dose equivalent (SDE) was 565 mr. The highest annual whole body exposure received by a single individual for 2009 was 246 mr DDE. The highest annual extremity exposure for 2009 was 850 mr and the highest SDE was 301 mr. The highest annual whole body exposure received by a single individual for 2010, through the second quarter of the year, was 327 mr DDE. The highest annual extremity exposure through the second quarter of 2010 was 450 mr and the highest SDE was 370 mr.

The facility also collected and analyzed urine samples for Tritium (H-3) bioassay purposes. The highest attributable dose in 2008 from H-3 was 1.97 mr committed effective dose equivalent (CEDE). The highest H-3 attributable dose in 2009 was calculated to be 0.38 mr CEDE. The highest attributable dose to date in 2010 from H-3 was approximately 20 mr CEDE.

(4) Radiation Monitoring Equipment

Examination of selected radiation monitoring equipment indicated that the instruments had the acceptable up-to-date calibration sticker attached. The instrument calibration records indicated that the calibration of certain portable survey meters was typically completed by licensee staff personnel. In the event that an instrument could not be calibrated by the licensee, it was shipped to a vendor for calibration. Calibration frequency met procedural requirements and records were maintained as required.

Area Radiation Monitors (ARMs) and stack monitors were also being calibrated as required. These monitors were typically calibrated by licensee staff personnel.

(5) Radiation Protection Training

The inspector reviewed the General Employee Radiation Training (also known as GERT training) given to MIT staff members, to those authorized to use the experimental facilities of the reactor, to students, and to visitors. It was noted that the training was available online through the EHS website. The training satisfied the requirements of 10 CFR Part 19 and the training program was acceptable.

The inspector also noted that the EHS Office was working to develop an online version of the Radiation Worker I and Radiation Worker II courses. Currently that training is provided on an individual basis for those who need it by the RPO.

(6) MIT As Low As Reasonably Achievable (ALARA) Program

See Section 7 below for a discussion of the licensee's ALARA program and various action items developed following a higher than expected exposure of one individual that occurred in 2007.

(7) Facility Tours

The inspector toured the reactor containment, the reactor control room, and selected support laboratories and maintenance areas with licensee representatives on various occasions. The inspector noted that facility radioactive material storage areas were properly posted. Radiation and High Radiation Areas were posted as required and properly controlled.

b. Conclusions

The inspector determined that the Radiation Protection and ALARA Programs, as implemented by the licensee, satisfied regulatory requirements because: 1) surveys were generally completed and documented acceptably to permit evaluation of the radiation hazards present; 2) postings met regulatory requirements; 3) personnel dosimetry was being worn as required and recorded doses were within the NRC's regulatory limits; 4) radiation survey and monitoring equipment was being maintained and calibrated as required; and, 5) the radiation protection training program was acceptable.

4. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

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

- Facility records of measurements and analysis of effluent samples
- MIT Reactor Radiation Protection Procedure 3010, "Conduct of Environmental Radiological Surveys," Rev.1, dated May 2000
- MIT Reactor Radiation Protection Procedure 4001, "Calibration and Source Check of Environmental Monitors," Rev.4, dated August 2001
- MIT Reactor Radiation Protection Procedure 4011, "Effluent and Process Radiation Monitoring System – Quarterly Calibrations," Rev.4, revision dated April 2007
- MIT Reactor Radiation Protection Procedure 4012, "Effluent and Process Radiation Monitoring System – Annual Calibrations," Rev.3, issued April 4, 2007
- MIT Reactor Radiation Protection Procedure 4201, "Annual Ar-41 Calibration," Rev.5, dated December 2002
- MIT Reactor Radiation Protection Procedure 5001, "Cooling Tower Sampling and Analysis Procedure," Rev.5, dated June 2007
- MIT Reactor Radiation Protection Procedure 6001, "Air Particulate Sampling," Rev.5, dated April 2007
- MIT Reactor Radiation Protection Procedure 6002, "Air Gas Sampling – Argon-41," Rev.5, dated December 2002
- "MIT Research Reactor, Nuclear Reactor Laboratory, Massachusetts Institute of Technology Annual Report to the U.S. Nuclear Regulatory Commission for the Period July 1, 2008 to June 30, 2009," submitted August 28, 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 August 29, 2010

b. Observations and Findings

The inspector determined that gaseous releases continued to be monitored as required, were acceptably analyzed, and were documented in the annual operating reports in accordance with TS 7.13.5. Airborne concentrations of gaseous releases, principally Argon-41, were well within the concentrations stipulated in 10 CFR 20, Appendix B, Table 2, and TS limits. The dose rate to the public, as a result of the gaseous releases, was below the dose constraint specified in 10 CFR 20.1101(d) of 10 millirem per year. COMPLY code results indicated a Calendar Year (CY) annual dose to the public of 0.8 mr for 2008 and data for CY 2009 indicated an annual dose to the public of 0.5 mr.

