December 17, 2012

Dr. T. Tehan, Director Rhode Island Nuclear Science Center Rhode Island Atomic Energy Commission 16 Reactor Road Narragansett, RI 02882-1165

SUBJECT: RHODE ISLAND ATOMIC ENERGY COMMISSION, REQUEST FOR ADDITIONAL INFORMATION REGARDING THE RHODE ISLAND NUCLEAR SCIENCE CENTER REACTOR LICENSE RENEWAL (TAC NO. ME1598)

Dear Dr. Tehan:

The U.S. Nuclear Regulatory Commission (NRC) is continuing the review of your application for renewal of Facility Operating License No. R-95 for the Rhode Island Nuclear Science Center Reactor dated May 3, 2004, as supplemented by letters dated December 15, 2009; January 4, January 19, December 7, and December 14, 2010; and January 24, February 24, July 15, September 29, and October 6, 2011. During our review, questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed requests for additional information no later than March 16, 2013. In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.30(b), your response must be executed in a signed original under oath or affirmation. You must submit 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."

If you have any questions regarding this review, please contact me at 301-415-2784 or by electronic mail at <u>William.Kennedy@nrc.gov</u>.

Sincerely,

/**RA**/

William B. Kennedy, Project Manager Research and Test Reactors Licensing Branch Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

Docket No. 50-193

Enclosure: As stated cc w/encl: See next page

Docket No. 50-193

Rhode Island Atomic Energy Commission

CC:

Governor State House Room 115 Providence, RI 02903

Dr. Stephen Mecca, Chairman Rhode Island Atomic Energy Commission Providence College Department of Engineering-Physics Systems River Avenue Providence, RI 02859

Dr. Jack Breen, Chairman Providence College 549 River Avenue Providence, RI 02918

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Test, Research, and Training Reactor Newsletter University of Florida 202 Nuclear Sciences Center Gainesville, FL 32611 Dr. T. Tehan, Director Rhode Island Nuclear Science Center Rhode Island Atomic Energy Commission 16 Reactor Road Narragansett, RI 02882-1165

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Docket No. 50-193 Enclosure: As stated cc w/encl: See next page

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Office	PRLB:PM	PRPB:LA	PRLB: Acting BC	PRLB:PM
Name	WKennedy	GLappert	Plsaac	WKennedy
Date	12/13/2012	12/13/2012	12/17/2012	12/17/2012

# **OFFICE OF NUCLEAR REACTOR REGULATION**

# **REQUEST FOR ADDITIONAL INFORMATION**

## **REGARDING LICENSE RENEWAL FOR**

## THE RHODE ISLAND NUCLEAR SCIENCE CENTER REACTOR

## LICENSE NO. R-95

### DOCKET NO. 50-193

The following requests for additional information (RAIs) are related to the Safety Analysis Report (SAR) submitted as part of the application for license renewal for the Rhode Island Nuclear Science Center (RINSC) reactor dated May 3, 2004, and the responses to RAIs submitted by letters dated December 15, 2009; January 4, January 19, December 7, and December 14, 2010; and January 24, February 24, July 15, September 29, and October 6, 2011. Unless otherwise noted, RAIs that refer to the proposed technical specifications (TS) refer to the version of the TS submitted by letter dated September 29, 2011.

Responses to the RAIs should be in the form of discussion or analysis or both. The responses must provide sufficient information for the NRC staff to independently verify all safety-related conclusions. Responses to the RAIs may be in the form of replacement pages for the SAR. NUREG-1537, Part I, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content," dated February, 1996, contains guidance for providing sufficient information to satisfy the related regulatory requirements in Title 10 of the *Code of Federal Regulations* (10 CFR).

- 4.33 The responses to RAI 4.24 and 4.25 present a ramp reactivity transient analysis with an initial power level of 1.8 megawatts (MW) and an initial flow rate of 1740 gallons per minute (gpm). Explain why the initial conditions used in the analysis are the most conservative initial conditions allowed by the proposed TS. If there are more conservative initial conditions, provide an analysis and discussion of the ramp reactivity transient that shows the safety limit (SL) will not be exceeded. Include an explanation of why the assumptions used in the analysis are the most conservative assumptions for any operation allowed by the proposed TS.
- 7.5 The response to RAI 7.3 omitted the alignment tolerance for the bridge misalignment scram (now called the "bridge low power position" scram, as specified in proposed TS 3.2.1.3). Provide the alignment tolerance. If misalignment could allow core bypass flow, provide a discussion of the impact on the thermal hydraulic analyses for normal and accident conditions. Explain how the primary coolant system instrumentation would detect core bypass flow.
- 7.6 Based on discussions and firsthand observations during NRC staff visits to the RINSC, it is clear that there have been modifications to the instrumentation and control (I&C) systems that are not fully described in the SAR. Revise the SAR to include descriptions and analyses of the current I&C systems. The revisions should be consistent with the guidance in NUREG-1537 and not restricted to Chapter 7 of the SAR if the modifications affect descriptions or analyses presented elsewhere in the SAR.

