July 1, 2008

Dr. Wade Richards, Manager of Operations and Engineering
NIST Center for Neutron Research
National Institute of Standards and Technology
U.S. Department of Commerce
100 Bureau Drive, Mail Stop 8561
Gaithersburg, MD 20899-8561

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY TEST REACTOR APPLICATION FOR LICENSE RENEWAL (TAC NO. MD3410)

Dear Dr. Richards:

We are continuing our review of your application for renewal of Facility Operating License No. TR-5 for the National Institute of Standards and Technology test reactor dated April 9, 2004, as supplemented on October 2, 2006; and May 30, and August 14, 2007. During our review, questions have arisen for which we require additional information and clarification. As we discussed with you during our telephone conversation of June 30, 2008, please provide responses to the enclosed requests for additional information no later than August 8, 2008. In accordance with 10 CFR 50.30(b), your response must be executed in a signed original under oath or affirmation. Following receipt of your response, we will continue our review of your application.

If you have any questions regarding this review, please contact me at 301-415-2784.

Sincerely,

/RA/

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

Docket No. 50-184

Enclosure: As stated
cc w/enclosure: Please see next page

cc:

Environmental Program Manager III
Radiological Health Program
Air & Radiation Management Adm.
Maryland Dept of the Environment
1800 Washington Blvd
Suite 750
Baltimore, MD 21230-1724

Director, Department of State Planning
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Director, Air & Radiation Management Adm.
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Director, Department of Natural Resources
Power Plant Siting Program
Energy and Coastal Zone Administration
Tawes State Office Building
Annapolis, MD 21401

Marilyn J. Praisner, President
Montgomery County Council
100 Maryland Avenue
Rockville, MD 20850

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

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Name	WKennedy wbk	Wbk for EBarnhill	Lnt for DCollins	WKennedy wbk
Date	6/1/08	6/1/08	6/1/08	6/1/08

REQUEST FOR ADDITIONAL INFORMATION

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NATIONAL BUREAU OF STANDARDS REACTOR

DOCKET NO. 50-184

Questions related to the Safety Analysis Report

4.1 Section 4.6, Thermal Hydraulic Design & TS 2.2, LSSS. Provide justification for 500 kW power operation under natural convection flow by demonstrating that no credible accidents would result in exceeding the safety limit. (See TS question 2.2.)

4.2 Section 4.6, Thermal Hydraulic Design, p. 4-49. Provide justification that the Costa correlation is the appropriate and limiting method for calculating the critical heat flux given the coolant pressure found in the NBSR fuel channels.

13.1 Section 13.2.2.2.2, Rapid Removal of Experiments, p. 13-9. Please explain the result of minimum CHFR at BOC in the new analysis for the ramp reactivity insertion versus the EOC minimum CHFR for the previous analysis. Please explain the differences in the initial CHFRs for the two analyses, original analysis from FSAR submitted with the renewal application dated April 9, 2004, and new analysis submitted by letter dated October 2, 2006.

13.2 Section 13.2.2.2.1, Startup Accident, p. 13-2. The new ramp reactivity insertion analysis states that the RELAP5 MOD3.3 point kinetics model was found to incorrectly predict the power excursion during the transient. Justify the use of this model for the other accident analyses using this model.

13.3 Appendix A, Section 5.4.3 & 5.4.4, Throttling of Coolant Flow to the Outer Plenum, p. 5-4. What is the stroke time for valve DWV-1?

Questions related to the Technical Specifications

General

In accordance with 10 CFR 50.36, provide proposed Technical Specifications (TSs). The proposed TSs should be in conformance with ANSI/ANS-15.1, “American National Standard for The Development of Technical Specifications for Research Reactors,” as appropriate. The standard provides valuable guidance in the development of the TSs such that they meet the requirements of 10 CFR 50.36. The proposed TSs shall be reviewed and approved by the Safety Evaluation Committee in accordance with the Administrative Controls required by the current TS 7.2(1), “Safety Evaluation Committee.”

Pursuant to 10 CFR 50.36(b), the technical specifications will be derived from the analyses and evaluations included in the safety analysis report (SAR). Some of the following requests for additional information (RAIs) request justification or reference to analysis in the SAR be provided as a basis for the proposed TSs. This may be accomplished by referencing analysis already contained in the SAR, providing replacement SAR pages that contain the analysis, or by providing a separate analysis, discussion, and/or reference. In the latter case, the staff may incorporate that response in its Safety Evaluation Report by reference, and replacement pages for the SAR may be provided at a later time.