The licensee reported the annual total activity of liquid released from the facility to the sanitary sewer. The total activity was reported in terms of tritium and all other activity less tritium. The total activity monitored and analyzed by the licensee for Fiscal Year (FY) 2009 was 577.5 millicuries (mCi) of tritium and 211 mCi of all other isotopes. For FY 2010, the licensee reported a total activity release of 154.3 mCi tritium and 325 Ci of all other isotopes. The predominant source was acknowledged to be the cooling tower blowdown. The concentration was below the 10 CFR 20.2003 limit with no credit for dilution due to other MIT waste streams (estimated at 2.7 million gallons per day).

Solid waste and tritiated liquid waste was shipped to a licensed, offsite disposal facility. There were no investigative studies or human therapy exposures during the year to be reported pursuant to TS 7.13.5.i.

The licensee recorded data throughout the year from five radiation monitors mounted within a quarter mile of the reactor. The data indicated that exposure to individuals in that area was approximately 0.3 mr for FY 2008, 0.3 mr for FY 2009 and 0.2 mr for FY 2010 . The predominant source of that exposure was noted to be Argon-41.

c. Conclusions

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

5. 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:

- MIT Administrative Procedure 1.4, “Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto,” latest revision dated May 6, 2008
- MIT Administrative Procedure 1.5, “Procedure Adherence and Temporary Change Method,” latest revision dated September 19, 1979

b. Observations and Findings

The inspector noted that the licensee radiation protection group was in the process of compiling a list of procedures in use at the facility to ensure that the correct and current version was listed and available. Once that task was complete, focus would be placed on revising those procedures that needed to be revised so that they reflected current administrative conditions. Management and supervisory oversight was focused on the proper implementation and adherence to procedures. The inspector observed that procedures were being followed.

c. Conclusions

Procedures were being listed and revised as needed and implemented in compliance with license requirements.

6. Transportation

a. Inspection Scope (IP 86740)

To verify compliance with regulatory requirements for shipping licensed radioactive material, the inspector reviewed the following:

- Various completed forms, NRC Form 540, Uniform Low Level Radioactive Waste Manifest, for 2008 and 2009
- MIT Administrative Procedure 1.19, "Receiving, Storing, and Issuing of NRL Materials," latest revision dated May 20, 2004
- MIT Reactor Radiation Protection Procedure 1101, "Receipt of Radioactive Material," Rev. 5, dated November 2002
- MIT Reactor Radiation Protection Procedure 1102, "Receipt and Handling of New Fuel," Rev. 5, latest revision dated November 2002
- MIT Radiation Protection Program, Required Procedures for Radiation Protection Procedure, Section III-H, "Transportation of Radioactive Material," Seventh Edition (interim), latest revision dated January 2006
- "2008 DOT Shipping Audit," completed by a Senior Reactor Operator on January 29, 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, 2008 to June 30, 2009," submitted August 28, 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 August 29, 2010

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that the licensee had shipped spent fuel, radioactive waste, and other types of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation (DOT) and NRC regulations. It was noted that the Operations Group completed the majority of the shipments but that no formal procedure(s) existed for making shipments.

The inspector also verified that the licensee maintained copies of consignees' licenses to possess radioactive material as required and that the licenses were verified to be current prior to initiating a shipment. The training of the staff

members responsible for shipping the material was also reviewed. The inspector verified that the shippers had received training covering the various requirements of the DOT.

c. Conclusions

The licensee continued to ship radioactive material in accordance with regulatory requirements.

7. Follow-up on Previously Identified Items

a. Inspection Scope (IP 92701)

To determine what items the licensee had completed in response to Inspector Follow-up Item, IFI 50-020/2008-203-01, the inspector reviewed:

- MIT ALARA Committee Charter, dated March 10, 2008
- MIT Reactor ALARA Procedure, “Dose Evaluation,” undated
- MIT Reactor ALARA Procedure, “ALARA Program,” undated
- MIT Reactor ALARA Procedure, “ALARA Job Reviews,” undated
- MIT Reactor ALARA Procedure, “ALARA Suggestion Program,” undated
- MIT Reactor ALARA Procedure, “ALARA Goal Development and Tracking,” undated
- Presentation given at the All-Hands meetings conducted May 6, 2009 to discuss ALARA and dose reduction issues
- MIT ALARA Policy signed by the Director, NRL; the Director EHS; and the Chair, Reactor Safeguards Committee, dated March 2008
- MIT Reactor ALARA Committee Meeting minutes for meetings held on February 25, April 8, and August 5, 2009, and January 7, April 14, and September 9, 2010
- Action Item status matrix for issues related to the 2007 high exposure event
- Bulletin board ALARA display of cumulative dose received versus ALARA objectives, electronic dosimeter alarms, etc.
- Observations of facilities, equipment, operations, and postings during facility tour

b. Observations and Findings

IFI 50-020/2008-203-01 - Track ALARA Committee action items remaining from the 2007 higher than expected exposure event.