- 10.5 Based on discussions and firsthand observations during NRC staff visits to the RINSC, it is clear that there have been modifications to the pneumatic tube irradiation system described in Section 10.2.3 of the SAR. Revise the SAR to include descriptions and analyses of the current pneumatic system. The revision should be consistent with the guidance in NUREG-1537 and not restricted to Chapter 10 of the SAR if the modification affects descriptions or analyses presented elsewhere in the SAR.
- 11.6 The response to RAI 11.3 didn't fully address NUREG-1537 Section 11.1.4 and 11.1.6 in regards to the bases for the methods and procedures used for conducting radiation and contamination surveys. Provide a more in-depth description of the nominal frequencies at which the facility is surveyed for these hazards. The description should include additional surveys that may be used during non-routine activities.
- 11.7 The response to RAI 11.4 didn't fully describe the provisions for the use of extremity monitoring and the conditions under which extremity monitoring is used. Provide this information.
- 13.22 The responses to RAI 13.4 and RAI 13.5 reference empirical data in a report on a fuel failure at the University of Virginia. Provide a copy of the report and explain why the report is applicable to the RINSC reactor (for example, similar fuel composition, similar operating characteristics, etc.).
- 13.23 The response to RAI 13.7 provides a reactivity transient analysis that shows the safety limit on reactor power will be exceeded. The response makes the statement, "However, the safety limit on power does not apply to transients." This statement is inconsistent with the regulations in 10 CFR 50.36, "Technical Specifications," for safety limits and limiting safety system settings. Propose new limiting safety system settings that prevent the reactor power safety limit from being exceeded. Alternately, propose a different safety limit(s) that prevents the uncontrolled release of radioactive material from the fuel and will not be exceeded during any reactor transient. Provide discussion and analyses that support the proposed TS for all operations allowed by the TS and reactor license. Include estimates of the safety margins provided by the SL(s) and LSSS(s). (Note: The responses to the RAIs maintain the SLs for reactor power and primary coolant flow, height, and temperature. The revised proposed TS submitted September 29, 2011, contain an SL for fuel cladding temperature only.)
- 13.24 The response to RAI 13.11 describes administrative controls that slow draining of the reactor pool in the case of a beam port break. These controls form the bases for assumptions in the pool drainage analysis presented in the response to RAI 10.2. Proposed TS 3.9.3.1 states, "Each beam port shall have no more than an area of 1.25 in<sup>2</sup> open to confinement during reactor operation." However, this administrative control does not prevent activities that could increase the cross-sectional area of drainage pathways immediately following reactor operation, and thus invalidate the assumptions used in the drainage analysis. Revise the proposed TS to include requirements that are always consistent with assumptions in the analysis or revise the analysis to be consistent with the proposed TS.
- 13.25 RAI 14.117 requested an analysis of the consequences of a failure of an experiment that contains fissionable material. The purpose of the questions was to understand the potential radiological consequences of failure of such an experiment and to determine

whether the TS requirements provide reasonable assurance that the radiological consequences would be within the regulatory limits in 10 CFR Part 20. The response to the RAI states that the quantity of fissionable materials used in experiments shall be limited by the reactivity worth of the experiment. Proposed TS 3.8.1.4 is not sufficient to ensure the radiological consequences of an experiment failure will be within the regulatory limits because the reactivity worth of a material depends on many different factors, and not just the quantity of material. Revise the proposed TS to include requirements for experiments that contain fissionable material that ensure failure of the experiment will not result in exceeding the limits in 10 CFR Part 20. The regulation 10 CFR 50.36(b), states that the proposed TS must be "derived from the analyses and evaluation included in the safety analysis report." In accordance with that requirement, provide an analysis of the failure of an experiment that contains fissionable material.

The following RAIs relate to the responses to RAIs provided by letters dated December 15, 2009; January 4, January 19, December 7, and December 14, 2010; and January 24, February 24, July 15, September 29, and October 6, 2011; and the revised proposed TS submitted by letter dated September 29, 2011. Unless otherwise noted, RAIs that refer to the proposed TS refer to the version of the TS submitted by letter dated September 29, 2011. In responding to the following RAIs, provide a response to each individual RAI, and provide a complete set of revised proposed technical specifications that incorporate any changes made as a result of the responses to the RAIs. NUREG-1537 and American National Standards Institute/American Nuclear Society (ANSI/ANS) standard titled, "The Development of Technical Specifications for Research Reactors," (ANS-15.1) provide guidance for developing TS that meet the requirements of 10 CFR 50.36. Please note that 10 CFR 50.36 requires that "technical specifications will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto, submitted pursuant to 10 CFR 50.34."

