

December 23, 1999

Dr. John A. Bernard, Director  
Nuclear Reactor Laboratory  
Massachusetts Institute of Technology  
138 Albany Street  
Cambridge, MA 02139-4296

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (TAC NO. MA6134)

Dear Dr. Bernard:

We are continuing our review of your amendment request for Amended Facility Operating License No. R-37 for the Massachusetts Institute of Technology Research Reactor which you submitted on June 30, 1999. During our review of your amendment request, questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed request for additional information within 30 days of the date of this letter. In accordance with 10 CFR 50.30(b), your response must be executed in a signed original under oath or affirmation. Following receipt of the additional information, we will continue our evaluation of your amendment request.

If you have any questions regarding this review, please contact me at (301) 415-1127.

Sincerely,

Original signed by

Alexander Adams, Jr., Senior Project Manager  
Events Assessment, Generic Communications  
and Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

Docket No. 50-20

Enclosure:  
As stated

cc w/enclosure:  
See next page

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Massachusetts Institute of  
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Docket No. 50-20

cc:

City Manager  
City Hall  
Cambridge, MA 02139

Assistant Secretary for Policy  
Executive Office of Energy Resources  
100 Cambridge Street, Room 1500  
Boston, MA 02202

Department of Environmental  
Quality Engineering  
100 Cambridge Street  
Boston, MA 02108

REQUEST FOR ADDITIONAL INFORMATION  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY RESEARCH REACTOR  
DOCKET NO. 50-20

1. Please provide a discussion that shows how the new fission converter beam and associated medical therapy room meet the requirements of TS 6.5, as proposed for revision by MIT.
2. You have proposed changes to Technical Specification (TS) 6.5.5(c) and 6.5.12(d) to allow an alarm to the reactor operator to be used as an alternative to automatic closure of shutters upon failure of electric power or air pressure, if pneumatically operated. Medical devices used under 10 CFR Part 35 are required to be fail-safe (i.e., automatically close) under this type of failure.

What has been the operational history of the existing beam shutters in regard to failures that resulted in automatic closure?

Please ensure that your answers to the following questions address both beams.

Are you proposing this to allow an irradiation in progress to be completed if either electrical power or air pressure fails to the shutters that control beam delivery?

Your proposed TS states that lowering reactor power would substitute for shutter closure. What do you mean by the phrase "lower power?" Would power be lowered by running in the control rods or by scrambling the reactor? If you run in the control rods, do you shut the reactor down or go to some lower power level?

Discuss the radiation fields in the medical therapy facilities after ending a treatment by normal shutter closure. Compare these radiation fields with the fields that would result in ending a treatment by lowering reactor power as proposed by you.

Discuss control of the treatment dose to the patient. Compare treatment control ending the treatment with the beam shutters verses lowering reactor power as proposed by you.

Please provide a human factors analysis if this type of shutter failure occurs to show that the reactor operator and the medical therapy room operator will in addition to their other activities respond to the alarms and take the proper actions.

Would the alarm just alert the operator in the control room or would personnel at the medical therapy facilities also receive an alarm? If so, should the alarm at the medical therapy facilities also be a TS requirement?

3. You have proposed changing the frequency of calibration checks based on experience gained since 1994. Please describe that experience and how it supports your proposed frequency. How does the experience gained with the existing beam for calibration checks and beam characterization relate to the new fission converter based beam?
4. Your proposed TS 6.5.14 d. contains a typographical error in that the parentheses in the note at the end of the section are not closed. Please correct.

5. Your proposed TS 6.5.14 e discusses the minimum number of neutron-sensitive monitors needed to initiate a patient irradiation. You currently have four neutron-sensitive monitors. Please explain how the monitors are used during a patient irradiation. Is there any advantage to having an epithermal monitor and thermal monitor operable versus two epithermal monitors or two thermal monitors? What is the impact, if any, of continuing an irradiation with one operable monitor?
6. Your proposed TS 6.5.19 proposes an annual calibration of reactor facilities that are used to perform measurements related to medical therapy. What is the basis for the annual calibration frequency?
7. Your existing definition 10 for "written directive" contains information that the order in writing should contain. Similar information exists in your quality management program (QMP). With the addition of a second beam and medical therapy room, should the specific room and beam be specified as part of the written directive and in the QMP? Also, please consider if the definition of recordable event should be amended to include treatment at the wrong room and beam.
8. The QMP, section 3.c, last sentence, appears to have a typographical error. Please review and correct if necessary.
9. Section 7 of the QMP has modifications of the QMP submitted to NRC Region I. With the consolidation of the non-power reactor regulatory program at NRC Headquarters, please update this requirement to submit modifications to the document control desk.
10. TS 6.5.6 allows an alternative means of verifying shutter position. Please discuss this alternative means for the converter control shutter (CCS), the water shutter, and the mechanical shutter, and the visibility of the alternative means from the medical treatment console.
11. Discuss the radiation fields in the medical therapy room in case of power failure. Please justify not having the mechanical shutter on emergency power. Please explain the impact on the beam monitoring equipment if facility power fails. Please explain the impact of preserving records of dose given to a patient if power fails. Should this equipment be on an emergency power source and should this be a TS requirement? How long will it take to open the door manually on the new medical therapy room and how does this compare to electrically opening the door?
12. Do the requirements of TS 6.5 apply to the CCS? If not, please explain.
13. Describe the protocol for normally "turning on" the neutron beam and for normally "turning off" the neutron beam. This should include the expected time for each component to complete its function.
14. Please provide engineering drawings for the following systems:

- a. the CCS and its housing
- b. the mechanism used to raise and lower the CCS
- c. the water shutter
- d. the mechanism used to open and close the water shutter
- e. the mechanical shutter and its housing
- f. the mechanism for opening and closing the mechanical shutter

Are there any common components to any of these shutters whose failure could disable multiple shutters? How would the MIT staff become aware of a failure of these shutters to perform properly and what would be the impact on a patient and the staff treating the patient.

- 15. The fission converter is to produce epithermal neutrons so should this term also appear in the definitions that refer to beam components such as definitions 4 and 7?
- 16. Should the ability to close the mechanical shutter manually be a TS requirement with periodic surveillance?