April 1, 2014

Dr. Kenan Unlu, Director
Radiation Science and Engineering Center
Breazeale Nuclear Reactor
University Park, PA 16802-2301

SUBJECT: PENNSYLVANIA STATE UNIVERSITY - REQUEST FOR ADDITIONAL INFORMATION FOR LICENSE AMENDMENT REQUEST REGARDING THE REACTOR BAY VENTILATION SYSTEM UPGRADE FOR THE PENN STATE BREAZEALE REACTOR (TAC NO. ME8001)

Dear Dr. Unlu:

By letter dated February 7, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12040A166), Pennsylvania State University (the licensee) requested an amendment to the Facility Operating License R-2 for the Penn State Breazeale Reactor.

The U.S. Nuclear Regulatory Commission is continuing to review your amendment request regarding the reactor bay ventilation system upgrade which impacts the license technical specifications. During our previous review, we requested additional information regarding your application by letter dated November 21, 2012 (ADAMS Accession No. ML12284A197), and subsequently, you responded by letter dated January 7, 2013 (ADAMS Accession No. ML13024A411). After reviewing your responses, further questions have arisen that require additional information and clarification. Please provide responses to the enclosed request for additional information 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 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.” Following receipt of the additional information, we will continue our evaluation of your amendment request.

If you have any questions regarding this review, please contact me at 301-415-1404 or by electronic mail at Xiaosong.Yin@nrc.gov.

Sincerely,

/RA/

Xiaosong Yin, Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-005

Enclosure:
Request for Additional Information

cc w/encl: See next page

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Test, Research, and Training
Reactor Newsletter
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Mark A. Trump
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Radiation Science and Engineering Center
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If you have any questions regarding this review, please contact me at 301-415-1404 or by electronic mail at Xiaosong.Yin@nrc.gov.

Sincerely,

/RA/

Xiaosong Yin, Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-005

Enclosure:
RAI

cc w/encl: See next page

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ADAMS Accession No.: ML14036A319; *concurred via e-mail NRR-088

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OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

REGARDING LICENSE AMENDMENT FOR

PENNSYLVANIA STATE UNIVERSITY

THE PENN STATE UNIVERSITY BREAZEALE NUCLEAR REACTOR

LICENSE NO. R-2

DOCKET NO. 50-005

By letter dated February 7, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12040A166), Pennsylvania State University (PSU, the licensee) requested an amendment to the Facility Operating License R-2 for the Penn State Breazeale Reactor.

The U.S. Nuclear Regulatory Commission (NRC) is continuing to review your amendment request regarding the reactor bay ventilation system upgrade which impacts the license technical specifications (TSs). During our previous review, we requested additional information regarding your application by letter dated November 21, 2012 (ADAMS Accession No. ML12284A197), and subsequently, you responded by letter dated January 7, 2013 (ADAMS Accession No. ML13024A411). After reviewing your responses, further questions have arisen that require additional information and clarification. Please provide responses to the enclosed request for additional information (RAI) within 30 days of the date of this letter.

1. TS 3.3.3, “an air particulate monitor” was used in reference to the fission product activity monitoring. In Table 3 of TS 3.6.1, a “continuous air (radiation) monitor” was used as one of the radiation monitoring channels. Clarify if they are the same monitor and the purpose of these monitors. Revise your proposed TS as required.

2. In TS 3.4, you have rewritten the section and replaced it with the proposed TS 3.4. Provide detailed justification for the proposed changes. Specifically, respond to the following:

    a) Define the “low pressure confinement boundary (LPCB)”.

    b) Describe the relationship between the LPCB and the confinement that is defined in the current PSU TSs?

    c) Describe how the LPCB is established, including a discussion of the materials required, how they will be put in place, and what instruction is provided for establishing the boundary.

    d) Clarify if there will be surveillance in place associating with this LPCB.

