MIT NUCLEAR REACTOR LABORATORY

AN MIT INTERDEPARTMENTAL CENTER

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

Re: Massachusetts Institute of Technology; License No. R-37; Docket No. 50-20; Reportable Occurrence 50-20/2012-1: Operation with Fewer than the Required Number of Nuclear Safety Channel Period Scrams; NRC OPS Center Log #47-770

Dear Sir or Madam:

The Massachusetts Institute of Technology hereby submits a report of an occurrence at the MIT Research Reactor (MITR) in accordance with paragraph 7.7.2 of the Technical Specifications. An initial report was made by telephone to the U.S. Nuclear Regulatory Commission Headquarters Operations Center on 26 March 2012.

The format and content of this report was based on Regulatory Guide 1.16, Revision 1.

1. Report No.: 50-20/2012-1; Ops Center No. 47-770

2a. Report Date: 4 April 2012

2b. Date of Occurrence: 25 March 2012

3. Facility: MIT Nuclear Reactor Laboratory

4. Identification of Occurrence:

During a startup of the MIT Research Reactor on 25 March, 2012, there was a period of time in which only one operable nuclear safety channel period scram existed. Technical Specification No. 3.2.3-1 requires that there be at least two such operable channels prior to the reactor being brought critical.

5. Conditions Prior to Occurrence:

The reactor had been operating at 5.5 MW. At 0356 a scram occurred on channel 3, a period safety channel. (Note: Channels 1-3 are the period safety channels and channels 4-6 are the neutron flux level channels.) This scram was attributed to electronic noise because no other channels showed any changes and when channel 3 was subsequently tested according to the full

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power startup checklist (PM 3.1.1.2 -- a test that includes introduction of a simulated period signal), it was found to be fully operational.

PM 3.1.6, the reactor Restart Checklist, was completed, and at 0449, control blades were withdrawn beginning an approach to the estimated critical position (ECP) of 13.6 inches. As per startup procedure, channels 1 and 2 were operating with source range fission chambers and channel 3 was operating with its ion chamber, which indicates on scale at a power level of approximately 500 W. As reactor power reaches approximately 1 kW, channels 1 and 2 are normally manually switched to ion chamber one at a time so that a minimum of two channels are always on scale during the entire power level range of reactor operation.

6. Description of Occurrence:

When the control blades reached the ECP, no indication of criticality was seen on any of the three period channels. Because the time was then about 20 minutes past the time originally assumed for criticality in the ECP calculation, xenon poisoning would make the critical position somewhat higher. Standard operating procedure is to raise the blades in 0.1 inch increments until criticality is reached or until the blades reach 0.5 inches above the ECP. The operator and shift supervisor in the control room withdrew the control blades in 0.1 inch increments. Shortly after reaching a blade position of 14.1 inches (0.5 inches above the ECP calculated height), the operator noticed that the power level indication on one of the power level indicating channels (channel 9) was reading approximately 1 MW and rising. The operator reached to scram the reactor manually, while the channel 3 period channel also scrammed the reactor.

All subsequent analyses showed that reactor power and period remained within the limits specified in technical specifications. Because channels 1 and 2 were not switched to ion chambers as is normally done at lower power levels, and their fission chambers do not function effectively at power levels above about 5 kW, only channel 3 was capable of providing a period scram above this level, for a time of approximately two minutes.

7. Description of Apparent Cause of Occurrence:

The cause of this occurrence was the operation of the reactor at power levels above which channel 1 and 2 fission chambers would be able to function. This was brought about by the operators failing to switch from the fission chambers to the ion chambers at the required time and thus allowing power levels to increase above 1 kW with only channel 3 operable.

8. Analysis of Occurrence:

The reactivity conditions seen in the blade positions and movements are consistent with normal startup conditions after a scram from full power operation. There were no signs of any external causes of reactivity changes such as changes in D_2O reflector level, or in-core experiment flooding. Testing of the channels after the occurrence found that all three period channels functioned correctly in period display and scram capability.

9. Corrective Action:

Corrective action consists of the following:

a) A fourth, independent indication of reactor period will be installed in the control room (action to be completed by 1 May 2012), until such time as the nuclear safety system is replaced with the updated system (see item 10 below).

b) Retraining of all licensed personnel as to the importance of maintaining deliberate vigilance in approach to criticality (action to be completed by 1 May 2012).

10. Additional Information:

A replacement for the entire nuclear safety system (channels 1-6) has been purchased and detectors are currently being built by the vendor. Pending any necessary regulatory approval, installation is planned to be completed by summer of 2013. This replacement will eliminate the need to shift from fission chamber to ion chamber during startups.

11. Failure Data:

None.

Sincerely,

John P. Foster
Superintendent
MIT Research Reactor

Thomas H. Newton, Jr., Ph.D, PE
Director of Reactor Operations
MIT Research Reactor

cc: MITRSC

USNRC - Senior Project Manager
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Office of Nuclear Reactor Regulation

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