August 21, 2015

Dr. Timothy W. Koeth, Director
Nuclear Reactor and Radiation Facilities
Chemical and Nuclear Engineering, Building 090
University of Maryland
College Park, MD 20742

SUBJECT: UNIVERSITY OF MARYLAND - REQUEST FOR ADDITIONAL INFORMATION FOR LICENSE RENEWAL OF THE MARYLAND UNIVERSITY TRAINING REACTOR (TAC NO. ME1592)

Dear Dr. Koeth:

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of your application for the renewal of Facility Operating License No. R-70, for the Maryland University Training Reactor (MUTR), dated May 12, 2000 (a redacted version of the application is available on the NRC's public Web site at www.nrc.gov under Agencywide Documents Access and Management System Accession No. ML052910399), as supplemented. During our review, questions have arisen requiring additional information and clarification to complete the review. The specific information requested is addressed in the enclosure to this letter. It is requested that the University of Maryland respond to this request within 30 days from the date of this letter.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.30(b), "Oath or affirmation," the University of Maryland must execute its response in a signed original document under oath or affirmation. The University of Maryland response must be submitted in accordance with 10 CFR 50.4, "Written communications." Information included in the response that is considered sensitive or proprietary must be marked in accordance with10 CFR 2.390, "Public inspections, exemptions, requests for withholding," to be withheld from the public. Any information related to security should be submitted in accordance with 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements." Review of your renewal request will continue following receipt of the additional information.

If you have any questions or need additional time to respond to this request, please contact Mr. Eben Allen at 301-415-4246, or by electronic mail at Eben.Allen@nrc.gov.

Sincerely,

/RA Patrick Issac for/

Linh N. Tran, Senior Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-166

Enclosure:
Request for Additional Information

cc: See next page

cc:

Director, Dept. of Natural Resources
Power Plant Siting Program
Energy & Coastal Zone Administration
Tawes State Office Building
Annapolis, MD 21401

Mr. Roland G. Fletcher, Program Manager IV
Radiological Health Program
Maryland Department of Environment
1800 Washington Blvd., Suite 750
Baltimore, MD 21230-1718

Mr. Vincent G. Adams
Facility Coordinator
Chemical and Nuclear Engineering, Building 090
University of Maryland
College Park, MD 20742

Mary J. Dorman
Radiation Safety Officer
Department of Environmental Safety
3115 Chesapeake Building 338
University of Maryland
College Park, MD 20742

Professor Robert Briber
Department of Materials Science and Engineering
University of Maryland
College Park, MD 20742-2115

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

If you have any questions or need additional time to respond to this request, please contact Mr. Eben Allen at 301-415-4246, or by electronic mail at Eben.Allen@nrc.gov.

Sincerely,

/RA Patrick Issac for/

Linh N. Tran, Senior Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No.: 50-166

Enclosure:
Request for Additional Information

cc: See next page

DISTRIBUTION:

Public	JEads, NRR	RidsNrrDprPrta	CMontgomery, NRR
RidsNrrDpr	AAdams, NRR	PRLB r/f	LTran, NRR
GWertz, NRR	PIsaac, NRR		

ADAMS Accession No.: ML15083A383 **NRR - 088**

OFFICE	NRR/DPR PRLB	NRR/DPR/ LA	NRR/DPR/PRLB	NRR/DPR/PRLB	NRR/DPR/PRLB	NRR/DPR/PRLB
NAME	EAllen	ABaxter/NParker	GWertz	AAdams	(PIsaac for) LTran	EAllen
DATE	~~03/03/2015~~ 7/07/15	~~04/15/2015~~ 07/07/15	4/16/2015	~~6/30/2015~~ 7/14/15	~~5/5/2015~~ 8/20/15	8/21/15

OFFICIAL RECORD COPY

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

FOR THE RENEWAL OF FACILITY OPERATING LICENSE NO. R-70

THE MARYLAND UNIVERSITY TRAINING REACTOR

DOCKET NO. 50-166

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of your application for renewal of Facility Operating License No. R-70, for the Maryland University Training Reactor (MUTR), dated May 12, 2000 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML052910399). During our review of the SAR and supplemented information dated August 4, 2004, September 17, 2004 February 2, 2011, September 28, 2011, March 21, 2013 and November 25, 2014 (ADAMS Accession Nos. ML042240227, ML042940317, ML110350175, ML11277A026, ML13095A006 and ML14332A300, respectively), questions have arisen requiring additional information and clarification.

1. MUTR SAR, Section 4.5.2, "Reactor Core Physics Parameters," (Ref. 1) lists three reactivity coefficients and their associated values. However, it appears the combined reactivates have a positive value. NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Standard Review Plan and Acceptance Criteria," Section 4.5.2 provides guidance that an analysis should show that reactivity coefficients are sufficiently negative to prevent or mitigate damaging reactor transients. Describe what constitutes a power coefficient and show how overall reactivity coefficients are negative; or justify why the current method is acceptable.