Pursuant to 10 CFR 50.36(a), summary statement of the bases or reasons for such specifications, other than those covering administrative controls, shall also be included in the proposed specifications, but shall not become part of the technical specifications.

Pursuant to 10 CFR 50.36(b), the Commission may include such additional TS as the Commission finds appropriate, and the approved TSs and any additional TSs will be incorporated into the renewed license.

The following is a list of specific sections of the proposed TSs submitted as Appendix A on August 14, 2007, that require clarification or additional information.

1.0 Introduction

1.3.16 Revise the definition to make it specific to the NBSR.

1.3.18c Define the phrase, "rod drop test mode."

1.3.19 Clarify the portion of the definition that states, "when the reactor is if it is subcritical..." Also, clarify whether or not the statement "with the reactivity worth of all installed experiments included," means that all experiments are in their most reactive positions.

1.3.29 Explain treatment of the regulating rod (e.g., assumed to be in the most reactive position) in the calculation of the shutdown margin.

2.0 Safety Limit and Limiting Safety System Setting

2.2 Define "nominal reactor power." (See TS question 3.1.1.)

2.2 The proposed TS allows for operation of the reactor with natural convection cooling at power levels up to 500 kW. Provide analysis that demonstrates the fuel temperature will remain below the safety limit during all credible accidents initiated during operation with natural convection cooling. (See SAR question 4.1.)

3.0 Limiting Conditions for Operations

3.1.1 Define "nominal reactor power." (See TS question 2.2.)

3.1.2(2) Proposed TS 3.1.2(2) is unclear with regard to the assumed positions of the highest-worth shim arm and the regulating rod. Confirm that the shutdown margin will be met with the highest-worth shim arm and the regulating rod in their most reactive positions and revise TS 3.1.2(2) accordingly. Otherwise, provide additional justification for proposed TS 3.1.2(2). (See TS question 1.3.29.)

3.1.2(3) Proposed TS 3.1.2(3) does not specify the amount of reactivity by which the reactor will remain subcritical with the highest-worth shim arm fully withdrawn. Provide the amount of reactivity by which the reactor will remain subcritical with the highest-worth shim arm fully withdrawn to ensure consistency with proposed TS 3.1.2(2) and TS 1.3.19.

3.1.3 Explain what is meant by "the reactor shall not normally operate," in proposed TS 3.1.3 and revise proposed TS 3.1.3 accordingly. If it is intended that proposed TS 3.1.3 allow

operation without all grid positions filled with full length fuel elements or thimbles, provide justification for such operation and analyses that show that such operation would not lead to accidents with consequences greater than those accidents analyzed in the SAR.

3.3 Section 5.4.1 of the SAR states, "the chemistry of the primary coolant must be properly controlled to ensure that the components in contact with the primary coolant are not degraded over the life of the plant." The guidance contained in ANSI/ANS-15.1 Section 3.3(9) includes requirements for water chemistry. Provide justification for not including primary coolant chemistry requirements in the proposed TS, or propose primary coolant chemistry requirements that ensure that the components in contact with the primary coolant will not be degraded over the life of the plant. (See TS question 4.3.1.)

3.6 The guidance contained in ANSI/ANS-15.1 Section 3.6 states that "minimum equipment required to be connected to emergency power…" should be listed in the specification. Such equipment is listed in the basis of proposed TS 3.6, but not in the specification. Provide justification for not specifying the equipment required to be connected to emergency power, or specify the equipment required to be connected to emergency power and the minimum operating time for the equipment.

3.7(1) Provide a basis for the statement, "this value may be increased in an emergency situation up to 500 mrem per calendar year if authorized by the Emergency Director." Include in the basis reference to discussion and/or analysis in the SAR of emergency situations that would warrant the Emergency Director authorizing an increase in the dose to a person outside the site boundary. Provide a discussion of the authorization process, including acceptable reasons for authorization, ALARA considerations, consultation with experts, and any other important considerations.

