MIT NUCLEAR REACTOR LABORATORY

AN MIT INTERDEPARTMENTAL CENTER

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50-020

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn.: NRC Licensing Project Manager Patrick Boyle / Document Control Desk

Subject: Supplement to Technical Specifications Surveillance Frequency Definition Update for Improved Compliance under 10 CFR 50.36(c)(3) for the MIT Research Reactor, Facility Operating License No. R-37

The Massachusetts Institute of Technology (MIT) hereby submits supplemental information for the License Amendment Request (LAR) that was submitted to the Nuclear Regulatory Commission dated 18 June 2020 for MIT's Facility Operating License No. R-37. The requested amendment was for a change in MIT Technical Specification (TS) 1.3.11, adding a third term and condition for surveillance requirements for the definition of "Frequency". The reason for this change was to allow deferral of certain TS-required surveillance, to be performed beyond its mandated interval because the reactor was not operating in a status such that the surveillance could be performed. This supplement is in response to NRC's letter dated 9 July 2020, which requested supplemental information for application acceptance, and imposed a deadline of 28 August 2020. The deadline was later extended to 31 January 2021.

In order to specify which surveillance activity can be deferred, the proposed new definition, TS 1.3.11c in the 18 June 2020 submittal, is modified for clarity, replacing "However" with "Where indicated in the surveillance Technical Specifications". The new proposed TS 1.3.11c statement now reads as follows: "Where indicated in the surveillance Technical Specifications, scheduled surveillances that cannot be performed while the reactor is shut down may be deferred until the next planned period of reactor operation. Such surveillances shall be performed as soon as practicable when reactor operation resumes." Therefore, the only surveillance activities that can be deferred beyond their normal interval are those denoted in their own sections with a statement describing the conditions under which they can be deferred. Any surveillance requirement with no such denotation is not deferrable.

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As stated in the 18 June 2020 LAR letter, surveillance requirements for measuring reactivity worth of control devices and for nuclear channel plateau tests could not be performed prior to their annual due dates due to a prolonged reactor shutdown and campus lockdown for the COVID-19 public health emergency. These two surveillance frequencies are stated in TS 4.2.1 Reactivity Worth of Control Devices, TS 4.2.6a Period, and TS 4.2.6b Neutron Flux Level, as "at least annually". As a part of this supplemental information, a new statement is proposed for insertion in TS 4.2 under "Applicability": "The surveillance requirements in specifications #1, #6a, and #6b of this section can be deferred during periods of reactor shutdown until the next planned period of reactor operation, in which case they shall be performed as soon as practicable when reactor operation resumes."

Text is also added in two places in the Basis for TS 4.2 to explain why it is desirable to allow the above surveillance requirements to be deferrable.

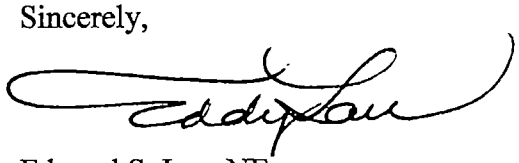
MIT considers timely completion of test and calibration procedures in accordance with the TS surveillance requirements important to safe reactor operation at power. Measurements of control device reactivity worth can be performed only with the reactor operating at low power – measuring doubling times vs. regulating rod position, and balancing worth of devices at various heights for shim blades. During periods of reactor shutdown, the reactivity worth of the control devices does not change. As long as the reactor stays shut down, previously-measured reactivity worth can still be used accurately to calculate Estimated Critical Position, etc. Typically, these annual measurements update the new control device worth, which changes slowly over time due to depletion of absorber isotopes or "burnup", to provide trending analysis on when the device may need to be replaced. No significant depletion occurs when the reactor is not operating.

Likewise, nuclear instruments measuring reactor period and neutron flux level do not exhibit drastic performance changes or trip setpoint movement during reactor shutdown time. Any significant change or malfunction will be apparent in required pre-startup channel tests. Procedures for verification that reactor period indication is accurate on the wide-range flux monitors can be performed only when the reactor is operating. Some of the procedures for verification of neutron flux level also require the reactor to be operating at power, for instance by comparison of neutron flux to equilibrium thermal power via calorimetric calculations based on coolant flows and temperatures. Additionally, performance verification for the corresponding neutron detectors can be performed only with the reactor operating at low power for discriminator setpoint determination, and at high power for fission chamber plateau tests. Precision in these areas is not required when the reactor is shut down, during which time all the control device absorbers are inserted in core. Furthermore, written procedures are available for non-routine reactor startup, which uses thermal power to verify neutron flux response of all the nuclear instruments.

The enclosed TS pages show how the new text is arranged on page 1-4 of the MITR TS under Section 1.3.11 "Frequency", and on pages 4-4, 4-7, and 4-8 of TS 4.2 Reactor Control and Safety Systems. The supplemental information herein for the proposed TS surveillance deferral meets the requirements of ANSI/ANS-15.1-2007 Section 4 "Surveillance requirements", which states in part, "For each surveillance requirement, it should be specified if the surveillance activity can or cannot be deferred."

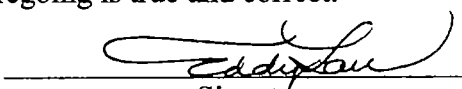
MIT continues to evaluate reactor safety to be improved by this change, because the safety significance of the equipment being affected by the relevant surveillance requirements (neutron flux channel calibrations and absorber reactivity worth measurements) is fully applicable only when the reactor is operating, and because the change removes an unnecessary source of time pressure on personnel to operate the reactor in circumstances where other factors may argue against it. This amendment request has been previously approved by the MIT Reactor Safeguards Committee.

