

June 12, 2000

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 SPECIAL, ANNOUNCED INSPECTION REPORT NO. 50-20/2000201

Dear Dr. Bernard:

This letter refers to the inspection conducted on April 24-27, 2000, at the MIT Research Reactor. The enclosed report presents the results of that inspection.

The purpose of this inspection was to review the installation and start up of the fission converter. 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 concern or noncompliance to NRC requirements was identified. No response to this letter is required.

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

Sincerely,

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-20/2000201

cc w/enclosure: Please see next page

Massachusetts Institute of
Technology

Docket No. 50-20

cc:

City Manager
City Hall
Cambridge, MA 02139

Assistant Secretary for Policy
Executive Office of Energy Resources
100 Cambridge Street, Room 1500
Boston, MA 02202

Department of Environmental
Quality Engineering
100 Cambridge Street
Boston, MA 02108

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: 50-20

License No: R-37

Report No: 50-20/2000201

Licensee: Massachusetts Institute of Technology

Facility: MIT Research Reactor

Location: 138 Albany Street
Cambridge, Massachusetts

Dates: April 24-27, 2000

Inspector: Thomas F. Dragoun

Approved by: Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

This special, announced inspection included onsite review of Reactor Safeguards Committee oversight, selected aspects of the design change functions program, radiation protection program, and procedures program as related to the installation and start up of the fission converter.

The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

REVIEW AND AUDIT

The review and audit program satisfied Technical Specification requirements.

DESIGN CHANGE FUNCTIONS

The current fission converter systems configuration satisfied Technical Specification requirements.

RADIATION PROTECTION

The radiation protection practices met regulatory requirements.

PROCEDURES

The procedures program satisfied Technical Specification requirements.

Report Details

Summary of Plant Status

The reactor was secured. The new cooling tower was operational but cooling fins were being replaced at vendor expense. The new design eliminated the need for biocide treatment of water. Electrical power to the fission converter cooling pumps was connected and wiring for some instrumentation was installed. The fission converter cooling system was filled with heavy water. The primary and secondary sides of the cooling system were leak checked. The reactor control blade drive mechanism, that was relocated due to interferences, was re-installed. Installation work was performed by the reactor staff. Daily work coordination meetings were held.

1. REVIEW AND AUDIT

a. Scope (IP 40745)

The inspector reviewed selected aspects of:

- Reactor Safeguards Committee meeting
- Committee membership
- oversight

b. Observations and Findings

The inspector observed a portion of a MITRSC meeting held April 24, 2000. The agenda indicated an excellent oversight of activities. An extensive packet of documents and data had been provided to the members prior to the meeting by the Secretary. Detailed questions to the reactor staff during the meeting demonstrated that a critical review of this information had occurred. The committee noted an inconsistency in the estimates of the build up of hydrogen in the core purge system on isolation of the system. Recent data indicated that reactor power must be reduced within 15 minutes (proposed TS 3.3.2) while the original data allowed for 1½ hours (existing TS 3.4). The NRL Director advised the inspector that a temporary instruction for reactor operators was issued that will require reducing reactor power within 2 minutes if the core purge blower trips and cannot be restarted. The inconsistencies in the hydrogen build up data will be resolved within 120 days. This matter will be reviewed in a future inspection (Inspector Follow up Item 50-20/2000201-01).

The safety review personnel qualifications satisfied Technical Specification requirements and licensee administrative controls. Further, the number of personnel involved in the safety reviews also satisfied Technical Specification and licensee procedural requirements.

c. Conclusions

The review and audit program satisfied Technical Specification requirements.

2. DESIGN CHANGE FUNCTIONS

a. Scope (IP 40745)

The inspector reviewed selected aspects of:

- fission converter installation
- fission converter system configuration
- fuel loading
- quality assurance

b. Observations and Findings

Installation of the fission converter and support systems was incomplete. Most of the major mechanical components and piping were installed. Work on electrical power, instrumentation, controllers, and status displays was in progress.

