

January 25, 2006

Dr. John A. Bernard, Jr
Director of Reactor Operations
Massachusetts Institute of Technology
Research Reactor
MITNRL-NW12
138 Albany Street
Cambridge, MA 02139

SUBJECT: NRC INSPECTION REPORT NO. 50-20/2005-201

Dear Dr. Bernard:

This letter refers to the inspection conducted on November 14 - 18, 2005 at the Massachusetts Institute of Technology Research Reactor. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. Based on the results of this inspection, no safety concerns or noncompliance with NRC requirements were identified. No response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice", a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Thomas Dragoun in King of Prussia, PA at 610-337-5373.

Sincerely,

/RA/

Brian E. Thomas, Branch Chief
Research and Test Reactors Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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

Enclosures: NRC Inspection Report No. 50-20/2005-201

cc w/enclosure: Please see next page

Massachusetts Institute of Technology

Docket No. 50-20

cc:

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City Hall
Cambridge, MA 02139

Department of Environmental
Quality Engineering
100 Cambridge Street
Boston, MA 02202

Dr. William Vernetson
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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-20

License No.: R-37

Report No: 50-20/2005-201

Licensee: Massachusetts Institute of Technology

Facility: MIT Research Reactor

Location: Cambridge, Massachusetts

Dates: November 14 - 18, 2005

Inspector: Thomas F. Dragoun

Approved by: Brian E. Thomas, Branch Chief
Research and Test Reactors Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Massachusetts Institute of Technology
Report No: 50-20/2005-201

The focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's Class 1 research reactor programs including: experiment approval, radiation protection, and effluent and environmental monitoring.

Experiment Approval

- Experiment approvals were conducted in accordance with licensee procedural requirements. Actions were taken by the licensee to ensure that anticipated increases in experiment utilization of the reactor will be conducted safely.

Radiation Protection

- The implementation of selected elements of the radiation protection program were found to be complete and satisfactory.

Effluent and Environmental Monitoring

- The licensee's programs for effluent controls and environmental monitoring are conducted in accordance with the Technical Specifications and NRC regulatory requirements.

REPORT DETAILS

Summary of Plant Status

The reactor was operating on a normal schedule.

1. Experiment Approval

a. Inspection Scope (Inspection Procedure (IP) 69005)

Regulatory requirements for experiments are found in 10 CFR 50.59, and Technical Specifications (TSs) 6.1 and 7.9. The implementation of these requirements was determined from a review of:

- Procedure PM 1.4, "Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto", dated September 19, 1979
- Procedure PM 1.10, "Experiment Review and Approval", dated September 19, 1979
- Active experiments as follows:
 - "UMICH-1," a sample irradiation in location 2PH1, the highest neutron flux location in the heavy water reflecting tank. Approval was documented on a Part 1 Review Sheet from procedure PM 1.10. There was no detectable radiation from the current sample after irradiation, which was released but not shipped.
 - "CTD-1 (Composite Technology Development)" was approved by a Part 1 Review Sheet on July 7, 2005. The final sample in the series indicated the sample strength was 485 curies of long lived activity. The sample was held for decay.
 - "SWRi-1-1" was approved by a Part 1 Review Sheet. This was a rabbit system sample irradiation. Activated elements of the sample were predicted by Microsoft Excel computer spread sheet data. The major contributors to the post-irradiation levels were aluminum-28 and manganese-56, confirming the licensee's calculations. The gross activity in the sample was 113.5 curies so it remained in the rabbit system shielded receiver to allow for decay.
 - "TRC-1." The approval included a detailed "Safety Evaluation Report for the Irradiation of Tracerco's KR-78 sample", dated January 25, 2005.
 - "55-25." The approval included a detailed "Safety Evaluation Report for the Irradiation for Harvard School of Public Health."
- "Special Procedure for the Initial Installation of the High Temperature Irradiation Facility (HTIF) Rig" draft, dated September 2, 2005. Under review by staff but not complete

b. Observations and Findings

The approval process for new experiments that require a full safety review, as determined by the 10 CFR 50.59 screening procedure, was reviewed as part of NRC Inspection Report No. 50-20/2004-201. The program for review and approval of new experiments that do not require an extensive safety evaluation was reviewed during the current inspection. For this category of experiment, "Part 1" of Procedure 1.10 contains the written guidance for the elements that should be considered during a safety evaluation and provides a form for documenting the results. "Part 2" of the same procedure was used to confirm that the safety precautions required by "Part 1" have been implemented and the experiment can proceed.