2. MUTR SAR Section 4.6, "Thermal Hydraulic Design," (Ref. 1) or the MUTR thermal-hydraulic analysis (Ref. 5) does not include a departure from nucleate boiling ratio (DNBR). NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 14, Appendix 14.1, Section 2.1.2 provides guidance that a DNBR should be calculated with a minimum value of 2. Provide a DNBR analysis that indicates a minimum value of at least 2, or justify why one is not needed.

3. MUTR SAR Section 11.1.7, "Environmental Monitoring," states that the operation of the facility will have no negative impact on the environment. The MUTR environmental monitoring program results were provided in response to RAIs No. 47 and No. 72 (Refs. 6 and 2, respectively). However, the results are from 2004, and therefore, are out of date. NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 11.1.7 provides guidance that an appropriate monitoring program should contain probable pathways to people, and trends of recorded results. Provide updated information on the environmental monitoring program or justify why it is not needed.

Enclosure

4. The following RAIs are based on the maximum hypothetical accident (MHA), "Accident Analysis MHA" (Ref. 3). NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 13.2 provides guidance for accident analysis, and determination of consequences. Additional information or clarification is needed in the following areas.

   a) Guidance in NUREG-1537, Section 13.2, item (3) states that assumptions that change the course of events and mitigate consequences (including automatic functions and operator actions) until a stabilized condition has been reached should be described. The accident analysis appears to be limited to uniform mixing of fission products in the reactor room and subsequent elevated or ground release. It is not clear (i) what the initial condition of the ventilation fans are; (ii) if radiation detectors or operator action initiate protective functions; (iii) if two separate scenarios are analyzed; (iv) what the sequence for the analyzed exposure times (question 4(e)ii of this document); or (v) when a stable condition would be reached. Provide an updated analysis describing the sequence of events including initiation of engineered safety features to mitigate an accident, or justify why the current method is acceptable.

   b) Guidance in NUREG-1537, Section 13.2, item (5) states, in part, that methods and assumptions developed for the "Radiation Protection Program and Waste Management," chapter of the SAR should be adapted as appropriate for the analysis. Submitted information should allow the results to be independently verified. The following parameters require further clarification:

      i. The total confinement leakage rate of 0.0356 meters cubed per second (RAI No. 1A, Ref. 4) appears to conflict with the assumed leakage rate of 0.0242 meters cubed per second (page 1, Ref. 3), and room leakage parameter of 0.00236 meters cubed per second (pages 4, 6, 8, 10, and 12, Ref. 3).

      ii. It appears the breathing rate parameter of 3.3x10-04 meters cubed per second (pages 4, 8, and 12, Ref. 3) is inconsistent with the breathing rate of 4.17x10-04 meters cubed per second (pages 16 and 17, Ref. 3).

      iii. The release height of 7.25 meters and a wind speed of 2.32 meters per second are provided as input parameters for "HOTSPOT" (page 16, Ref. 3). However, dispersion values for various distances and atmospheric stability classes (page 3, Ref. 3) cannot be verified using these input parameters.

      Provide an updated analysis clearly stating confinement leakage, breathing rates, release heights, and wind speed parameters as necessary before each series of computations, or justify why the current method is acceptable.

   c) Guidance in NUREG-1537, Section 13.2, item (6) provides for defining the source term quantity of radionuclides. The fission product inventory is 25 percent equivalent of those described in NUREG/CR-2387 (page 2, Ref. 3). It appears

the activities of Cesium and Strontium are less than 25 percent of those values listed in NUREG/CR-2387. Provide an updated analysis using consistent methodology for determining the source term, or justify why the current method is acceptable.

d) Guidance in NUREG-1537, Section 13.2, item (6) provides for describing a source term that could cause direct or scattered radiation exposure. Ground shine was analyzed using "HOTSPOT," at 10 meters (pages 16 and 17, Ref. 3). However, direct or scattered radiation to members of the public located 6.096 meters from the roll up door or in hallway 1398 (RAI No. 1C, Ref. 4) due to the uniform distribution of fission products within the reactor room is not considered. NUREG-1537, Section 13.2, item (7) provides guidance for evaluating exposure of a member of the public until the situation is terminated or the person is moved. Provide an updated analysis to include direct or scattered radiation exposure to members of the public specific to the MUTR facility; or justify why the current method is acceptable.

e) Guidance for facility specific consequences is provided in NUREG-1537, Section 13.2, item (7). The guidance states, in part, that exposure conditions should account for staff and members of the public specific to the facility until the situation are stabilized. The following locations for members of the public and times of exposure require further clarification:

   i. Potential radiological consequences to members of the public in unrestricted areas are evaluated at 10, 100, 200, and 300 meters (page 18, Ref. 3). However, the MUTR SAR, Section 2.1.1.2, "Boundary and Zone Area Maps," (Ref. 1) list the nearest on-campus residence hall and nearest off campus public residence from the reactor building at approximately 230 and 370 meters, respectively. A maximum exposed members of the public located at 6.096 meters from the roll up door and in hallway 1398 (RAI No. 1C, Ref. 4) do not appear to correlate to the nearest distance of 10 meters. Guidance for other locations of interest that may be applicable to the MUTR facility is provided in NUREG-1537, Section 11.1.1.1.

   ii. Public exposure from a ground release use 72,050 seconds (pages 4 and 6, Ref. 3); public exposure from an elevated release uses 650 seconds (pages 8 and 10, Ref. 3); occupational exposure uses 300 seconds (pages 12 and 14, Ref. 3); and exposure to a receptor uses 0.34 and 20 hours, respectively (pages 16 and 17, Ref. 3). It is not clear how to chronologically view the events, or if exposure times are consistent with one another.

   Provide an updated analysis clearly indicating exposure times and subsequent dose estimates to a maximum exposed member of the public at the facility boundary, nearest residence, and/or other location of interest as necessary, or justify why the current method is acceptable.

5. MUTR proposed TS 3.1, “Reactor Core Parameters,” Specification (5) describes reactivity coefficients at the MUTR (Ref. 7). NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 14, Appendix 14.1, Section 4 provides guidance that certain limiting conditions for operations have accompanying surveillance requirements to include test, method, frequency, and acceptability. It appears the reactivity coefficients do not have a surveillance requirement. Provide a surveillance specification for TS 3.1 Specification (5), or justify why one is not necessary.

6. MUTR proposed TS 3.7, “Limitations On Experiments,” Specification (4) describes limits on experiments (Ref. 7). Specification (4) describes explosive materials in quantities greater than 25 milligrams and less than 25 milligrams, but does not include quantities equal to 25 milligrams. Provide a revised TS 3.7 Specification (4) to provide for explosive material quantities equal to 25 milligrams, or justify why no change is necessary.

7. MUTR proposed TS 4.1, “Reactor Core Parameters,” Specification (5) describes annual inspections of fuel elements, but does not appear to have an associated surveillance interval with its periodicity (Ref. 7). Acceptable surveillance intervals are provided in the American Nuclear Standards Institute, Incorporated/American Nuclear Society (ANSI/ANS) 15.1-2007, Section 4. Add an interval to TS 4.1, Specification (5) or justify why one is not necessary.

8. The Basis in MUTR proposed TS 4.4, “Confinement,” references a “minimum leakage rate assumed in the SAR,” however, actual confinement leakage values were determined (Refs. 7 and 4). NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 14, Appendix 14.1, Section 1.2.2 provides guidance that the proposed TS basis should be reference to the facility’s analysis. Provide a revision to proposed TS 4.4 to include a qualitative reference, or justify why no change is necessary.

9. MUTR proposed TS 5.2, “Reactor Primary Coolant System,” Specification (1) Basis describes thermal-hydraulic analysis for “other TRIGA reactors,” (Ref. 7). NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 14, Appendix 14.1, Section 1.2.2 provides guidance that the proposed TS Basis should reference the facility’s analysis. It appears from the thermal-hydraulic analysis that actual values were determined (Ref. 5). Provide a revision to proposed TS 5.2 to include a qualitative reference, or justify why no change is necessary.

10. MUTR thermal-hydraulic analysis shows core locations for the instrumented fuel element (IFE) (Ref. 5). MUTR proposed TSs do not appear to address these core locations. NUREG-1537, Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors Format and Content, Section 14, Appendix 14.1, Section 3.1 item (4) provides guidance that TSs should include criteria for restricting certain fuel bundles from core positions so that assumptions used in the development safety limits are met. NUREG-1537, Section 14, Appendix 14.1, Section 1.2.2 provides guidance that a TS

should include a basis for each specification. Propose a TS including a basis that incorporates acceptable IFE locations, or justify why no change is necessary.