Observations showed that the fission converter systems were installed and configured in accordance with the Technical Specifications and safety analysis report, including:

- use of aluminum blocks (TS 6.6.4-5).
- anti-syphon location of cooling system components (TS 6.6.4-6).
- installation of a hydrogen recombiner (TS 6.6.2.4).
- use of corrosion resistant materials (TS 6.6.4-2).

Discussions and review of records and calculations indicated that the fission converter tank was loaded with fuel elements and satisfied the following requirements:

- the effective neutron multiplication factor (TS 6.6.2.1-6).
- fuel plate orientation (TS 6.6.2.1-7).
- reactivity effect on the reactor core (TS 6.1.1 and 6.6.2.2-2).
- all positions filled in the tank (TS 6.6.2.1-4).
- fuel burn-up limitation (TS 6.6.2.1-5).
- use of self-protecting fuel (TS 6.6.2.3-1).
- designated fuel storage monitoring (TS 3.10.3(f) and 6.6.2.3-2).
- hot channel factor (TS 6.6.2.1-1).

The piping, instrumentation, and display console systems for the fission converter and BNCT treatment room were designed by the reactor staff and graduate students. The system designer provided oversight of the installation of that system. The fission converter tank was fabricated by a vendor who provided records of quality assurance verifications. The tank failed the first bypass flow test (TS 6.6.2.1-2) but was found acceptable in subsequent tests after modifications to the down comer region.

c. Conclusions

The current fission converter systems configuration satisfied TS requirements.

3. RADIATION PROTECTION

a. Scope (IP 83743)

The inspector reviewed selected aspects of:

- radiological oversight of work
- radiation surveys

b. Observations and Findings

Continuous radiological oversight of the fission converter systems installation and replacement of the control blade drive in the reactor tophat area was provided by two contracted HP technicians (Bartlett). "Dog Houses" were being erected over the fission converter tank area to collect argon 41 generated during system startup to assess the effectiveness of air leakage control measures.

c. Conclusions

The radiation protection program met regulatory requirements.

4. PROCEDURES

a. Scope (IP 42745)

The inspector reviewed selected aspects of:

- administrative controls
- procedural implementation
- records

b. Observations and Findings

Procedures were available and implemented for the replacement of the control blade mechanism, fuel transfers to the fission converter tank, and measurement of bypass flow in the tank. Checklists were completed and filed as required. Detailed procedures were available for the various future phases of fission converter start up. All procedures were reviewed and approved in accordance with the licensee's administrative requirements.

c. Conclusions

The procedures program satisfied Technical Specification requirements.

5. EXIT MEETING SUMMARY

The inspector presented the inspection results to members of licensee management at the conclusion of the inspection on April 27, 2000. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Bernard, Director of Reactor Operations
O. Harling, Principal Investigator
E. Lau, Assistant Operations Superintendent
F. McWilliams, Reactor Radiation Protection Officer
T. Newton, Assistant Operations Superintendent
S. Tucker, Quality Assurance Supervisor

INSPECTION PROCEDURES USED

IP 40745: CLASS I NON-POWER REACTOR REVIEW AND AUDIT AND DESIGN
CHANGE FUNCTIONS

IP 42745 CLASS I NON-POWER REACTOR PROCEDURES

IP 83743: CLASS I NON-POWER REACTORS RADIATION PROTECTION

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-20/2000201-01 IFI Resolve differences in estimates of hydrogen build up in the core
purge system

Closed

none

LIST OF ACRONYMS USED

BNCT Boron Neutron Capture Therapy
CFR Code of Federal Regulations
IFI Inspector Follow-up Item
IP Inspection Procedure
MITRSC MIT Reactor Safeguards Committee
NRC Nuclear Regulatory Commission
NRL Nuclear Reactor Laboratory
TS Technical Specifications