

April 24, 2009

Dr. John Bernard, Director of Reactor Operations
MIT Nuclear Reactor Laboratory
Mail Stop NW12-208a
128 Albany Street
Cambridge, MA 02139

SUBJECT: MASSACHUSETTS INSTITUTE OF TECHNOLOGY NUCLEAR REACTOR-
AMENDMENT RE: NUMBER OF HEAT EXCHANGERS REQUIRED BY
TECHICAL SPECIFICATIONS (TAC NO. MC 5155)

Dear Dr. Bernard:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 38 to Facility Operating License No. R-37 for the Massachusetts Institute of Technology Nuclear Reactor. The amendment consists of changes to the technical specifications (TSs) in response to your application dated May 7, 2008, as supplemented by letter dated November 7, 2008. The amendment changes the wording of the TS to remove a restriction on the number of heat exchangers in the reactor coolant system. A copy of the related safety evaluation supporting Amendment No. 38 is enclosed.

Sincerely,

/RA/

Cindy K. Montgomery, Project Manager
Research and Test Reactors Branch A
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-20

Enclosures:

1. Amendment No. 38
2. Safety Evaluation

cc w/encls: See next page

Massachusetts Institute of Technology

Docket No. 50-20

cc:

City Manager
City Hall
Cambridge, MA 02139

Department of Environmental Protection
One Winter Street
Boston, MA 02108

Director
Radiation Control Program
Department of Public Health
90 Washington Street
Dorchester, MA 02121

Nuclear Preparedness Manager
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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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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DOCKET NO. 50-20

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 38
Licensee No. R-37

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to Facility Operating License No. R-37 filed by the Massachusetts Institute of Technology (the licensee) on May 7, 2008, as supplemented on November 7, 2008, conforms to the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the regulations of the Commission as stated in Chapter I of Title 10 of the *Code of Federal Regulations* (10 CFR);
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance that (i) the activities authorized by this amendment can be conducted without endangering the health and safety of the public and (ii) such activities will be conducted in compliance with the rules and regulations of the Commission;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;
 - E. This amendment is issued in accordance with the regulations of the Commission as stated in 10 CFR Part 51, and all applicable requirements have been satisfied; and
 - F. Prior notice of this amendment was not required by 10 CFR 2.105, and publication of a notice for this amendment is not required by 10 CFR 2.106.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the enclosure to this license amendment, and paragraph 2.C(2) of License No. R-37 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 38, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Kathryn Brock, Chief
Research and Test Reactors Branch A
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Enclosure:
Appendix A Technical
Specifications Changes

Date of Issuance: April 24, 2009

5.3 Primary Coolant System

Applicability

The specification applies to the design of the primary coolant system.

Objective

To assure compatibility of the primary coolant system with the safety analysis.

Specification

The reactor coolant system shall consist of a reactor vessel, a single cooling loop containing one or more heat exchangers, and appropriate pumps and valves. All materials, including those of the reactor vessel, which are in contact with primary coolant (H₂O), shall be aluminum alloys, stainless steel, or titanium alloys except for small non-corrosive components such as gaskets, filters, and valve diaphragms. The reactor vessel shall be designed in accordance with the ASME Code for Unfired Pressure Vessels. It shall be designed for a working pressure of 24 psig and 150 °F. Heat exchangers shall be designed for 75 psig and a temperature of 150 °F. The connecting piping shall be designed to withstand a 60 psig hydro test.

Basis

The reactor coolant system originally consisted of a single loop that contained two heat exchangers. It was subsequently modified to add a third heat exchanger although it was normally operated with only two heat exchangers on line. Most recently it has been changed to contain only one heat exchanger. Core safety is unaffected by the

number of heat exchangers provided that the required heat transfer surface area is available for heat removal and that primary coolant flow remains as required by Specification 3.7.

The materials of construction are primarily aluminum alloy, stainless steel, or titanium alloys and are chemically compatible with the H₂O coolant. The design, temperature, and pressure of the reactor vessel and other primary system components provide adequate margins over operating temperatures and pressures. The reactor vessel was designed to Section VIII, 1968 edition, of the ASME Code for Unfired Pressure Vessels. Subsequent design changes will be made in accordance with the most recent edition of this code.

ENCLOSURE TO LICENSE AMENDMENT NO. 38

FACILITY OPERATING LICENSE NO. R-37

DOCKET NO. 50-20

Replace the following page of the Appendix A Technical Specification with the enclosed page. The revised page is identified by amendment number and contains a vertical line indicating the area of change.

Remove

5.3

Insert

5.3

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 38 TO

FACILITY OPERATING LICENSE NO. R-37

MASSACHUSETTS INSTITUTE OF TECHNOLOGY NUCLEAR REACTOR

DOCKET NO. 50-20

1.0 INTRODUCTION

By letter dated May 7, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML081350611), as supplemented on November 7, 2008 (ADAMS Accession No. ML083180135), the Massachusetts Institute of Technology (MIT or the licensee) submitted to the U.S. Nuclear Regulatory Commission (NRC) a request for amendment to the Technical Specifications (TSs) in Appendix A, to Facility Operating License No. R-37 for the MIT Reactor (MITR). The requested amendment would change the TS requirement for “three heat exchangers” to “one or more heat exchangers.”

