UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 9, 2021

Dr. Steven R. Reese, Director
Oregon State University
100 Radiation Center
Corvallis, OR 97331-5903

SUBJECT: OREGON STATE UNIVERSITY – REGULATORY AUDIT RE: LICENSE AMENDMENT REQUEST TO REMOVE TECHNICAL SPECIFICATION REQUIREMENTS RELATED TO THE INSTRUMENTED FUEL ELEMENT AND GRAMMATICAL CHANGES (EPID L-2020-NFA-0005)

Dear Dr. Reese:

By letter dated June 17, 2020 (Agencywide Documents Access and Management System Accession Nos. ML20171A576, and ML20171A575), Oregon State University (OSU) applied for an amendment to Facility Operating License No. R-106 for the Oregon State University TRIGA nuclear research reactor. The requested licensing action would amend the facility technical specifications (TSs) to remove the TS requirements related to the instrumented fuel element. Additionally, OSU proposes to make numerous grammatical and editorial changes to the TS.

The U.S. Nuclear Regulatory Commission (NRC) staff will conduct a virtual regulatory audit starting on April 15, 2021, to gain a better understanding of the application and any proposed changes to the facility. The audit may include review of documentation, observation of the facility, and discussions with facility personnel and management. The enclosed audit plan provides additional details of the objective and scope of the audit. To facilitate an efficient audit, please provide ready access to working space, requested documentation, and areas of the facility.

Following completion of the audit, the NRC staff will provide an audit summary. The summary will include a description of any information identified during the audit that will need to be docketed to supplement the application and allow the NRC staff to continue its review.

If you have any questions, please contact me at (301) 415-2856, or by electronic mail at Michael.Balazik@nrc.gov.

Sincerely,

Signed by Balazik, Michael
on 04/09/21

Michael F. Balazik, Project Manager
Non-Power Production and Utilization Facility
Licensing Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-243
License No. R-106

Enclosure:
As stated

cc: See next page

cc:

Mayor of the City of Corvallis
Corvallis, OR 97331

Maxwell Woods, Assistant Director
Nuclear Safety and Emergency
Preparedness Division
550 Capitol St. NE
Salem, OR 97301

Dr. Irem Tumer, Vice President
for Research
Oregon State University
A312 Kerr Administrative Services Bldg
Corvallis, OR 97331-5904

Mr. Robert Schickler
Reactor Administrator
Oregon State University
100 Radiation Center, A-100
Corvallis, OR 97331-5903

Mr. Daniel Harlan, Chairman
Reactor Operations Committee
Oregon State University
100 Oak Creek Building
Corvallis, OR 97331-5904

Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

SUBJECT: OREGON STATE UNIVERSITY – REGULATORY AUDIT RE LICENSE AMENDMENT REQUEST TO REMOVE TECHNICAL SPECIFICATION REQUIREMENTS RELATED TO THE INSTRUMENTED FUEL ELEMENT AND GRAMMATICAL CHANGES (EPID L-2020-NFA-0005) DATED: APRIL 9, 2021

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ADAMS Accession No. ML21092A137 **NRR-106**

OFFICE	**NRR/DANU/PM**	**NRR/DANU/LA**	**NRR/DANU/BC**	**NRR/DANU/BC**
NAME	MBalazik	NParker	DHardesty	MBalazik
DATE	4/6/2021	4/6/2021	4/7/2021	4/9/2021

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OFFICE OF NUCLEAR REACTOR REGULATION

REGULATORY AUDIT PLAN

REGARDING PROPOSED AMENDMENT NO. 26 TO

RENEWED FACILITY OPERATING LICENSE NO. R-106

OREGON STATE UNIVERSITY

OREGON STATE UNIVERSITY TRIGA NUCLEAR RESEARCH REACTOR

DOCKET NO. 50-243

Background

The U.S. Nuclear Regulatory Commission (NRC) staff is continuing its review of the Oregon State University (OSU) TRIGA research reactor (OSTR) license amendment request (LAR), provided by letter dated June 17, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20275A267). The LAR proposes to remove the technical specification (TS) requirements related to the instrumented fuel element (IFE). Additionally, OSU proposes to make numerous grammatical and editorial changes to the TSs. This regulatory audit is intended to assist the NRC staff in its review of the LAR.