- 14.177 Proposed TS 1.21 defines "Reactivity Worth of an Experiment." The definition implies that the reactivity change due to flooding is included in the reactivity worth of the experiment. This seems contrary to the statement in the response to RAI 14.65 that, "an experiment could be found to have enough positive reactivity that if additional positive reactivity were added due to flooding, the shutdown margin would be less than 1.0% delta k/k." Explain this apparent discrepancy, and revise the proposed TS as appropriate.
- 14.178 Proposed TS 1.31.7 states that abnormal and significant degradation of the fuel cladding is a reportable occurrence. Section 6.7.2(c)(v) of ANS-15.1 recommends that abnormal and significant degradation of the coolant boundary also be a reportable occurrence. Explain why the proposed TS do not include abnormal and significant degradation of the coolant boundary as a reportable occurrence.
- 14.179 Proposed TS 3.1.1.3.1 specifies limits for the total reactivity worth of experiments. Section 3.8.1 (2) of ANS-15.1 recommends that the TS should specify the "sum of the absolute values of the reactivity worths of all experiments." Proposed TS 3.1.1.3.1 does not sum the absolute values of the reactivity of all experiments. Explain this apparent discrepancy, and revise the proposed TS as appropriate.
- 14.180 The responses to RAI 14.65 and RAI 14.137 state that, "in order to determine the reactivity worth of a new experiment for which there is no data on similar experiments, the only way to determine the reactivity worth of the experiment is to perform an approach to critical with the experiment loaded in the core." Revise proposed TS 3.1.1.3.1 and 3.1.1.3.2 to explicitly state the allowed reactor operations when testing the reactivity worth of new experiments.
- 14.181 Proposed TS 3.7.1.1 and 3.7.1.2 specify radiation monitoring instrumentation required during reactor operation and fuel movement. Explain why the instrumentation is not required during all conditions that require confinement specified in proposed TS 3.4.1. Revise the proposed TS as appropriate.
- 14.182 Current TS 3.7.1 contains requirements for radiation monitors that include explicit requirements for using portable monitors in the event that the installed instrumentation fails. Proposed TS 3.7.1 1.2 and 3.7.1.2.2 do not contain similar requirements. Revise the proposed TS to include explicit requirements for the use of

replacement monitors. Provide analyses and evaluation in the SAR that justify the proposed TS. (Note: The response to RAI 14.80 which references an NRC safety evaluation is not an adequate basis for a TS. As required by 10 CFR 50.36(b), TS "will be derived from the analyses and evaluation included in the safety analysis report.")

- 14.183 The regulation 10 CFR 50.54(m)(1) requires a Senior Reactor Operator to be present at the facility during recovery from an unplanned or unscheduled significant reduction in power. Proposed TS 6.1.3.2 does not include this requirement. Revise the proposed TS to correct this discrepancy.
- 14.184 Proposed TS 6.1.3.2.2 requires a Senior Reactor Operator to be present at the facility during fuel or control rod position changes. Explain the reason for not including reflector position changes in proposed TS 6.1.3.2.2, and revise the proposed TS as appropriate.
- 14.185 Section 6.2.2 (4) of ANS-15.1 states that the charter for the review and audit group should include provisions for dissemination, review, and approval of meeting minutes in a timely manner. Proposed TS 6.2.2 does not include any similar provisions. Revise the proposed TS to include provisions for dissemination, review, and approval of meeting minutes in a timely manner, or justify omitting such provisions from the proposed TS.
- 14.186 Section 6.2.2 (2) of ANS-15.1 states that a quorum should consist of at least half of the voting membership of the review and audit group. Proposed TS 6.2.2.2 does not specify a minimum number of NRSC members for a quorum. What is the minimum number of NRSC members needed for a quorum? Revise the proposed TS as appropriate.
- 14.187 Proposed TS 6.2.2.2 implies that members of the Nuclear and Radiation Safety Committee could also be members of the Rhode Island Atomic Energy Commission. Proposed TS 6.2.1.1 does not include provisions for members of the RIAEC to be members of the NRSC. Clarify whether members of the RIAEC can also be members of the NRSC, and revise the proposed TS as appropriate.
- 14.188 Section 6.2.3 (5) of ANS-15.1 states that the review and audit committee shall review violations of the license. Proposed TS 6.2.3 does not include such a requirement. Explain why no such provision exists in the proposed TS, or revise the proposed TS to include such a provision.
- 14.189 Section 6.2.3 (8) of ANS-15.1 states that the review and audit group shall review audit reports. Proposed TS 6.2.3 does not include such a requirement. Explain why no such provision exists in the proposed TS, or revise the proposed TS to include such a provision.
- 14.190 Section 6.2.3 of ANS-15.1 contains provisions for distribution of minutes of the review and audit group meetings. Proposed TS 6.2.3 does not include such provisions. Explain why no such provisions exist in the proposed TS, or revise the proposed TS to include such provisions.

