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July 25, 1984

Regional Administrator, Region I
Division of Engineering and Technical Programs
United States Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

ATTN: Thomas T. Martin, Director

Gentlemen:

Subject: Appraisal Report No. 50-20/84-01

The Massachusetts Institute of Technology hereby submits this reply to the findings contained in appraisal report #50-20/84-01 which was issued by your staff on 15 June 1984 following an on-site emergency preparedness appraisal during the period 3-6 April 1984. It should be noted that MIT had by its letter of 12 July 1984 requested an extension of the 30 day reply requirement to 25 July 1984.

Responses to the specific findings noted on the appraisal are contained in Appendix A and B to this letter.

MIT requests further guidance from the Commission with regard to the Appraisal Report's significant finding concerning the need to develop emergency action levels (EALs) based on specific instrument readings for each of the four classification levels specified in the Emergency Plan. The presently approved MIT Emergency Plan and its implementing procedures are conservatively based on nuclides with low MPC's, as described in the plan and in Appendix A to this letter. In order to comply with the Appraisal Report's finding, we believe that it will be necessary to revise not only the procedures but also the basis for the plan by assuming an emergency where nuclides with higher MPC's are released, such as fission product gases. It appears that EALs for specific instruments could then be developed. However, before MIT undertakes to revise its Emergency Plan in this manner and, subsequently, to resubmit it to the Commission for reapproval, guidance is requested concerning the desirability of this approach. It should be noted that basing the Plan on low MPC nuclides does not preclude reassessment of the emergency classification once the necessary evidence has been obtained, e.g. absence of alpha-emitters or identification of the airborne nuclides in a release (please see Section 4.7.2.6, Reassessment Actions, in the Emergency Plan and also Appendix A of this letter).

It should further be noted, as explained in Section 4.6 of the Emergency Plan, that the design basis accident for the MITR-II predicts off-site doses that are less than the general emergency action levels (Standard ANSI/ANS-15.16) and, hence, consideration is being given to dropping that classification from the Emergency Plan. However, the former MIT Reactor Emergency Plan, which postulated general emergency dose levels off-site, did stipulate corresponding arrangements for protective actions off-site. Hence, those features and an emergency planning zone (100 meter radius) have been retained in the present plan, but consideration is being given to changing the name from general emergency to a sub-category of site area emergency. The purpose of this change would be to emphasize that a general emergency is not credible for the MIT Reactor while, at the same time, retaining conservative preparatory features that were built into the MITR Emergency Plan when it was first developed prior to startup of the MITR and that have subsequently been reviewed and approved by City of Cambridge authorities.

Sincerely,

John A. Bernard
Superintendent
MIT Research Reactor

L. Clark, Jr.
Lincoln Clark, Jr.
Director of Reactor Operations

Enclosures: (1) Appendix A
(2) Appendix B

cc: USNRC-OMIPC
USNRC-DMB
Chief, Emergency Preparedness Licensing Branch
MITRSC (With Appraisal Report)

Appendix A

Significant Emergency Preparedness Findings

1. EALs for Each Classification Level

MIT has had a radiological emergency plan in effect since the inception of the MIT Research Reactor in the late 1950s. It has always been MIT's policy to (1) base that plan's implementing criteria on very conservative assumptions and (2) provide procedural approval for relaxing those conservative assumptions, if, during the course of an emergency, physical evidence to the contrary were obtained. For example, if an implementing criterion were based on an alpha emitting isotope and actual measurements showed that no alpha radiation was present, that criterion would be relaxed. In accordance with this policy, the EALs for the present MITR Emergency Plan (the one approved in its entirety by the USNRC on 06/24/83) were based on particulate releases with MPCs of $6 \cdot 10^{-14}$ μCi/ml and gaseous releases with MPCs of $1 \cdot 10^{-10}$ μCi/ml. These MPCs correspond to the most limiting situations listed in 10 CFR 20 for isotopes that could be reactor-produced. EALs for a general emergency were then derived using those MPCs and data on the characteristics of the MIT Reactor's radiological instruments. (Refer to section 4.7.2 of the emergency plan.) Having established those EALs, it was not possible to extend the correlation of the MITR's effluent monitor readings with offsite dose calculations to the other classes of emergencies because, as shown on p. 13 of section 4.7.2 of the plan, the resulting EALs would be many times less than background. After reviewing this problem, it was concluded that the safest, most effective solution would be to continue present MITR policy which was to maintain written procedures at the AOP (abnormal operating procedures) level that (1) required investigation of any abnormal radiation level and (2) required a reactor shutdown prior to levels indicative of an "unusual event" being attained. These procedures are written, for example, in terms of the activity of the purge gas that is swept across the surface of the core tank.