Regulatory Audit Bases

The purpose of this audit is to determine if the licensee's proposed LAR meets all the applicable regulatory requirements of Title 10 of the *Code of Federal Regulations* and addresses applicable guidance provided in NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," Part 1, "Format and Content," and Part 2, "Standard Review Plan and Acceptance Criteria" (ADAMS Accession Nos. ML042430055 and ML042430048, respectively).

Regulatory Audit Scope

The NRC staff plans to conduct this virtual audit via teleconference and/or video conference with OSU staff. The NRC staff will review the OSU's LAR along with supporting basis and reference documentation. This audit will provide information necessary to continue the NRC staff's evaluation of the LAR. In addition, the audit may identify additional information that will be required to be docketed to support the basis of the licensing decision.

The NRC staff will use the online reference document portal provided by OSU staff. Access to the online portal is limited to specific NRC staff (e.g., based on NRC e-mail addresses or the use of passwords which will only be assigned to NRC staff directly involved in the LAR review on a need-to-know basis), and the documents in the online portal are read-only to prevent NRC staff from saving, copying, downloading, or printing any documents. The conditions associated with the online reference document portal must be maintained throughout the review process. The NRC staff who should be granted access to the portal are those listed in the "Audit Team" section below. The NRC staff will provide a request to close the online reference document portal at the conclusion of the audit.

Audit Information

OSU should be prepared to support the NRC staff by having technical staff available for discussions and documentation supporting the LAR readily available. Additionally, the OSU staff should be prepared to provide referenced documents and reports, calculations, and computer code verification that support the analysis documented in the safety analysis report (SAR), bases for TSs, or rationale for any required plans and procedures, as necessary. The NRC staff will focus on the following information needs:

1. NUREG-1537, Part 1, Chapter 14, Appendix 14.1, "Standard Format and Content for Technical Specifications for Research Reactors," Section 4.1, "Reactor Core Parameters," item (3), "Pulse Limits," states the relationship between pulse peak fuel temperature and inserted reactivity should be determined when changes are made in the core.

   The proposed TS reactivity limit of $2.30 provides a $0.03 margin to the recommended maximum fuel temperature limit of 830 degrees Celsius (1526 degrees Fahrenheit) during pulse mode operation. A minimal change in core reactivity may result in the fuel exceeding the maximum temperature limit as recommend by the fuel vendor. The OSTR TSs do not specify a surveillance requirement to determine the relationship between pulse peak fuel temperature and inserted reactivity when changes are made to the core.

   Provide an explanation why a surveillance requirement to determine the relationship between pulse peak fuel temperature and inserted reactivity is not needed when changes are made to the core

2. During the conversion from highly enriched uranium (HEU) to low-enriched uranium (LEU) fuel, OSU stated, in part, in its response, dated June 20, 2008 (ADAMS Accession No. ML082350345), to the NRC's request for additional information (RAI), item 11, the following: "*The transient rod calibration (measured and simulated) consisted of a total of eight individual measurements. The MCNP5 error in total rod worth is ~5.5%. The measurement error in total rod worth, assuming eight measurements each with an uncertainty of 5% is ~14.1%.*"

   Explain whether this measurement error of the transient rod was considered in the analysis of the proposed pulse limit of $2.30, when a pulse of $2.33 results in the maximum fuel temperature limit of 830 degrees Celsius (1526 degrees Fahrenheit).

3. The prompt temperature coefficient becomes less negative as the core ages, as shown in Figure 4-21 of the OSU HEU/LEU fuel conversion SAR (ADAMS Accession No. ML080420546). With a less negative prompt temperature coefficient, explain the resultant change in pulse power and maximum fuel temperature for the same reactivity insertion. Explain what other core characteristics that could change over core life that may affect the maximum fuel temperature for the same reactivity insertion for pulse mode operation. As these other core characteristics change over core lifetime, clarify whether a $2.30 pulse at core end-of-life would exceed the 830 degrees Celsius (1526 degrees Fahrenheit) temperature limit.

4. In the LAR, “Pulse Mode Analysis,” OSU states, in part, that although RELAP-3D (Reactor Excursion and Leak Analysis Program) is a deterministic code that does not provide uncertainty, the value of $2.30 was chosen as the pulse limit based upon the understood conservatism. However, the “understood conservatism” was not explained in the LAR. Describe and provide an explanation of the “understood conservatism” in the analysis for the determination of the $2.30 pulse limit.