3.7, Part 1 Proposed TS 3.7 does not include specifications for equipment required to monitor the routine release of effluents. Provide a specification for such equipment and a related specification for surveillance of the equipment in Section 4 of the proposed TSs. Include a basis that references discussion or analysis in the SAR that provides reasonable assurance that effluent releases will be monitored and recorded as required by 10 CFR 20.2103(b)(4), and that doses from airborne effluents will be within the constraint of 10 mrem given in 10 CFR 20.1101(d). Otherwise, provide a justification based on calculation and analysis for not requiring effluent monitoring equipment. (See TS question 3.7 below.)

3.7, Part 2 ANSI/ANS-15.1 guidance on radiation monitoring and effluents is divided into two sections. Section 3.7.1 provides guidance on the TS requirements for the minimum number of radiation monitors. Section 3.7.2 recommends including effluent release limits for different categories of radionuclides. Contrary to this, effluent release limits are not included in proposed TS 3.7. Further, the scope of proposed TS 3.7.1 is listed as covering only the ARM system, although fission product monitors are mentioned in proposed TS 3.7.1(2). Sections 11.1.4.2 and 11.1.4.3 of the SAR discuss a continuous tritium monitor for building and effluent purposes that is not included in the TS. Also, the basis for proposed TS 3.7.1 contains a discussion of effluent release limits that are not included in the TS and are more appropriately contained in proposed TS 3.7.2 to meet ANSI/ANS-15.1 guidance. Restructure both proposed TS 3.7.1 and 3.7.2 to meet ANSI/ANS-15.1 guidance or justify this departure.

3.8.1(1) Basis (2) of proposed TS 3.8.1 states that the maximum allowed reactivity for the pneumatic irradiation system is 0.2% $\Delta\rho$. Provide discussion and/or analysis that

demonstrate(s) that the maximum rate of reactivity addition possible with the pneumatic irradiation system is bounded by the analysis of a ramp insertion of 0.5% Δρ in 0.5 seconds.

3.8.1(3) ANSI/ANS-15.1 Section 3.8.3 guidance includes conditions related to failure and malfunctions of experiments. Specifically, the ANSI guidance states, "experiments shall be designed such that they will not contribute to the failure of other experiments, core components, or principal physical barriers to uncontrolled release of radioactivity." Contrary to this, proposed TS 3.8.1(3) does not include comparable requirements. Revise proposed TS 3.8.1 to include the additional conditions related to failure and malfunctions of experiments or provide justification for not including the additional conditions.

3.9.1(1) Current TS 3.7(1) specifies an optimal k_{eff} of 0.9 for fuel elements or fueled experiments being stored or handled. The proposed TS 3.9.1(1) specifies an optimal k_{eff} of 0.95 for fuel elements or fueled experiments being stored or handled. ANSI/ANS-15.1, Section 5.4, specifies an optimal k_{eff} of 0.9. Provide justification for the reduction in the safety margin for fuel elements or fueled experiments being stored or handled.

3.9.1(2) Proposed TS 3.9.1(2) regarding fuel storage indicates that the fuel storage pool is "a stable environment, where water chemistry, temperature, and level are easily monitored…" However, no requirements are included regarding these parameters. Include acceptable ranges of values for these parameters or justify why these parameters should not be included in the proposed TS.

3.9.2.2(2) Proposed TS 3.9.2.2(2) appears to be applicable at all times, and not only during "all other fuel handling conditions." Provide justification that proposed TS 3.9.2.2(2) is only applicable during "all other fuel handling conditions," or consider incorporating this requirement into proposed TS 3.4.1.

4.0 Surveillance Requirements

4.2.1 ANSI/ANS-15.1 Section 4.2(4) includes scram time surveillance after any work on the rods or drive system. Verify that the testing required by proposed TS 4.1.1(4) includes the surveillances required by proposed TS 4.2.1, and thus is in conformance with the ANSI guidance.

4.2.1(1) Provide justification for not determining the withdrawal and insertion speed for the regulating rod.

4.2.2 The guidance contained in ANSI/ANS-15.1 Section 4.2(9) includes interlocks in the operability checks which are not present in the proposed TSs. Include interlocks or justify this departure from ANSI guidance.

4.3.1 ANSI/ANS-15.1 guidance specifies quarterly checks of the starting function of emergency shutdown and sump pumps. Contrary to this, proposed TS 4.3.1 specifies annual checks for shutdown cooling pumps. Provide justification for the non-conservative departure from ANSI guidance.

4.3.1 Operability checks for the secondary cooling water activity monitor are included in both proposed TS 4.3.1 and TS 4.7.1. Correct or justify this duplication.

