U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	50-20
License No:	R-37
Report No:	50-20/97-01
Licensee:	Massachusetts Institute of Technology
Facility:	MIT Research Reactor
Location:	138 Albany Street Cambridge, Massachusetts
Dates:	April 7-11, 1997
Inspector:	Thomas F. Dragoun, Project Scientist
Approved by:	Marvin M. Mendonca, Acting Director Non-Power Reactors and Decommissioning Project Directorate

EXECUTIVE SUMMARY

The recently implemented respiratory protection program satisfied regulatory requirements and program aspects were acceptable. Radiation protection program policies are clear, comprehensive, and logical. ALARA reviews of the silicon project were needed and are underway. Radiological controls during irradiation of a BNCT patient were acceptable.

Report Details

Summary of Plant Status

The reactor was operated continuously at full power except during the BNCT treatment. Silicon ingots were irradiated. Student tours were conducted. A dry run with a BNCT patient was conducted early in the week followed by irradiation of the patient later in the week.

R1 Radiological Protection

R1.1 Radiation Protection

a. Inspection Scope (Inspection Procedure 83743)

The inspector reviewed:

- radiation protection procedures,
- caution signs and postings,
- personnel dosimetry and exposure records,
- routine surveys and monitoring,
- exit radiation surveys,
- calibration of bioassay equipment,
- respiratory protection program

b. Observations and Findings

Clear and descriptive procedures were available for all activities reviewed. Warning signs and postings satisfied regulatory requirements and accurately reflected radiological conditions. Routine surveys were completed on schedule and reviewed by the ARRPO. The frequency, type of survey, survey records, and quality of survey procedures resulted in an acceptable assessment of radiological conditions in the facility.

Personnel dosimetry records indicated that exposures were below NRC limits. Besides beta-gamma exposures, staff are monitored for a broad energy spectrum of neutron exposures. Exposures due to tritium uptake were properly recorded. The highest overall exposures were associated with the silicon project. The RRPO indicated that ALARA reviews of the project were underway but recommendations were not completed. Results will be reviewed in a future inspection. The RRPO established criteria for the ratio of whole body to extremity exposure. The quarterly data is reviewed for anomalies and values outside this range are investigated. This is a innovative practice.

In a July 15, 1996 letter, the licensee stated that the area radiation monitoring system would be replaced by December 31, 1996. This was due to difficulties repairing the old system. The inspector determined that 7 of 10 detectors and readout channels were replaced, operationally checked, alarms adjusted, and initially calibrated. Operating procedures were revised and appear to be appropriate. Three units with extended range malfunctioned and were returned to the manufacturer for conversion to normal range. However, TS 3.8 requires is satisfied since only one ARM is required when the reactor floor is occupied.

A new respiratory protection program was implemented. The policies, procedures, equipment, training, fit testing, and medical evaluations prior to use satisfied requirements in 10 CFR 20.1703. Bioassay verification of respirator effectiveness consists of urinalysis by liquid scintillation and in-vivo direct counting using standard techniques. Notification to the NRC prior to first use of respirators will be made as required by 10 CFR 20.1703 (d).

During inspection 95-01, the RRPO stated that written frisking instructions would be developed. Procedure 0150, "Personnel Contamination Monitoring and Decontamination" was issued and training provided to the staff. Random staff interviews indicated good understanding of the requirements. Inspector followup item 95-01-01 is closed.

c. Conclusions

The radiation protection program met regulatory requirements. The quality of procedures was notable. The new respiratory protection program and area radiation monitoring system constitute significant improvements.

R1.2 Effluent and Environmental Monitoring (Inspection Procedure 80745)

a. Inspection Scope (Inspection Procedure 80745)

The inspector reviewed:

- Airborne effluent release data,
- Compliance with air emission constraint rule effective January 9, 1997, and
- Status of effluent monitoring system replacement.

b. Observations and Findings

Records indicate releases of argon 41 decreased by a factor of ten over the past ten years. The concentration of particulate activity effluents are at approximately 0.1% of limits specified in 10 CFR 20 Appendix B using the calculation specified in TS 3.8. Public exposures are below the constraint limit based on COMPLY computer code calculations.

In a July 15, 1997 letter, the licensee indicated that replacement of the effluent monitoring system may begin 31 March 1997. The inspector observed installation of new meter faces on the readouts and discussed the circuit improvements with the designer. Except for the detectors, the system was fabricated in-house. Final installation of the system will be reviewed in a future inspection.

c. Conclusions

Effluent releases and doses to the public were properly controlled and monitored.

R1.3 Boron Neutron Capture Therapy

a. Inspection Scope (Inspection Procedure 69745)

The inspector reviewed:

- Compliance with revised TS related to BNCT,
- Radiological control, oversight, and monitoring during therapy,
- Training and exposure monitoring of medical personnel,
- Reactor operation during the therapy, and
- Administrative records and controls,

b. Observations and Findings

During inspection 93-02, the RRPO stated that radiological hazards during routine and abnormal BNCT conditions would be reviewed in detail. The inspector discussed the results of this review and the BNCT protective measures to be taken with the RRPO. The review was thorough and fully satisfactory. All precautions were observed to be implemented during the irradiation on April 10, 1997. Inspector followup item 93-02-01 is closed.

The Commonwealth of Massachusetts was granted agreement state status and assumed regulatory oversight of the use of byproduct material. This changed the license status of physicians from Beth Israel Deaconess Medical Center who authorize the BNCT irradiations. TS amendment 30 was issued by the NRC on April 3, 1997 to account for this change in status. The inspector confirmed that TS amendment 30 was implemented during the patient irradiation on April 10, 1997.

Training provided the medical staff by the RRPO and conformance with safety requirements by the staff was acceptable. Constant coverage and radiation monitoring was provided by the RRPO and the ARRPO during patient irradiation.

Records of extensive administrative controls, safety equipment surveillances, and pre- and post-irradiation checks were complete, reviewed by supervision, and readily available to the inspector.

Reactor control during the irradiation was by senior personnel, included backup operators, with oversight by the Assistant Superintendent of Operations.

c. Conclusions

The boron neutron capture therapy irradiation was conducted in accordance with regulatory requirements and licensee commitments.

X1 Exit Interview (Inspection Procedure 307C3)

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on April 11, 1997. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Bernard, Director of Reactor Operations
T. Date, Assistant Reactor Radiation Protection Officer
E. Lau, Assistant Operations Superintendent
F. Massé, Campus Radiation Protection Officer
F. McWilliams, Reactor Radiation Protection Officer (RRPO)
T. Newton, Assistant Operations Superintendent

INSPECTION PROCEDURES USED

IP 30703: ENTRANCE AND EXIT INTERVIEWS

IP 80745: CLASS I NON-POWER REACTORS EFFLUENT AND ENVIRONMENTAL MONITORING

IP 83743: CLASS I NON-POWER REACTORS RADIATION PROTECTION

IP 69745: CLASS I NON-POWER REACTOR EXPERIMENTS

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened
None

Closed

50-20/93-02-01	IFI
50-20/95-01-01	IFI

LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
ARM	Area Radiation Monitor
ARRPO	Assistant Reactor Radiation Protection Officer
BNCT	Boron neutron capture therapy
CFR	Code of Federal Regulations
IFI	Inspector Followup Item
IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
RRPO	Reactor Radiation Protection Officer
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications