

April 28, 2011

Dr. Tatjana Jevremovic  
Director, Utah Nuclear Engineering Program  
Joseph Merrill Engineering Building  
50 Central Campus Drive, Room 2298  
University of Utah  
Salt Lake City, UT 84112

SUBJECT: UNIVERSITY OF UTAH - REQUEST FOR ADDITIONAL INFORMATION  
REGARDING THE LICENSE RENEWAL (TAC NO. ME1599)

Dear Dr. Jevremovic:

We are continuing our review of your application for renewal of Facility Operating License No. R-126, for the University of Utah TRIGA Reactor, dated March 25, 2005, and superseded in its entirety by an Updated Safety Analysis Report (SAR), dated June 1, 2009. By letters dated February 22, 2010, and July 15, 2010, we requested additional information (RAI) to continue our review. By letter dated October 4, 2010, you provided responses to the RAIs along with an updated SAR. During our review, we have identified additional information that still needs clarification. In addition, we have identified two additional RAIs that were not part of the original RAI request. Please provide the additional information to the enclosed RAIs within 30 days of the date of this letter.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 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 security, 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."

T. Jevremovic

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If you have any questions regarding this review, or need additional time to respond to this request, please contact me at 301-415-0893 or by electronic mail at: [Geoffrey.wertz@nrc.gov](mailto:Geoffrey.wertz@nrc.gov).

Sincerely,

**/RA/ by LTran for**

Geoffrey A. Wertz, Project Manager  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-407

Enclosure:  
As Stated

cc: See next page

University of Utah TRIGA Reactor

Docket No. 50-407

cc:

Mayor of Salt Lake City  
451 South State  
Room 306  
Salt Lake City, UT 84111

Dr. Thomas Parks  
Vice President for Research  
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Ms. Karen Langley  
Director, University of Utah  
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Dr. Cynthia Furse  
Associate Vice President for Research  
201 President's Circle, Room 210  
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Test, Research, and Training  
Reactor Newsletter  
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Director, Division of Radiation Control  
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168 North 1959 West  
P.O. Box 144850  
Salt Lake City, UT 84114-4850

T. Jevremovic

- 2 -

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As Stated

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ACCESSION NO.: **ML110730573** \*via e-mail

NRR-088

|        |           |           |                           |           |
|--------|-----------|-----------|---------------------------|-----------|
| Office | PRLB:PM*  | PRLB:LA   | PRLB:BC                   | PRLB:PM*  |
| Name   | GWertz    | GLappert  | JQuichocho<br>(LTran for) | GWertz    |
| Date   | 4/27/2011 | 4/28/2011 | 4/28/2011                 | 4/28/2011 |

**OFFICIAL RECORD COPY**

**OFFICE OF NUCLEAR REACTOR REGULATION**  
**REQUEST FOR ADDITIONAL INFORMATION FOR**  
**THE RENEWAL OF FACILITY OPERATING LICENSE FOR**  
**THE UNIVERSITY OF UTAH TRIGA REACTOR**  
**LICENSE NO. R-126; DOCKET NO. 50-407**

We are continuing our review of your application for renewal of Facility Operating License No. R-126, for the University of Utah TRIGA Reactor (UUTR), dated March 25, 2005, and superseded in its entirety by an Updated Safety Analysis Report (SAR), dated June 1, 2009. By letters dated February 22, 2010, and July 15, 2010, we requested additional information (RAI) to continue our review. By letter dated October 4, 2010, you provided responses to the RAIs. During our review, we have identified additional information that still needs clarification. In addition, we have identified two additional RAIs that were not part of the original RAI request. Please provide the additional information to the enclosed RAIs within 30 days of the date of this letter.

The following RAIs are from NRC RAI letter dated February 22, 2010:

RAI 13

Your response to RAI No.13 provided an updated SAR Chapter 1.5 which indicated that the fuel was enriched to 20%. However, Table 4.2-1 Table 1.5-1 indicates that the fuel enrichment is less than 20%. Please clarify the fuel enrichment value.

Your response to RAI No.13 provided updated SAR Chapters 4.2.1.13, 4.2.1.14, and 4.5.3.1, which mentioned the presence of erbium in the fuel. However, updated SAR Table 4.2-1 does not include erbium. Please clarify whether erbium is present in the UUTR fuel and provide the updated SAR description and tables.

RAI 21

Your response to RAI No. 21 provided updated information regarding the reactor core configuration that would yield the highest power density and fuel temperature. However, the updated SAR Chapter 4.5.2.3 does not explicitly state if this is the **limiting core configuration** that does yield the highest power density and fuel temperature. Please provide limiting core configuration information, including the power level (100kW), limiting power density, and any other pertinent core parameters.

ENCLOSURE

RAI 22

Your response to RAI No. 22 provided updated SAR Chapters 4.5.3.3, Prompt Negative Temperature Coefficient, 4.5.3.4, Moderator Temperature Coefficient; and, 4.5.3.5, Void Coefficient, and indicated that an eigenvalue of 1.0 was used for the reactivity computations. However, neither the temperature nor reactivity condition at this value ( $k_{\text{eff}}=1.0$ ) was specified. Please clarify the computational methods used to calculate the Fuel, Moderator and Void Temperature Coefficients for the UUTR.

Your response to RAI No. 22 provided an updated SAR, Chapter 4.5.2, Reactor Core Physics Parameters, Tables 4.5-9 and 4.5-11, which listed various temperature reactivity coefficients. Our analysis could not replicate the calculations. Please review the analysis and advise if numerical values are correct or if changes are needed.

Your response to RAI No. 22 provided an updated SAR, Chapter 4.5.2, Reactor Core Physics Parameters, Table 4.5-10, which indicates an increase in the  $k_{\text{eff}}$  from 293 degrees Kelvin (K) to 333 degrees K. Our review finds this increase is not consistent with other TRIGA reactors. Please verify the  $k_{\text{eff}}$  have been calculated correctly.

RAI 41

Your response to RAI No. 41 provided information of the radiological risks from experiments. However, we could not identify any information relative to experiments involving special nuclear material. If the UUTR plans to perform fueled experiments, please provide an analysis indicating the safety precautions and limitations, including appropriate Technical Specifications (TSs), to ensure that this type of experiment is bounded by the Maximum Hypothetical Accident (MHA), or otherwise adequately controlled to ensure the safety of the workers and public.

RAI 57

Your response to RAI No. 57 provided an updated SAR Chapter 13, Accident Analysis. During our review of updated SAR Chapter 13.2.2, Insertion of Excessive Reactivity, we could not identify the source of the temperature coefficients used in the excess reactivity accident scenario. We noted different temperature coefficients were listed in updated SAR Chapter 4.5.3.1 and SCALE-generated values tabulated in updated SAR Chapter 13.2.2. Please provide a reference for the source of the temperature coefficients used in the analysis.

Your response to RAI No. 57 provided an updated SAR Chapter 13, Accident Analysis. In our review of updated SAR, Chapter 13, various codes were used including PARET-ANL, MCNP5, and SCALE. Furthermore, updated SAR Table 13.2.9 does not indicate very good agreement between SCALE5.1 and MCNP5. Please indicate which codes were used for each updated SAR Chapter 13 accident, the basis for their use, and any validation information versus other codes or actual measurements of the UUTR. Additionally, please define the neutronic codes used in updated SAR Chapter 4, Section 4.5, Nuclear Design, and ensure their application and use is consistent and acceptable for inputs provided to the updated SAR Chapter 13 analyses.

Your response to RAI No. 57 provided an updated SAR Chapter 13, Accident Analysis. However, for reactor facilities that are integral to publicly-occupied buildings (e.g., engineering classroom buildings), the maximum exposed member of the public could be in the public space within building rather than outside. The MHA analyses presented in the updated SAR does not appear to discuss the dose to on-site non-occupational occupants of the Merrill Engineering Building (MEB) such as students, faculty, visitors, etc. More specifically:

1. Please provide a dose assessment for the maximum exposed individual member of the public in the unrestricted area of the MEB. Please describe the assumptions used and any systems, plans, procedures or stay times for which credit is taken in the analysis.
2. Unless the duration of exposure to members of the public is limited by evacuation in accordance with the facility emergency plan, assume that members of the public are exposed until the event ends. If an evacuation is credited to limit the dose to members of the public, please provide a basis for the evacuation (Emergency Plan, procedure, etc.) and an assessment of the evacuation time credited (such as results of drills, etc.).

Your response to RAI No. 57 provided an updated SAR Chapter 13, Accident Analysis. During our review of updated SAR Chapter 13.2.1, Maximum Hypothetical Accident (MHA), we noted that the dose consequences of various accident scenarios were provided. However, it was not clear what assumptions were used regarding the dispersion of radioactive effluents by the ventilation system. Some information was provided in the updated SAR, but additional details are needed. More specifically:

1. Please provide an explanation of the normal operation of the ventilation system and the system's response to a high radiation condition. Include the instruments used to monitor the radiation levels, the alarm settings, the components that change state (dampers closing) in the limited intake mode, and the resulting parameters used in any dose calculations (flow or leak rates, etc.).
2. For each scenario provided in updated SAR Chapter 13, please clearly state the status of the ventilation system (normal operation, limited intake mode, or secured) and the associated dose. Include the dose consequences should the ventilation system fail to actuate to the limited intake mode or be manually secured.
3. If the ventilation system is not required to meet the dose requirement of 10 CFR Part 20, please provide a definitive statement supporting this conclusion.

The following RAIs are from NRC letter dated July 15, 2010:

RAI 3.1

Your response to RAI No. 3.1 indicated that a burnup limit was not necessary but did not provide any supporting information. NUREG-1537, Appendix 14.1, Section 3.1 (6) indicates a limit of 50% from the original concentration of uranium-235 in the fuel for TRIGA reactors. Please discuss the applicability of a burnup limit and whether it is appropriate for inclusion in the UUTR TS.

RAI 3.5

Your response to RAI No. 3.5 provided a corrected core excess reactivity value of \$1.20 from the previous value of \$2.80. However, our review of the updated SAR found examples where the \$2.80 value was still the referenced value (e.g., updated SAR, Chapter 4.2.2). Please provide a consistent SAR reference for the value for the core excess reactivity.

New RAIs:

1. NUREG-1537, Section 14, Technical Specifications, Section 5.4, Primary Coolant Cleanup System, recommends a pH range from 5.5 to 7.5. UUTR Updated SAR, Chapter 14, TS 3.3, indicates a pH range from 5 to 8. Please evaluate and justify the use of a larger pH range.
2. NUREG-1537, Section 14, Technical Specifications, requests specific information on acceptable safety limits for TRIGA fuel.
  - 2.1. NUREG-1537, Section 14, Technical Specifications, Section 2.1, Safety Limits, provides an acceptable limit of 500 degrees Celsius (C) for Aluminum clad fuel. The UUTR TSs, Section 2.1, Safety Limits, indicates a safety limit of 530 degrees C for aluminum clad fuel. Please provide a justification for the use of the higher temperature limit.
  - 2.2. The updated SAR, Chapter 4.2.1.1, Reactor Fuel Description indicates a safety limit of 1150 degrees C for stainless steel fuel. The updated SAR, Chapter 14, Technical Specifications, Section 2.1, Safety Limit – Fuel Element Temperature, has a value of 1000 degrees C. Please clarify the correct value.