



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 28 TO

AMENDED FACILITY OPERATING LICENSE NO. R-37

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DOCKET NO. 50-20

1.0 INTRODUCTION

By letter dated March 31, 1994, as supplemented on September 29, and November 4, 1994, the Massachusetts Institute of Technology (MIT or licensee) submitted a request for amendment to Amended Facility Operating License No. R-37 for the MIT Research Reactor (MITR) to extend the expiration date of the license from midnight, May 7, 1996, to midnight, April 24, 2001.

2.0 EVALUATION

Title 10 CFR 50.51 specifies that each license will be issued for a fixed period of time not to exceed 40 years from date of issuance. The current term for the MITR is 40 years commencing with the May 7, 1956, issuance of Construction Permit No. CPRR-5. The licensee has requested that the expiration date of the license be extended from midnight, May, 7, 1996, to midnight, April 24, 2001. MIT has requested that four periods of time be recaptured:

- (1) The period from May 7, 1956, the date of issuance of CPRR-5, until June 9, 1958, the issuance date of Facility Operating License No. R-37, or July 21, 1958, the date of initial criticality.
- (2) The period from July 21, 1958, until June 1, 1959, during which the first reactor (MITR-I) was operated infrequently at low power for startup testing.
- (3) From May 24, 1974, the date the MITR-I was shut down to perform modifications to the facility under Construction Permit No. CPRR-118, (CPRR-118 was issued on April 9, 1973, but component acquisition problems delayed the reactor shut down until May 24, 1974) until August 14, 1975, the date of initial criticality of the modified reactor (MITR-II). The NRC issued Amendment No. 10 to the license on July 23, 1975, which authorized operation of the modified reactor.
- (4) The period from August 14, 1975, until April 15, 1976, during which the MITR-II was operated infrequently at low power for startup testing.

ENCLOSURE 2

The staff has determined that the time between May 7, 1956, the issuance date of Construction Permit No. CPRR-5 and June 9, 1958, the issuance date of Facility Operating License R-37, and between May 24, 1974, the day reactor operations with the MITR-I were terminated to modify the reactor under Construction Permit No. CPRR-118, and July 23, 1975, the date of issuance of Amendment No. 10 to Amended Facility Operating License R-37 which authorized a return to reactor operation with the MITR-II, represents time that was not available to the licensee due to construction. This period of time is 1188 days, which when added to the expiration date of the Amended Facility Operating License of May 7, 1996, results in an extended expiration date of August 8, 1999, which results in a license term of 40 years.

The staff has also determined that the time (a) between June 9, 1958, the issuance date of the license for the MITR-I, through July 21, 1958, the date of initial criticality, to June 1, 1959, the end of low power testing, and (b) between July 23, 1975, the date of issuance of Amendment No. 10, through August 14, 1975, the date of initial criticality for the MITR-II, to April 15, 1976, the end of low power testing, cannot be added to extend the expiration date of the license. This is because this time was authorized by the license for reactor operation, was available to the licensee for operations and, after initial criticality in both cases, was used by the licensee for low power testing.

The NRC staff has evaluated the safety issues associated with issuance of the proposed license amendment. These issues involve the condition of various facility systems and the ability of these systems to continue to function adequately during the additional time period. Very few components in a non-power reactor (NPR) are subjected to high temperatures and pressures or high neutron fluence. The facility technical specifications (TS) contain surveillance requirements for components that have a safety function. The licensee has conducted surveillances in accordance with the TS. The TS surveillances ensure that facility equipment functions as described in the safety analysis report and ensure that unacceptable degradation of equipment is not occurring. The NRC NPR inspection program reviews the frequencies and results of these surveillances to ensure compliance with the requirements of the TS. The NRC inspection program has not identified any problems in the area of facility surveillance and condition of equipment. Items that have fixed lifetimes such as control rods are replaced on an established schedule.

The licensee discussed the material condition of the containment building, core components, primary and heavy water systems, nuclear and process instrumentation, and effluent monitoring equipment. The licensee described the full array of tests that are performed periodically to ensure containment building equipment operability. These tests include surveillances required by the TS and additional surveillances carried out by the licensee. Core

components are inspected quarterly in accordance with a facility procedure. In addition, normally inaccessible areas such as the graphite reflector and exterior of the heavy-water tank have been occasionally inspected. The licensee gave details concerning these occasional inspections that indicated no remarkable findings.

A number of reactor components such as the light-water tank, heavy-water tank, and all in-core components were installed as part of the MITR-II construction in 1974. At the end of the requested 40 year license term in 1999 these components will have seen 25 years of service.

Unlike power plant ferritic steel reactor vessels, the MIT vessel is fabricated of aluminum which is not subject to ductile-brittle transition. However, other damage mechanisms such as irradiation aging, corrosion, and low-cycle fatigue based on pH, neutron fluence, and stress to the vessel exist that must be considered. Research on the irradiation of aluminum at the U.S. Department of Energy High Flux Isotope Reactor and High Flux Beam Reactor and calculations performed for 20 additional years of operation for the MITR-II at twice the current licensed power indicates that neutron irradiation will not be of concern for the MITR-II.

The licensee controls water chemistry through TS requirements, which minimizes corrosion. Areas of the facility such as the outer surface of the heavy-water tank, the reentrant thimbles, and certain experimental ports not in coolant that are difficult to inspect are kept under either CO₂ or He cover gas. This precludes the formation of corrosives. Stress on the reactor tank is a factor of three below the level of concern for aluminum.

The licensee has maintained instrumentation and control systems for reactor operation and detection of radiation. Over the last several years the licensee has replaced systems such as radiation monitor recorders for effluents and interior radiation detectors and the equipment for the calibration of temperature sensors. The licensee is also currently upgrading such systems as the stack area radiation monitor and the effluent radiation detectors. NRC review of MIT annual reports and the NRC NPR inspection program have shown the effluent releases from the MIT facility are below allowable limits and the personnel exposure to radiation is well controlled and below allowable limits.

The licensee has maintained emergency preparedness, security, operator training, and quality assurance in compliance with the regulations and the facility emergency, security, operator requalification, and quality assurance plans. The licensee also conducts audits, some of which are required by the TS, to ensure compliance with regulatory requirements.

The staff concludes from its consideration of the design, operation, testing, and monitoring of the mechanical and electrical equipment, structures, and reactor vessel that an extension of the operating license for the MIT Research Reactor to a 40-year service life is consistent with NRC safety evaluations, supporting amendments, and licensing submittals made by the licensee.

Therefore, there is reasonable assurance that the MIT Research Reactor will continue to operate safely for the additional period authorized by this amendment.

3.0 ENVIRONMENTAL CONSIDERATION

The Environmental Assessment and Finding of No Significant Impact relating to the proposed extension of the Amended Facility Operating License expiration date for the MIT Research Reactor was published in the Federal Register on February 8, 1995 (60 FR 7589).

4.0 CONCLUSION

The 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 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 Contributor: Alexander Adams, Jr.

Date: February 8, 1995

Attachment:
Environmental Assessment and Finding
of No Significant Impact