MIT NUCLEAR REACTOR LABORATORY

AN MIT INTERDEPARTMENTAL CENTER

John A. Bernard
Director of Reactor Operations
Principal Research Engineer

Mail Stop: NW12-208a
138 Albany Street
Cambridge, MA 02139

Phone: 617 253-4202
Fax: 617 253-7300
Email: Bernardj@mit.edu

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U.S. Nuclear Regulatory Commission
Attn: Document Control Room
Washington, DC 20555

Re: Massachusetts Institute of Technology – Request for Additional Information Regarding Amendment Request (TAC No. MC5155); License No. R-37; Docket No. 50-20

Dear Sir or Madam:

The Massachusetts Institute of Technology hereby provides the response for the above request. Please contact the undersigned with any questions.

Sincerely,

John A. Bernard, PhD, PE, CHP
Director of Reactor Operations

I declare under the penalty of perjury that the foregoing is true and correct.

Executed on 7 Nov 08 (Date) _______ (Signature)

cc: w/enclosures — Cindy Montgomery
Research and Test Reactors Branch A
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

w/enclosures — Senior Project Manager
Research and Test Reactors Branch A
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

w/enclosure — Senior Reactor Inspector
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

w/o enclosure — Document control Desk

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NRR

Heat Exchanger RAI Response

1. The radiation detection systems in both the primary and secondary coolant systems (as specified in TS 3.8.3) will remain unchanged with the installation of the new heat exchanger. Thus, the radiological impact is unchanged. Detection of a primary to secondary leak is as follows:

Operating: Primary pressure exceeds secondary pressure. As in the current system, any leak of primary water into the secondary system would be immediately detected by the secondary water monitors. Appropriate action would then be taken, including shutting down the reactor until repairs could be made.

Shutdown: Primary pressure exceeds secondary pressure. Immediately after shutdown, the coolant system remains in operational alignment. Although the radiation levels in the coolant are significantly reduced, the secondary water monitors remain sensitive enough to detect the presence of radionuclides in the water, and thus a leak would still be detected immediately. Once the reactor is in shutdown alignment, there is no secondary water flow to the main heat exchanger.

The attached Appendix describes the secondary water monitors.

2. The thermal-hydraulic safety limits for the MITR-II are based on reactor power, core tank level, primary flow, and primary temperature. The heat exchangers in the primary system can only significantly affect the latter two parameters. Whether there are one, two, or three heat exchangers in use, as long as the heat from the reactor can be adequately removed under the nominal flow and temperature conditions, the reactor safety limits will be met. The new heat exchanger has a significantly larger heat transfer surface area than one of the current heat exchangers, it has a higher overall heat transfer coefficient, and it is designed to remove at least 6 MW of heat under nominal conditions. A comparison of the two heat exchangers under the normal operating configurations and operating conditions is shown in the table below. This clearly shows the superiority of the new heat exchanger in removing heat. In particular, the primary to secondary temperature difference is greatly reduced.

It should be noted that all of the reactor safety instrumentation, including primary flow and temperature scrams, will be unchanged by this installation.

	Heat removed	**Primary ΔT (°C)**	**Primary to secondary mean ΔT (°C)**
Old (two shell-and-tube)*	4.0 MW	7.2	17.8
New (single plate type)	6.6 MW	12.6	8.5

Comparison of old and new heat exchangers at a primary flow rate of 2000 gpm, reactor outlet temperature 52 °C, and secondary inlet temperature ~30 °C.

*measured data

Appendix

Two redundant water monitors are mounted in a shielded location in the equipment room. Each system separately samples water from the eight-inch pipe leading to the cooling towers. Sample water is returned to the inlet pipe. Flow through the monitors depends on the pressure differential between the two pipes produced by the main pumps in the secondary system.

Activity could be introduced to the secondary water if a leak developed within any of the heat exchangers serviced by the secondary water system.

Each of the redundant monitors uses a gamma-sensitive scintillation detector that views a volume of water contained in a lead shield. It is sensitive to N-16 and F-18 which are present in the light water coolant whenever the reactor is operating and to Na-24 which is present both during operating and shutdown conditions because of its half-life. The N-16 isotope has a half-life of a few seconds, that of F-18 is approximately fifteen minutes, and that of Na-24 is about 16 hours. A flow of about two gpm is maintained through each lead shield as indicated by local flow meters, HF-5 and HF-5A. Flow switches will produce a "Trouble Radiation Monitor Alarm" if the flow falls below one gpm.