The licensee created and filled a new staff position titled "MIT Irradiation Services Coordinator." This was done in response to an expected increased demand for irradiation services and an anticipation that the upward trend will continue in the future. The incumbent in this new position was interviewed by the inspector. The inspector determined that she was recently granted a senior reactor operator license by the NRC and possessed experience and training commensurate with the responsibilities of the new position. However, at this time she does not participate in the safety evaluations but is responsible for schedules. The Coordinator reports to the Head of Research Development and one of her duties was to increase reactor utilization and be the contact for the outreach activities. The personnel in the reactor radiation protection program were unchanged since the last NRC inspection.

Records of experiment approvals and associated documentation were properly maintained as stipulated in the procedures. All experiments that were reviewed by the inspector involved irradiation in static flux traps in the reactor heavy water reflector tank or in the pneumatic transfer system ("Rabbit shots"). Calculations of predicted sample curie content post-irradiation and safety precautions during sample handling appeared to be satisfactory.

c. Conclusions

Experiment approvals were conducted in accordance with licensee procedural requirements. Actions were taken by the licensee to ensure that future increases in experimental utilization of the reactor will be conducted safely.

2. Radiation Protection

a. Inspection Scope (IP 69012)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and the TS requirements:

- Web based General Employee Radiation Training (GERT) basic radiation protection training and supplemental training on CD titled "ER Accidents" and "Pre-Hospital"

- GERT written exam and “MIT Reactor Radiation Protection GERT Reactor Practicum Checklist” original version, undated
- Annual review of the radiation protection program, “Subject: End of the Year Supplemental Information”, dated April 15, 2005, by the Reactor Radiation Protection Deputy Director
- Calibration and periodic check records for selected radiation survey and monitoring instruments for the past year
- Quarterly personnel radiation exposure records for 2004 and 2005
- Procedure RRP 3001, “Radiological Surveys,” Revision 4, issued July 2001, reviewed October 2003. Records for January 3, 2005, to date
- Procedure RRP 4802, “Calibration Procedure for the Eberline RO-2 and RO-2A Ion Chambers,” Revision 3, dated April 2000, updated April 2002
- Procedure RRP 4203, “Quarterly Operational Check of Hand and Foot Monitoring Equipment,” Revision 4, dated June 2001
- Procedure RRP 4806, “Calibration Procedure for the Bicron RSO-5 and RSO-50 Ion Chambers,” Revision 3, dated April 2000
- Procedure RRP 4808, “Calibration Procedure for the Ludlum Model 60 and 61 Alpha Counters,” Revision 4, dated February 2000
- Procedure RRP 4810, “Calibration Procedure for the Eberline Gadora-1b Dose Rate Meter,” Revision 3, dated April 2000
- Procedure RRP 4805, “Calibration Procedure for the Ludlum Model 2 and 3 GM Survey Meter for Exposure Rate Measurements,” Revision 4, dated February 2001
- Current inventory of portable radiation survey instruments
- Quarterly calibration records for the high range instruments

The inspector viewed a demonstration of the calibration and quality checks of the analytical laboratory equipment with intrinsic gamma detectors using the GENIE 2000 computer program

b. Observations and Findings

The inventory of portable radiation survey instruments appeared to be adequate to support routine and nonroutine needs. Routine surveys were performed daily, weekly, and monthly depending on the area. Survey results are recorded in tabular form and entered into a computer file. Maps are not used. Standard radiation postings are used to indicate the measured radiological conditions. The inspector

determined that the routine surveys were conducted as required by the detailed licensee procedures.