As a result of a higher than expected exposure of one individual in 2007, the licensee established various ALARA Action Items. During a previous inspection conducted in May of 2008, the NRC inspector observed that numerous actions had been completed or implemented as on-going practices. To acknowledge the licensee’s numerous pro-active follow-on measures to enhance safety and ALARA as a result of the findings of their internal analysis of the incident and the NRC Special Inspection Report, and to focus attention on the much smaller list of

remaining action items, IFI 50-020/2007-203-01 was closed. The licensee was informed that a new IFI would be established to continue tracking the remaining ALARA action items (IFI 50-020/2008-203-01).

Following the higher than expected exposure event, the Reactor Radiation Protection Officer, and the HP staff, along with the Reactor Superintendent and other MIT managers and group leaders, recognized that improvements could be made in the area of dose reduction. Consequently, greater emphasis was placed on ALARA. An ALARA program enhancement program was initiated and an ALARA policy was formulated. A formal ALARA committee for the reactor was organized and various ALARA procedures were written. (It was noted that these procedures have not been formally reviewed and approved to date.) ALARA goals were set and performance indicators were established. Each group in the MITR organization established an ALARA goal for the year and the facility dose was then tracked by group, as well as for each individual.

With emphasis placed on achieving the various groups' ALARA goals, the facility dose has been reduced. In 2006, the calendar year facility dose was 6.30 rem. In 2007, the yearly facility dose was 7.42 rem. In 2008, due to the establishment of aggressive ALARA goals, continued efforts on dose reduction, worker awareness, and various other improvements, the facility dose was 3.71 rem. The goal for 2009 was set at 4.3 rem. Due to increased emphasis on ALARA and dose awareness, the actual facility dose was 3.7 rem.

During this inspection, it was noted that a great deal of progress has been made in the area of dose reduction and ALARA implementation. Because of changes in the radiation protection management at the facility and new perspectives on what improvements were needed and what items or data needed to be tracked to achieve new ALARA goals, the entire ALARA Action Items list was being revised. The inspector determined that, since continued emphasis has been and is being placed on ALARA, IFI 50-020/2008-203-01 should be closed. However, adherence to ALARA principles will continue to be closely monitored by the NRC.

c. Conclusions

As a result of the inspection, IFI 50-020/2008-203-01 is closed.

8. Exit Briefing

The inspection scope and results were summarized on September 16, 2010, with members of licensee management. The inspector described the areas inspected and discussed the preliminary inspection findings. The licensee did not present any dissenting opinions or identify any information to be withheld from public disclosure.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

T. Bork	Irradiation Service Coordinator
D. Cormier	Senior Technician, Reactor Radiation Protection Office (RRPO), EHS
E. Lau	Superintendent for Reactor Operations
W. McCarthy	Reactor Radiation Protection Officer, RRPO, EHS
D. Moncton	Director, MIT Nuclear Reactor Laboratory
T. Newton	Associate Director, Reactor Engineering
J. Quattrochi	Staff Officer, Reactor Radiation Protection Office, EHS
S. Tucker	Quality Assurance Supervisor

Other Personnel

L. DiBerardinis	Director, Environment, Health, and Safety (EHS) Office
M. Galanek	MIT Campus Radiation Safety Officer and Assistant Director, Environment, Health, and Safety (EHS) Office

INSPECTION PROCEDURES USED

IP 69004	Class 1 Research and Test Reactor Effluent and Environmental Monitoring
IP 69005	Class 1 Research and Test Reactors Experiments
IP 69007	Class 1 Research and Test Reactors Review and Audit and Design Change Functions
IP 69008	Class 1 Research and Test Reactor Procedures
IP 69012	Class 1 Research and Test Reactor Radiation Protection
IP 86740	Transportation of Radioactive Materials
IP 92701	Follow-up on Previously Identified Items

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED:

None

CLOSED:

50-020/2008-203-01	IFI	Track ALARA Committee action items remaining from the 2007 higher than expected exposure event.

LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
CFR	*Code of Federal Regulations*
EHS	Environmental Health and Safety
IFI	Inspector Follow-up Item
IP	Inspection Procedure
LSA	Low Specific Activity
MIT	Massachusetts Institute of Technology
MITR	Massachusetts Institute of Technology Reactor
MITRSC	Massachusetts Institute of Technology Reactor Safeguards Committee
No.	Number
NRC	Nuclear Regulatory Commission
PARS	Publicly Available Records
Rev.	Revision
RO	Reactor Operator
RSC	Reactor Safeguards Committee
TS	Technical Specification