4.3.1 Provide justification for not including a surveillance requirement on the concentration of D_2 in the helium sweep system (TS 3.3.1(4)), or include such a surveillance requirement.

4.3.1 ANSI/ANS-15.1 Section 4.3(6) guidance includes a surveillance requirement for coolant system conductivity, pH or both. Contrary to this, proposed TS 4.3.1 does not include any such provisions. Include surveillance requirements for coolant system water quality or justify not including surveillance requirements for coolant system water quality. (See TS question 3.3.)

4.6 The ANSI guidance specifies quarterly to semiannual checks for battery voltage and specific gravity. Contrary to this, proposed TS 4.6 specifies annual checks while current TS 4.7 specifies semiannual checks. Change the surveillance period, or justify this non-conservative departure from ANSI guidance and prior practice.

4.7.1 Surveillance requirements for fission product monitors are not included in the proposed TSs. Add surveillance requirements for the fission product monitors or justify this departure from ANSI/ANS-15.1 guidance. (See TS question 3.7.)

4.9 Proposed TS 3.9.1(2) regarding fuel storage indicates that the fuel storage pool is "a stable environment, where water chemistry, temperature, and level are easily monitored…" However, no surveillance requirements are included regarding these parameters. Include surveillance requirements or justify why these parameters should not be included in the Proposed TS. (See TS question 3.9.1(2).)

5.0 Design Features

5.3(3) Proposed TS 5.3(3) states the fuel plates shall be "uranium-aluminum alloy, either aluminum-uranium oxide or uranium-aluminide, clad with aluminum." Only aluminum-uranium oxide is addressed in the SAR (Section 4.2.1.1, 4.2.1.4). Remove mention of the non-described fuel types or justify the inclusion of fuel types that have not been described in the SAR.

6.0 Administrative Controls

6.1.3 Proposed TS 6.1.3.a.3 specifies the events when an SRO is required to be present. Contrary to ANSI/ANS-15.1 guidance, the proposed TS does not include the condition of "recovery from unplanned or unscheduled shutdown or significant power reduction." Include this condition or justify this departure from ANSI guidance.

6.2.2 Proposed TS 6.2.2 specifies that the Safety Evaluation Committee (SEC) shall operate with a written charter that includes provisions for meeting frequency, quorums, use of subcommittees, and treatment of minutes, but provides no details regarding these provisions. ANSI/ANS-15.1 Section 6.2.2 provides related guidance. Include specifics regarding meeting frequency, quorums, use of subcommittees, and treatment of minutes or justify not including such specifics.

6.2.3 There are two TS 6.2.3 listed; one for the SEC and one for the Safety Audit Committee (SAC). Correct this error and indicate the appropriate numbers for the two proposed TS provisions.

6.2.3 The review scope of the SEC does not include operating abnormalities having safety significance or audit reports as suggested by ANSI/ANS-15.1. Add these requirements or justify this departure from ANSI guidance.

6.2.3 The scope of the audit function of the SAC is stated as “the committee shall audit the NBSR reactor operations and the performance of the SEC.” Provide more detail about the specific areas of reactor operation audited and how the SAC audits the performance of the SEC. ANSI/ANS-15.1 Section 6.2.4 contains additional guidance.

6.4 Proposed TS 6.4 does not have a requirement for procedures for “maintenance that could have an impact on safety…”, as recommended in ANSI/ANS-15.1 guidance. Include maintenance that could have an impact on safety in the scope of procedures or justify this departure from ANSI guidance.

6.5 Proposed TS 6.5.b indicates that minor changes to experiments that do not significantly alter the experiment safety envelope shall be reported to the SEC at their next meeting. However, proposed TS 6.5.b does not indicate at what level of authority determinations are made regarding what constitutes a “minor change” to a previously approved safety envelope contrary to ANSI/ANS-15.1 guidance. Include the approval level for minor changes to experiment safety envelopes or justify this departure from ANSI guidance.

6.8.1 Proposed TS 6.8.1 provides a list of record categories to be retained for five years or the life of a component if less than five years. ANSI/ANS-15.1 guidance includes four categories that are missing from proposed TS 6.8.1: (1) radiation surveys, (2) experiments performed, (3) operating procedure changes, (4) audit reports & meetings. Add these record retention requirements or justify this departure from ANSI guidance.