2.0 EVALUATION

The licensee has requested a change to TS 5.3, “Primary Coolant System.” TS 5.3 currently reads:

Specification

The reactor coolant system shall consist of a reactor vessel, a single cooling loop containing three heat exchangers, and appropriate pumps and valves. All material, including those of the reactor vessel, in contact with primary coolant (H₂O), shall be aluminum alloys, stainless steel, or titanium alloys except small non-corrosive components such as gaskets, filters, and valve diaphragms. The reactor vessel shall be designed in accordance with the ASME Code for Unfired Pressure Vessels. It shall be designed for a working pressure of 24 psig and 150 °F. Heat exchangers shall be designed for 75 psig and a temperature of 150 °F. The connecting piping shall be designed to withstand a 60 psig hydro test.

The licensee has proposed changing TS 5.3 to read as follows:

Specification

The reactor coolant system shall consist of a reactor vessel, a single cooling loop containing one or more heat exchangers, and appropriate pumps and

valves. All material, including those of the reactor vessel, in contact with primary coolant (H₂O), shall be aluminum alloys, stainless steel, or titanium alloys except for small non-corrosive components such as gaskets, filters, and valve diaphragms. The reactor vessel shall be designed in accordance with the ASME Code for Unfired Pressure Vessels. It shall be designed for a working pressure of 24 psig and 150 °F. Heat exchangers shall be designed for 75 psig and a temperature of 150 °F. The connecting piping shall be designed to withstand a 60 psig hydro test.

The licensee is considering replacement of their three primary heat exchangers. While the proposed change to the TS would allow for any number of heat exchangers, the licensee plans to replace the three original heat exchangers with a single new flat plate-type unit.

The licensee states that the requirements for the radiation detection systems in the primary and secondary coolant systems are not changed by the proposed license amendment. In the event of a leak of the primary system, the licensee states that when the primary and secondary cooling systems are operating, the primary pressure exceeds secondary pressure. Leaks of the primary coolant into the secondary coolant system would be detected by secondary water monitors and the reactor would be shutdown. In shutdown mode, the primary pressure also exceeds secondary pressure and the secondary water monitors remain sensitive to detect the presence of radionuclides in the coolant such that a leak would be detected immediately. In shutdown, there is no secondary coolant flow to the heat exchanger. The detectors use a gamma-sensitive scintillation detector that is sensitive to the principle radionuclides nitrogen-16, fluorine-18, and sodium-24. The ability to detect a failure in the heat exchanger system remains unchanged by the proposed TS amendment. The NRC staff agrees with the applicant that the ability to detect a leak in the heat exchanger system remains unchanged by the proposed TS amendment. The NRC finds that the proposed amendment will not adversely affect the radiation detection system or the licensee's ability to detect and respond to a leak in the primary coolant system or in the heat exchanger. Nor does the proposed amendment involve significant increase in the consequences of an accident.

The NRC staff examined whether the new heat exchanger would affect the thermal-hydraulic safety limits. The thermal hydraulic safety limits for the MITR are based on reactor power, core tank level, primary flow, and primary temperature. The licensee has not requested any change in these limits. The heat exchanger can have an influence on primary flow and temperature. This is a function of the attributes of the specific heat exchanger in use rather than the number of heat exchangers. The licensee will need to have sufficient heat removal capacity to meet the safety and operational limits for the reactor. The revised TS will allow the licensee to choose the number of heat exchangers needed to meet thermal hydraulic requirements. Further, all of the reactor safety instrumentation, including primary flow and temperature scrams will remain unchanged. As long as the heat from the reactor can adequately be removed under the nominal flow and temperature conditions, the safety limit will be met.

The new single plate-type heat exchanger that the licensee is considering can remove 6.6 MW of heat at a primary flow rate of 2000 gallons per minute, whereas the previous two exchangers could remove 4.0 Mw under the same conditions.

The TSs will continue to specify the materials of construction, working pressures and temperatures of the vessel, heat exchangers and pipes. The only difference between the current TSs and the proposed TSs is the change in requirement from “three heat exchangers” to “one or more heat exchangers”.

Based on the NRC staff review, the NRC staff finds that there exists no safety reason to require three heat exchangers in the reactor coolant system at the MITR. The NRC staff finds that the proposed change to the TS will not impact the ability of the licensee to detect heat exchanger failure and will not impact the ability to meet the safety limits for reactor operation. Therefore, the NRC staff concludes that the proposed change is acceptable.

3.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes in inspection and surveillance requirements. The NRC staff has determined that this amendment involves no significant hazards consideration, no significant increase in the amounts, and no significant change in the types, of any effluents that may be released off site, and no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

4.0 CONCLUSION

The NRC staff has concluded, based on the considerations discussed above, that (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously evaluated, or create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a margin of safety, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities, and (3) such activities will be conducted in compliance with the Commission’s regulations and the issuance of this amendment will not be inimical to the common defense and security or the health and safety of the public.

Principal Contributors: C. Montgomery
A. Adams, Jr.

Date: April 24, 2009