- 14.191 Section 6.2.4 of ANS-15.1 states, "In no case shall the individual immediately responsible for the area perform an audit in that area." Proposed TS 6.2.4 doesn't contain any provisions to ensure that audits are performed by an individual or group that is independent of the area under audit. Explain the controls in place at the RINSC to ensure audits are independent, and revise the proposed TS as appropriate.
- 14.192 Section 6.2.4 of ANS-15.1 contains provisions for reporting deficiencies uncovered by audits and preparing and distributing audit reports. Proposed TS 6.2.4 doesn't contain any such provisions. Explain why no such provisions exist in the proposed TS, or revise the proposed TS to include such provisions.
- 14.193 Section 6.4 of ANS-15.1 states, "procedures shall be reviewed by the review group and approved by Level 2 management or designated alternates..." Proposed TS 6.4.2 states that the NRSC reviews and approves procedures. Proposed TS 6.2.2.2 specifies that an NRSC quorum consists of a majority of non-RINSC and non-RIAEC members. These TS imply that a group with a majority of non-RINSC members gives the final approval for procedures. Explain why the approval of procedures is controlled by individuals outside the RINSC operating organization and not Level 2 management.
- 14.194 Section 6.4 of ANS-15.1 lists eight activities that require written procedures. The current TS 6.5 lists nine activities that require procedures and is consistent with the list in ANS-15.1. Proposed TS 6.4.2 only lists five activities that require procedures (proposed TS 6.4.2.1 through proposed TS 6.4.2.5). Provide a justification for no longer requiring procedures for the activities that are in the current TS, but not in the proposed TS (for example, surveillance checks, calibrations, and inspections required by the TS).
- 14.195 Section 6.5 of ANS-15.1 states that new experiments and substantive changes to previously approved experiments should be approved in writing by Level 2. Proposed TS 6.5 specifies that the NRSC approves new experiments and substantive changes to previously approved experiments. Explain why the approval of experiments is controlled by individuals outside the RINSC operating organization and not Level 2 management. (See RAI 14.193.)
- 14.196 Proposed TS 6.6.1 and 6.6.2 state that the NRC will be notified in accordance with proposed TS 6.7.2 in the event of a safety limit violation or other reportable occurrence. The regulations in 10 CFR 50.36(c)(7)(ii) and 10 CFR Part 20, Appendix D, require a licensee to make initial notification to the NRC Headquarters Operations Center. Revise the proposed TS to explicitly state that initial notification will be made to the NRC Headquarters Operations Center.
- 14.197 Section 6.6.2(1) of ANS-15.1 states that reactor operation shall not be resumed following a reportable occurrence unless authorized by Level 2 management (RINSC Director). Proposed TS 6.6.2.2 states that the SRO can authorize restart of the reactor. Explain the reason for assigning restart authority to the SRO instead of Level 2 management.

- 14.198 Proposed TS 6.7.1.7 states that the annual report will include, "a summary of annual radiation exposures in excess of 500 mrem received by... visitors." This appears to be inconsistent with the requirements of 10 CFR 20.1301, "Dose limits for individual members of the public," and 10 CFR 20.2203, "Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the constraints or limits." Specifically, 10 CFR 20.2203(a)(2)(iv) requires a written report within 30 days after learning of doses in excess of the limits for an individual member of the public in 10 CFR 20.1301. Explain how the proposed TS meet the regulatory requirements, or revise the proposed TS, as appropriate.
- 14.199 The regulations in 10 CFR 50.36 require that records of the results of each review of exceeding the safety limit, the automatic safety system not functioning as required by the limiting safety system settings, or any limiting condition for operation not being met be retained by the licensee until the NRC terminates the license for the facility. Proposed TS 6.8.1.3 requires records of reportable occurrences be retained for five years. The regulations in 10 CFR 50.36 require some records categorized in the proposed TS as records of reportable occurrences to be retained for the life of the facility. Revise the proposed TS to include a requirement that records of the results of each review of exceeding the safety limit, the automatic safety system not functioning as required by the limiting safety system settings, or any limiting condition for operation not being met be retained until the NRC terminates the license for the RINSC reactor.