11. MUTR proposed TS 6.0, “Administration,” describes administrative control of the MUTR facility (Ref. 7). Additional information and clarification is needed in the following areas.

    a) Figure 6.1, “MUTR Position in University of Maryland Structure,” and Figure 6.2, “MUTR Organizational Structure,” show solid-line and dashed-line connections, but appear to be missing a description. The lines are not identified in a leger or described within TS Section 6.0, “Administration,” as provided by guidance in ANSI/ANS-15.1-2007, Figure 1. Provide a description of the connection lines in Figures 6.1 and 6.2.

    b) Figure 6.2, “MUTR Organizational Structure,” shows members of the MUTR organization including staff and management. However, the TSs do not appear to correlate the MUTR members of the organization with the four assignment levels as provided in in ANSI/ANS-15.1-2007, Section 6.1.1. Guidance regarding expected responsibilities for assigned levels is provided in ANSI/ANS-15.4-2007, Section 3. Clarify the level of assignment in the TSs for the members shown in Figure 6.2.

    c) ANSI/ANS-15.1-2007, Section 6.1.2 provides guidance that management not only be responsible for policies and operation, but shall also adhere to all requirements of the operating license and TSs. MUTR proposed TS 6.1.2, “Responsibility,” describes specific responsibilities for the facility director, but does not appear to provide a description of responsibilities of other MUTR members shown in Figure 6.2. Clarify the specific responsibilities for all the MUTR member shown in Figure 6.2.

12. MUTR proposed TS 6.1.3, “Facility Staff Requirements," Specification (1) describes facility staffing requirements when the “reactor is operating” (Ref. 7). However, ANSI/ANS-15.1-2007, Section 6.1.3 provides guidance that the minimum reactor staffing is required when the reactor is “not secured.” Provide a revision to proposed TS 6.1.3 or justify why no change is necessary.

13. MUTR proposed TS 6.2.1.2, “Reactor Safety Committee Review Function,” Specification (3) states, “All new experiments or classes of experiments that could affect reactivity or result in the release of radioactivity,” (Ref. 7). However, “new experiment,” is not defined, nor is the terminology consistent with the MUTR proposed TS Definition 1.7 or Specification 6.5. It is not clear which category of experiments are applicable in proposed TS 6.2.1.2. Provide a revised TS 6.2.1.2 to delineate which experiments require review by the Reactor Safety Committee or justify why no change is necessary.

14. MUTR proposed TS 6.5, “Experiment Review And Approval,” Specification (3) uses the term “desired alternate,” which appears inconsistent with other alternatives described elsewhere in the TSs (Ref. 7). Furthermore, ANSI/ANS-15.1-2007 uses the word “designated,” throughout the guidance. Provide a revision to the proposed TS 6.5 or justify why no change is necessary.

15. MUTR proposed TS 6.7.2, “Special Reports,” Specification (1) references TS Definition 1.27 (Ref. 7). However, TS Definition 1.27 is “Reactor Operator,” and TS Definition 1.32 is “Reportable Occurrence.” It appears Definition 1.27 is erroneously used in proposed TS 6.7.2. Provide a revision to proposed TS 6.7.2 or justify why no change is necessary.

16. The following typographical errors were noticed. Consider reviewing the proposed TSs for other typographical or formatting errors and propose corrections as necessary.

    a) MUTR proposed TS Definition 1.37 may contain a grammatical error,

    b) MUTR proposed TS Definition 1.41 is numbered as 1.401,

    c) MUTR proposed TS 4.4 Specification may contain a grammatical error,

    d) MUTR proposed TS 5.2.1 Specification (1) appears to erroneously use “connective,”

    e) MUTR proposed TS 5.3.1 Specification (4) appears to be missing,

    f) MUTR proposed TS 5.3.2 Specification (1) states the control rods will contain borated graphite B_VC, and

    g) MUTR proposed TS 5.4 Specification (3) appears to be missing.

REFERENCES

1. University of Maryland, “Application for Renewal of Operating License No. R-70,” May 12, 2000, ADAMS Accession No. ML052910399.

2. University of Maryland, “University of Maryland’s Response to Request for Additional Information as it Pertains to the Environmental Report for the Maryland University Training Reactor,” August 4, 2004, ADAMS Accession No. ML042240227.

3. University of Maryland, “License Renewal For the Maryland University Training Reactor, Enclosure 2 Accident Analysis MHA Report (updated)” March 21, 2013, ADAMS Accession No. ML13095A006.

4. University of Maryland “Review of the Argon-41 Radiologic Dose Assessment For the Maryland University Training Reactor,” November 25, 2014, ML14332A300.

5. University of Maryland, “Response to Request #2 to the U.S. NRC’s April 6, 2010 Request for Additional Information (“RAI”),” February 2, 2011, ML110350175.

6. University of Maryland, “University of Maryland’s Response to Request for Additional Information as it Pertains to Section Eleven of the Safety Analysis Report,” September 17, 2004, ADAMS Accession No. ML042940317.

7. University of Maryland, “University of Maryland’s Response to Request for Additional Information License Renewal For the Maryland University Training Reactor” September 28, 2011, ADAMS Accession No. ML11277A026.