November 2, 2015

Mr. Stephen I. Miller, Reactor Facility Director
Armed Forces Radiobiology Research Institute
8901 Wisconsin Avenue
Bethesda, MD 20889-5603

SUBJECT: ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE - REQUEST FOR ADDITIONAL INFORMATION REGARDING THE RENEWAL OF FACILITY OPERATING LICENSE NO. R-84 (TAC NO. ME1587)

Dear Mr. Miller:

The U.S. Nuclear Regulatory Commission is continuing its review of the Armed Forces Radiobiology Research Institute (AFRRI) application for the renewal of Facility Operating License No. R-84 dated June 24, 2004 (Agencywide Documents Access and Management System Accession Nos. ML041800067, ML041800068, and ML101650415), as supplemented, for the AFRRI TRIGA reactor facility. During our review, questions have arisen, which require additional information and clarification. Please provide responses to the enclosed request for additional information no later than 30 days from the receipt of this letter.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.30(b), you must execute your response in a signed original document under oath or affirmation. Your response must be submitted in accordance with 10 CFR 50.4, "Written communications." Information included in your response that is considered sensitive or proprietary, that you seek to have withheld from the public, must be marked in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." Any information related to security should be submitted in accordance with 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

If you have any questions regarding this review, please contact me at 301-415-3398, or by electronic mail at Cindy.Montgomery@nrc.gov.

Sincerely,

/RA/

Cindy K. Montgomery, Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-170

Enclosure:
Request for Additional Information

cc: See next page

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ADAMS Accession No.: ML15273A477 **NRR-106**

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Test, Research, and Training
Reactor Newsletter
University of Florida
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REQUEST FOR ADDITIONAL INFORMATION

FOR THE LICENSE RENEWAL FOR

THE ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE

TRIGA REACTOR FACILITY

LICENSE NO. R-84

DOCKET NO. 50-170

The U.S. Nuclear Regulatory Commission (NRC) is continuing its review of the Armed Forces Radiobiology Research Institute (AFRRI) application for the renewal of Facility Operating License No. R-84 dated June 24, 2004 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML041800067, ML041800068, and ML101650415), as supplemented, for the AFRRI TRIGA reactor facility. The NRC staff's review used the guidance in NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," and supporting guidance from the American National Standards Institute/American Nuclear Society, ANSI/ANS-15.1-2007, "The Development of Technical Specifications for Research Reactors." The NRC staff has determined that the following additional information is needed:

1. NUREG-1537, Part 1, Section 13.1.2, "Insertion of Excess Reactivity," lists insertion-of excess-reactivity events, one of which is the ramp (slow) insertion of reactivity by drive motion of the most reactive control rod or shim rod, or ganged rods. Your RAI response dated April 20, 2012 (ADAMS Accession Nos. ML12122A146 and ML15296A451), as amended on September 21, 2012, (ADAMS Accession No. ML12272A303), stated that "The instantaneous insertion of $3.00 (2.1 % delta k/k) to the reactor core as a result of a worst case reactivity insertion is bounded by the analysis of the $3.50 (2.45% delta k/k) pulse limit and would not result in any adverse safety conditions within the AFRRI TRIGA core."

   Your response did not completely address a ramp insertion analyses. Provide a detailed ramp analysis identifying the maximum power level and fuel temperature experienced during the transient. Assume that the first scram, which would terminate the reactivity insertion, would fail in accordance with single failure criteria. Identify which reactor trip terminates the event and its associated response time, including the scram time of the control rods, in order to demonstrate the protection of the safety limit.

2. The AFRRI proposed technical specifications (TS) 4.3, "Coolant Systems," Specification a., states that "The pool water temperature, as measured near the input to the water purification system, shall be measured daily, whenever operations are planned." However, there is no requirement to calibrate the thermometer. Provide a TS surveillance requirement for calibrating the temperature measurement instrument or state why it is not necessary.

3. The AFRRI proposed TS 4.3, "Coolant Systems," Specification b., states, in part, that conductivity of the bulk water shall be measured monthly, not to exceed 6 weeks.

The basis for this TS is "Based on experience, observation at these intervals provides acceptable surveillance of limits that ensure that fuel cladding corrosion and neutron activation of dissolved materials are minimized."

NUREG-1537, Part 1, Appendix 14.1, Section 4.3, "Coolant Systems," Item (6) "Conductivity and pH," provides guidance that the conductivity and pH should be measured weekly. Monthly measurements are permitted if the reactor is shutdown for long periods of time and/or if justification is provided in the SAR.

The basis for TS 4.3 does not provide an adequate justification for the proposed monthly periodicity. Revise TS 4.3, Specification b., to weekly, or provide additional justification for monthly measurements, or justify why no change is necessary.

4. NUREG-1537, Part 1, Appendix 14.1, Section 3.1, "Reactor Core Parameters," Item (6)(b), "TRIGA Fuel," provides guidance that the fuel matrix should not exceed 50 percent of its initial concentration. NUREG-1537, Part 1, Appendix 14.1, Section 4.1, "Reactor Core Parameters," Item (6), "Fuel Parameters," provides guidance that the SAR should justify the surveillance method and intervals which ensure that the limit is not exceeded. Provide a TS and surveillance for burnup limit which is consistent with the guidance in NUREG-1537, Part 1, or justify why no change is necessary.