The significant finding reported by appraisal report #50-20/84-01 is that the MITR does not have EALs corresponding to the event, alert, or site emergency levels. The only viable method for obtaining such EALs is to substantially alter the basis of the MITR emergency plan. That is, changing the procedures to include EALs for the three lesser emergency classes is contingent upon first changing the source term used in the basis of the plan. Specifically, rather than implement the plan on the basis of the most limiting isotopes and then reassess the need for continuing an emergency response once the isotopes involved have been identified, it will be necessary to base the plan on the isotopes that would be most likely to be released. Accordingly, it is necessary to characterize the source term. It should be noted that no guidance was provided on the source term in

NUREG-0849. Also, given that this will constitute a major change in the plan that was submitted to the NRC in Sept. 1982, it will be necessary to resubmit the revised plan and obtain approval for the revisions.

As regards source terms, it is a common assumption that various iodine isotopes are the most likely to be released in significant quantities. However, recent data has shown that this is not the case, especially if a core remains covered with water or is cooled by spray. Much of the iodine will then be retained in the form of a salt, cesium iodide. This result is significant to the MIT Reactor because (1) all core tank penetrations are above the core (2) the core tank is contained within two other concentric tanks and (3) there is an ECCS system available to spray water onto the core. Hence, it is not considered credible that the core would be uncovered and it is unlikely that any iodine would be released from the core tank. Furthermore, even if iodine were released from the core tank, any venting of the surrounding containment building would be through charcoal filters that are at least 95% efficient for iodine. Accordingly, there is no logical reason for basing the MITR plan on iodine's MPC.

A review of fission product yield data and isotope half-lives suggest that xenon-135 is the isotope most likely to be released since it is an inert gas and, counting all methods of production, is produced in quantity. Xenon-135 decays to cesium-135 which is particulate in nature. Preliminary calculations have been made to obtain EALs for the MIT Reactor based on gaseous releases of xenon-135 and particulate releases of cesium-135. These calculations show that the MITR's effluent instruments would indicate sufficiently above background but on-scale for the event, alert, and, in some cases, site criteria also. No instruments would be on-scale for the general emergency situation. However, this may not be necessary since, as noted by the NRC staff during the appraisal, the general emergency category could be deleted. We currently have this under consideration.

If NRC guidance requires revising the emergency plan, MIT proposes to do the following:

(a) Retain the existing abnormal operating procedures that require a reactor shutdown before effluent levels permitted by an event have been reached.

(b) Rewrite the basis of the MITR emergency plan with fission product gases and their decay products being the nuclides of concern.

(c) Develop EALs for the event, alert, and site situations based on the MPCs for the fission product gases and their decay products.

(d) Retain, but rename, the procedure for a general emergency.

(e) Submit the changes made to the plan to the MIT Reactor Safeguards Committee (MITRSC).

(f) If approved by the MITRSC, submit the changes to the USNRC (Standardization and Special Projects Branch.)

(g) If approved by the USNRC, revise the EOP procedures and train personnel on the revised procedures.

Steps (b)-(e) will require 180 days once additional guidance is received from NRC. Given that the current plan required almost ten months for review by NRC, step (f) will probably require at least several months. Step (g) will require 180 days following completion of step (f).

It should be recognized that a revision of the basis of the emergency plan requires MIT Reactor Safeguards Committee approval and such a revision has not yet been discussed with that committee.

Status of Item: Awaiting NRC guidance.