The licensee recently purchased several alarming dosimeters to replace the pencil style direct reading dosimeters. Slightly larger and wider than a credit card, the new dosimeters have an extensive selection of alarm settings and data recording capabilities. Use of this equipment is anticipated to reduce worker doses.

The Reactor Radiation Safety Officer (RRSO) was continuing to develop and expand the availability of on-line training for workers and staff. The computer program used to create the training was Microsoft Power Point Presentations. This arrangement allowed the RRSO to make changes quickly as feedback came in and to develop additional training. The additional training under development was specialized to address the needs of small groups. The inspector reviewed the content of selected presentations and determined that information satisfied the requirements in 10 CFR Part 19.

By telephone call on June 6, 2005, to NRC, and letter dated June 16, 2005, the licensee reported a violation of TS 3.8.4(a) regarding the failure to take a sample of secondary cooling water during reactor operation. In addition to the initial corrective actions, the licensee subsequently reassigned the responsibility for this sampling to the radiation protection staff, who historically took the samples up to about one year ago. A review of these final corrective actions taken in accordance with paragraph 9.c of the licensee letter was complete and satisfactory. This is a violation of minor significance that is not subject to enforcement action.

The inspector reviewed the dose reports for the previous and present years. All doses were below NRC limits. The licensee's year for record purposes was defined as June 1, 2004 to July 30, 2005.

c. Conclusions

The implementation of selected elements of the radiation protection program were found to be complete and satisfactory.

3. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

The inspector reviewed the following to verify compliance with the control of liquid, solid and gaseous effluent required by 10 CFR Part 20:

- C Annual Report, Docket No. 50-20, License R-37, TS 7.13.5, dated October 21, 2005
- C Procedure PM 3.6, "Waste Storage Tank Dump Procedure," dated November 27, 1996

C Procedure RRP 5006, "Waste Storage Tank System Sampling and Analysis Procedure," Revision 4, dated January 2000

- "Waste Storage Tank Sewer Discharge Form," listed as RRP-5006.2, Revision 5, undated. Data for liquid discharged on August 29 and April 19, 2005, and December 10, 2004

b. Observations and Findings

No solid radioactive waste was shipped this year but a planned cleanup of the outside yard is expected to result in a sizeable load of waste to be processed during this cleanup project.

Argon-41 continues to be the main constituent of the stack releases during 2005. Calculations of the argon concentration taking into account the fixed dilution factor in the TS indicate that the total discharge was less than 1/2 of the allowable NRC limit. The RRSO calculates the amount of argon released each month.

There were three liquid discharges to the municipal sewer in the interval from December 2004 to August 2005. The volume of each discharge was approximately 800 gallons that had accumulated in the Waste Storage Tank. Analysis of the tank sample indicated that the concentration of radionuclides was below the TS limit. Dilution of the discharged by the water flow in the campus main system is not used in the calculations. This results in conservative control of liquid discharges. The effluent is passed through a 4.5 micron filter to assure that the discharge meets the solubility requirements. An in-line radiation monitor trips the discharge pump if the radiation level exceeds a pre-set value. The RRSO indicated that significant improvements in the effluent and environmental monitoring programs have been incorporated in the re-licensing submittal to the NRC which has not been approved at this time.

c. Conclusion

The licensee's programs for effluent controls and environmental monitoring are conducted in accordance with the TS and NRC regulatory requirements.

4. Exit Interview

The inspection scope and results were summarized on November 18, 2005, with members of the licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Bernard, Director of Reactor Operations
E. Lau, Assistant Operations Superintendent
T. Newton, Assistant Operations Superintendent
F. McWilliams, Reactor Radiation Safety Officer and Deputy Director, Environmental Health and Safety

INSPECTION PROCEDURES USED

IP 69004 Class I Research and Test Reactors Effluent and Environmental Monitoring
IP 69005 Class I Research and Test Reactors Experiments
IP 69012 Class I Research and Test Reactors Radiation Protection

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

LIST OF ACRONYMS USED

CFR Code of Federal Regulation
IP Inspection Procedure
NRC Nuclear Regulatory Commission
RRSO Reactor Radiation Safety Officer
TS Technical Specification