Sincerely,



Edward S. Lau, NE
Assistant Director of Reactor Operations
MIT Research Reactor

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

Executed on 1/29/2021 
Date Signature

Enclosure: MITR Technical Specifications pages 1-4, 4-4, 4-7, and 4-8

cc: USNRC –Senior Project Manager
Research and Test Reactors Licensing Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

USNRC –Senior Reactor Inspector
Research and Test Reactors Oversight Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

1.3.11 Frequency

Each required surveillance test or other function shall be performed within the specified time interval with:

a) A maximum allowable extension not to exceed 25% of the specified surveillance interval, unless otherwise stated in these Technical Specifications.

b) A total maximum combined interval time for any three consecutive surveillance intervals not to exceed 3.25 times the specified surveillance interval.

c) Where indicated in the surveillance Technical Specifications, scheduled surveillances that cannot be performed while the reactor is shut down may be deferred until the next planned period of reactor operation. Such surveillances shall be performed as soon as practicable when reactor operation resumes.

Surveillance tests required for experiments (Section 6) may be waived when an instrument, component, or system is not required to be operable, but any such instrument, component, or system shall be tested prior to being used as a required operable instrument, component, or system.

1.3.12 Immediate

Immediate means that the required action will be initiated without delay in an orderly manner by using written procedures when applicable.

1.3.13 Inadmissible Sample Materials

Those materials defined by the MIT Reactor Safeguards Committee (MITRSC) as either not allowable within the MITR-II or restricted from the reactor containment building. Examples include unapproved amounts of combustible, corrosive, or explosive materials.

1.3.14 Independent Experiments

Experiments that are not connected by a mechanical, chemical, or electrical link.

1.3.15 Irradiation

Use of reactor experimental facilities where the primary purpose is the production of activated material such as samples for neutron activation analysis, or materials that exhibit

4.2 Reactor Control and Safety Systems

Applicability

This specification applies to the surveillance of reactor control and safety systems. The surveillance requirements in specifications #1, #6a, and #6b of this section can be deferred during periods of reactor shutdown until the next planned period of reactor operation, in which case they shall be performed as soon as practicable when reactor operation resumes.

Objective

To ensure the reliability of the reactor control and safety systems.

Specification

1. Reactivity Worth of Control Devices: The integral and differential worths of the six shim blades and of the regulating rod shall be measured at least annually. Either calculations of the expected change or measurements shall be made upon changeout of an absorber and upon changes in core configuration that involve a new type of fuel or a change in the total number of non-fueled positions.

2. Rod Withdrawal and Insertion Speed: The withdrawal and insertion speed of each shim blade and the regulating rod shall be verified annually.

3. Scram Times: The scram time of each shim blade shall be verified annually or whenever any work has been done on either the shim blade, its electromagnet, or its associated drive. For purposes of this check, the scram time shall be measured from the full-out position to the 80% inserted position of the shim blade.

4. Scram and Power Measuring Channels: The instruments or channels listed in Table 4.2-1 shall be tested at least quarterly and each time before startup of the

8. Heat Balance: The signal from the linear power channel shall be checked against a heat balance calculation at least monthly, for any month that the reactor is operated above 1 MW continuously for at least 48 hours.

9. Control Device Inspection: Control devices shall be inspected annually as follows:

   a) Shim blade absorbers shall be checked visually.

   b) Shim blade electromagnets shall be checked both visually and by measuring the resistance of the coils.

   c) Shim blade and regulating rod drives shall be monitored for proper operation.

10. Control System Interlocks: A channel test of the following interlocks and scram shall be performed at least annually:

    a) Withdraw Permit Interlock,

    b) Subcritical Limit – Shim Blades Interlock,

    c) No Overflow Reflector Startup Interlock, and

    d) Low Level D_2O Reflector Scram.

Basis

The MITR-II has observed the criteria given in Specification 4.2.1 for determination of control device reactivity worths and found it to be adequate. Measurements of the integral and differential worths are required annually. Because such measurements require operation of the reactor, they are deferrable until the reactor is operating. Measurements following changeouts of absorbers and change of core configuration are desirable. However, such measurements are very time consuming. Moreover, sufficient experience exists with such changes that their effect on integral and differential reactivity worths can be predicted with reasonable accuracy. Accordingly,

normal MITR-II practice is to do a complete set of measurements following replacement of all absorber sections rather than to do measurements as each is replaced. (Note: It requires several days to replace one absorber and the entire process is usually done over an interval of several months.) Estimates of the change of worth are used pending the measurement. Estimates, not measurements, are normally used for changes of core configuration.

The insertion and withdrawal speed of the control devices is fixed by the motor and drive design as discussed in Section 4.2.2 of the SAR. These speeds are verified annually.

Scram time is as defined by Specifications 1.3.37 and 3.2.1. It is verified at least annually and whenever maintenance has been performed that could affect it.

The instruments and channels listed in Table 4.2-1 correspond to those in Table 3.2.3-1, "Required Safety Channels" with the exception that surveillance of the building overpressure and gasket deflated scrams is addressed elsewhere (Specification 4.4).

Some of the calibration procedures for the wide-range neutron flux monitors that calculate period and neutron flux level require operation of the reactor. These are therefore deferrable until the reactor is operating.

The thermal power indication is calibrated at least annually and the signal from the linear power channel is compared against a heat balance at least monthly for any month that the reactor is operated above 1 MW. These actions are done under conditions of thermal equilibrium which, because of the MITR-II's heat capacity (especially that of the graphite reflector), occurs after 48 hours of steady-state operation.