5. The AFRRI proposed TS 1.25 "Reference Core Condition," provides a value of $0.30 for Xenon reactivity. Given that the reactivity required to satisfy the AFRRI shutdown margin (SDM), TS 3.1.3, "Reactivity Limits," Specification b., is $0.50, in the Reference Core Condition, the resulting SDM reactivity could be as low as $0.20. This is not consistent with the guidance in NUREG-1537, which provides a value of $0.50 SDM reactivity.

   Provide justification for proposed TS 1.25, "Reference Core Condition," by proposing a TS 3.1.3, "Reactivity Limits," Specification b., SDM reactivity limit that is consistent with the SDM guidance in NUREG-1537, revise TS 1.25 "Reference Core Condition," or demonstrate that control rod worth can be determined to within $0.20.

6. Your letter dated March 30, 2015 (ADAMS Accession No. ML15093A099), revising your TS, deleted TS 3.8, "ALARA." Your TS 6.1.2, Responsibility, states "The Radiation Safety Officer shall implement a radiation protection program at AFRRI that satisfies the requirements of 10 CFR Part 20." Provide a justification for the deletion of TS 3.8.

7. The AFRRI proposed TS. 3.3, "Coolant Systems," states the following: "The reactor shall not be operated above a thermal power of 5 kW when the purification system inlet water temperature exceeds 60°C;" however, your thermal hydraulic analysis was performed at 45°C. Provide a thermal hydraulic analysis at 60°C, or modify your TS to be consistent with the thermal hydraulic analysis previously provided. Provide justification for the 5kW power limit when water temperature is above 60°C or remove the limit from the TS.

8. The AFFRI proposed TS 4.0, "Surveillance Requirements" states that "any surveillance requirements that cannot be performed due to a reactor outage shall be performed prior to resuming normal reactor operations." Specify which requirements fall into this category or justify why it is not necessary.

9. ANSI/ANS 15.1-2007, Section 6.2.3, Review Function, states "A written report or minutes of the [review] findings and recommendations of the review group shall be submitted to Level 1 and the review and audit group members in a timely manner after the review has been completed. Your TS Section 6.2.4, Review Function, does not have such a requirement. Your Section 6.2.3.5 Minutes, states that "Minutes of the previous meeting should be available to regular members at least one week before a regular scheduled meeting," however, in TS 6.2.1.1.a.1, the Level 1 is not a regular member. Explain the procedures by which the Level 1 is provided review findings in a timely manner.

10. The AFFRI proposed TS 6.3, "Procedures," specifies, in part, "written instructions for certain activities shall be approved by the Reactor Facility Director and reviewed by the RRFSS," but does not indicate if the procedures are required to be used and followed to ensure effective procedure adherence. Revise TS 6.3 to include instructions for using these procedures or justify why no change is necessary.

11. The AFRRI proposed TS 6.4, "Review and Approval of Experiments," provides requirements for new experiments or experiments not included in a Routine Reactor Authorization. However, the TS does not include a review in accordance with TS 3.6, "Limitations on Experiments." Revise TS 6.4 to add the review requirements associated with TS 3.6, or justify why no changes are necessary.

14. The AFRRI proposed TS 6.4, "Review and Approval of Experiments," provides requirements for new experiments or experiments not included in a Routine Reactor Authorization. However, the TS does not include a review in accordance with the requirements of 10 CFR 50.59. Revise TS 6.4 to add the review requirements associated with 10 CFR 50.59, or justify why no changes are necessary.

Financial Requirements

15. Pursuant to 10 CFR 50.33(f) (2), "[t]he applicant shall submit estimates for total annual operating costs for each of the first five years of operations of the facility." Since the information included in the previous correspondence was for the period of fiscal years (FYs) 2013 through 2018, please provide the following additional information:

    (a) Projected operating costs of the AFRRI facility for each of the FY2016 thru FY2021 (the first five year period after the projected license renewal). If the cost estimates have not changed since the previous submittal for the period of FY2013 through FY2018, please so state.

    (b) Has the source(s) of funding to cover the operating costs for FYs 2016 to 2021 changed since the August 13, 2010, submittal?

16. By letter dated August 13, 2010, you provided an updated decommissioning cost estimate for the facility that was developed using NUREG/CR-1756, "Technology, Safety and Costs of Decommissioning Reference Nuclear Research and Test Reactors." The decommissioning cost estimate was $14.831 million in 2011 dollars. The cost estimate

summarized costs by labor, radioactive wastes disposal, energy, and a 25-percent contingency factor.

(a) Please indicate if the basis for how the cost estimate was developed has changed. If NUREG/CR-1756 is still the basis, please so state.

(b) Please indicate if there are any changes to the means of adjusting the cost estimate and associated funding level periodically over the life of the facility.

17. AFRRI provided a Statement of Intent (SOI), dated August 11, 2010, stating that "[f]unding will be sought from the [U.S.] Department of Defense in accordance with established programming and budgeting procedures," per 10 CFR 50.75(e)(1)(iv).

(a) Please indicate if there have been any changes to the SOI and if decommissioning funding obligations of the AFRRI facility continue to be backed by the full faith and credit of the U.S. Government.