Appendix B

Emergency Preparedness Improvement Items - Responses

1. Labeling of Procedure by Title of Responsible Individual

Operating Procedures for the MIT Reactor are divided into threee categories. These are:

- Standard Operating Procedures (SOPs)
- Abnormal Operating Procedures (AOPs)
- Emergency Operating Procedures (EOPs)

The SOPs were not, to our knowledge, included in the appraisal. Furthermore the SOPs were and are already specific relative to the individual responsible. The AOPs consist of approximately 85 separate procedures each specifying precise actions to be taken in the event of a particular system malfunction. Each procedure lists "immediate" and "follow-up" actions. Section 5.0 of the AOPs already contained a directive that the console operator is responsible for performing the "immediate" action. A statement has been added to the effect that the shift supervisor is responsible for (1) verifying that the operator did carry out the "immediate" action and (2) performing or supervising the "follow-up" action. The EOPs are organized in a manner similar to the AOPs. Section 4.4.4 of these procedures already provides guidance on individual responsibilities for performing the actions required by the EOPs. This guidance has been made more specific by changing the opening paragraph to read:

> The following procedures provide the specific directions necessary for the implementation of the MITR Emergency Plan. Regarding non-radiological procedures, the console operator is to perform the indicated "immediate action" and the shift supervisor is both to verify that the console operator has carried out the "immediate action" and to perform or supervise the "follow-up action". Regarding the radiological emergencies, responsibilities are indicated by title in the procedures. Also, the senior NRC-licensed staff member on site is responsible for coordinating all actions in an emergency including all on-site and off-site actions. (Note: This individual may be the shift supervisor.)

As far as the radiological procedures are concerned, these were, with two exceptions, already labeled with the title of the individual responsible for performing the action. The procedures (PM 4.4.4.14/ PM 4.4.4.15) for dealing with excess radiation at the site boundary and a release of airborne material were already organized as follows:

Immediate Action - Reactor Operator

Immediate Action - Shift Supervi,or

Follow-Up Action - On-Site Activities

Follow-Up Action - Off-Site Activities

The word "activities" has been changed to "supervisor". The two radiological procedures (PM 4.4.4.11 and 4.4.4.12) that concern building and containment evacuation are similarly organized. All sections of PM 4.4.4.11 and the "immediate action" of PM 4.4.4.12 were already labeled by title. The "follow-up action" of PM 4.4.4.12 has now been labeled as "Follow-Up Action - Shift Supervisor/RPO".

Status of Item: Al' action to be complete by 15 Aug. 1984.

2. Incorporation of EALs

The major radiological emergency procedures are excess radiation at the site boundary resulting from a contained source (PM 4.4.4.14) and escape of airborne radioactive material from the containment building (PM 4.4.4.15). These procedures each contain a brief section entitled "Implementing Criteria" which lists the EALs. Specific EALs for the declaration of an event, or an alert, or a site area emergency have been added to PM 4.4.4.14. The same will be done with PM 4.4.4.15 once the significant finding listed in Appendix A of appraisal report #50 20/84-01 is resolved.

Regarding the other radiological procedures (e.g., containment evacuation and reactor reentry), EALs are not provided because these procedures are performed either as a subpart of the major radiological emergencies or other emergency procedures for which EALs exist.

EALs identical to those used for PM 4.4.4.14, "Excess Radiation at the Site Boundary Resulting from a Contained Source" have been incorporated in PM 4.4.4.11, "NW12 Evacuation".

Regarding the non-radiological emergencies, EALs were already listed in Table 4.7.3.4-1 of the plan. The information in this table has now been incorporated in the appropriate procedure.

Status of Item: All action to be complete by 15 Aug. 1984 except for incorporation of EALs in PM 4.4.4.15. This will be accomplished following resolution of the significant finding listed in Appendix A.

3. Review Procedures to Determine if Reference is Appropriate

This discrepancy was the result of several typographical errors. Several procedures referred to PM 4.4.1 when the proper reference was PM 4.4.4.15. This discrepancy was corrected during the course of the appraisal and reported to the appraisal team as having been corrected both during the appraisal and at the exit interview.

Status of Item: All action complete.

4. Provide Several High Range Dosimeters within Containment

Two high range (0-100 R) dosimeters have been placed in the emergency locker in the containment building. These have also been added to the inventory list for that locker.

Status of Item: All action to be complete by 15 Aug. 1984.

5. Provide Guidance on Supplying Dosimetry to Medical Personnel

A step has been added to the immediate action for a medical emergency to cover this contingency. Dosimeters will be issued to responding medical personnel if the injury involves radiation exposure or contamination. This is to be accomplished without delaying transport of the injured party.

Status of Item: All action to be complete by Aug. 15 1984.