5. For pulse mode operation, clarify any reactor parameters readily available to the operator to verify the inserted pulse reactivity does not exceed the proposed $2.30 limit thereby ensuring the maximum fuel temperature of 830 degrees Celsius (1526 degrees Fahrenheit) is not exceeded. For any reactor parameters identified, describe the associated instrumentation along with any surveillances.

6. TS 4.1, “Reactor Core Parameters,” specification e, states that 20 percent of the fuel elements comprising the core shall be inspected visually for damage or deterioration and measured for concentric or other swelling annual. Clarify whether the fuel elements immediately adjacent to the transient rod have were measured and visually inspected since the last pulse operation. If these fuel elements were inspected, provide the dates and results of the inspection.

7. Describe how the Limiting Core Configuration (LCC) was determined for this LAR. Additionally, describe how future core alterations are confirmed to be within the analysis of record LCC.

8. Explain any differences between how the IFE is modeled in the reactor and thermal-hydraulic analyses compared to the standard TRIGA fuel elements in the core. If any differences are identified, explain how the events examined in OSU’s SAR, Chapter 13, “Accident Analysis,” are impacted by replacing the IFE with a standard TRIGA fuel element.

9. With the proposed removal of the IFE requirements from TS, the protective functions based on Safety Power and Percent Power scrams are the primary limiting safety system settings (LSSS) safety functions. The NRC staff needs to understand all the details associate with these setpoints.

    a. What is measurement uncertainty for the Safety Power and Percent Power systems and how were they determined?

    b. What is the scram setpoint uncertainty for the Safety Power and Percent Power channels?

    c. What operational uncertainty is assumed to account for normal core power fluctuations?

    d. Describe the setpoint methodology used to set the LSSS scram functions and where the above uncertainties are included in that methodology.

Background Information

1. Provide the RELAP-3D thermal-hydraulic and reactor analyses available for review during the audit.

2. For the SAR Chapter 13 events:

   a. Are there any scenarios that utilize operational assumptions rather than operation at TS limits? If so, explain why this is acceptable for bounding accident analysis calculations. Of the events analyzed, which event has the minimum margin to the TS limits?

   b. Insertion of reactivity

      Describe how the mechanical block and electrical interlock for the transient rod is set to prevent the insertion of reactivity from exceeding $2.30 thereby limiting maximum fuel temperature below 830 degrees Celsius (1526 degrees Fahrenheit) as stated in TS 3.1.4, “Pulse Mode Operation.”

   c. Loss-of-coolant accident (LOCA)

      Describe the analytic geometry used the LOCA decay heat loss analysis.

3. Provide a comprehensive list of all the computer codes that were used in SAR Chapter 4, “Reactor Description” and Chapter 13 analyses and generally describe what those codes were used for, and whether those codes are new or modified from those used in the latest SAR.

Team Assignments

The NRC staff performing this audit will be:

- Michael Balazik (Audit Leader and Project Manager)
- Jeremy Dean (Technical Reviewer)

Logistics

The virtual audit will start on Thursday, April 15, 2021, with an entrance meeting, consisting of a focused review between the NRC staff and OSU staff. Following the review on April 15, 2021, the audit will continue as necessary until NRC staff have adequate understanding of issues to be addressed to complete the review of the LAR. The audit activities will be conducted via teleconference and/or video conferences, as appropriate, to support the efficient gathering of information by the NRC staff.

Audit Questions

The questions for discussion during the audit are primarily based on open items listed above related to OSU’s LAR. At the conclusion of the audit, necessary RAIs will be drafted to ensure the licensee has a clear understanding of the RAI scope.

Deliverables

At the completion of the regulatory audit the NRC staff will prepare a regulatory audit summary, which will be issued within 90 days after the audit. The regulatory audit summary will include the documents reviewed, the audit activities, and any RAIs that were discussed or that will be issued based on the audit, as applicable.

Audit Schedule

The NRC staff will conduct teleconferences and/or video conferences with OSU staff starting on April 15, 2021. Additional audit interaction will continue remotely as necessary.

Earlier if possible but no later than April 15, 2021, provide NRC staff access to the online reference documents portal with the documents stated in “Audit Information” above.