Enclosure

e) Describe how this proposed LPCB meets the performance requirement as specified for a confinement and is consistent with the definition in TS 1.1.8.

f) Describe the time needed to re-establish a confinement for the reactor bay when a confinement as defined in TS 1.1.8 is lost and describe how to verify the operability of the LPCB.

g) Evaluate the impact of an emergency or accident situation on the methodology used for establishing a LPCB and the effectiveness of the LPCB.

h) Describe the potential radiological impact to the personnel establishing the LPCB and others affected by the lack of confinement, until the end of the time it takes to establish a temporary confinement boundary, during accident conditions.

i) In this proposed TS, it also stated that "[L]arge penetrations SHALL NOT exist" to the reactor bay during reactor operation. Explain how this proposed TS is satisfied when the reactor bay heating ventilation air conditioning and exhaust system (RBHVES) is in service since the confinement isolation dampers represent a large air passage to the reactor bay.

j) Describe why the additional open dampers, running fans, and connections to outside air related to the RBHVES do not compromise the objective of TS 3.4 and continues to satisfy the basis to ensure that the air pressure in the reactor bay is lower than the remainder of the building and the outside air pressure.

3. Additional information is needed for TS 3.5. Respond to the following:

a) Provide an analysis supporting your justification to extend the reactor operation time from 48 hours to 30 days without an emergency exhaust fan. In Section 13.1.1 of PSU's current Safety Analysis Report (SAR), a credit has been taken to evaluate the radiological consequence using a stack release dilution. When this stack release credit can no longer be taken due to the fact that there is no operable emergency exhaust fan available, what is the radiological consequence? Show a calculation to support your justification. (see Regulatory Guide 1.145 "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, for an example of a method acceptable to the NRC staff).

b) Identify radiation release pathway(s) if none of the exhaust fans are operable.

c) Calculate the radiation consequence to the nearest receptor if none of the exhaust fans are operable for normal and post-accident conditions.

d) Specify who will be directly exposed (worker and general public) if an emergency occurs and there is no emergency exhaust fan operable.

e) Calculate potential maximum exposure during a movement of irradiated fuel or a fueled experiment when the fuel ruptured in the air and there are no exhaust fans operable. Use the maximum possible time period for this calculation from the discovery of the fuel rupture to the time when personnel were evacuated from the reactor under the assumption that there are no operable exhaust fans. Compare this potential maximum exposure to the scenario where fuel movement is immediately stopped after the discovery of no operable exhaust fans at the reactor bay.

f) Describe how the confinement negative pressure is being monitored and is the loss of negative pressure immediately obvious to the reactor operator at the controls?

g) What is the maximum potential radiological consequence when considering the combination of this proposal, which will allow 30 day reactor operation without an emergency exhaust fan and the extended 1-hour operation without any operable exhaust fans, with the proposal in TS 3.4, which will allow a LPCB to be established to re-establish a confinement?

4. Section 7.3.1.3 of the SAR lists reactor console digital control computer (DCC-X) generated scrams. Two of these scrams, “Reactor Bay Truck Door Open” and “Both East and West Facility Exhaust Fans Off” help ensure the confinement pressure boundary is maintained. Will these scrams remain in place and are any additional scrams being developed to support operation of the RBHVES?

5. Your response No. 2 to NRC’s RAI dated January 7, 2013, and the revised PSU SAR Chapter 6, described most of the components in the RBHVES system. There are several components on Figure 6-1 that have not been adequately described:

a) Provide additional details to the purpose of the economizer air damper and the relief damper.

b) On Figure 6-1, the gravity backdraft dampers, makeup air damper, economizer makeup air damper, and relief damper (dampers) are designated as normally closed. Describe the conditions when these dampers would be open.

c) The economizer air and relief dampers appear to communicate with outside air; describe the location of the intake or discharge point for this flow path.

d) No back draft dampers are shown for either one of these normally closed dampers, which means that the air can flow in either direction. Are these intended release points, and if so, what is the elevation for the release? If they are not intended to be a discharge point, what prevents air flow in the discharge direction?

e) Are these normally closed dampers positively controlled (i.e., locked closed) or is their position controlled only via the RBHVES controls?

6. In the proposed TS 3.6.2, respond to the following:

    a) Specify the time limit on how long the evacuation alarm could remain out of service. The proposed language would allow the facility to not have an automatic alarm for an unspecified period, providing the facility announcement system is "verified" to be working.

    b) Describe the impact to the operator actions when the alarm is not operable and other means must be utilized to notify facility personnel for the need to evacuate. Specifically address the potential to delay the operator from exiting the reactor bay following an elevated radiation level condition and the related dose consequence.

7. Provide detailed technical justification for the removal of TSs 3.6.3 and 4.6.2 regarding the Argon-41 (Ar-41) concentration limit and monitoring. Specifically, respond to the following:

    a) Are there other normally released isotopes that will have a health and safety impact being discharged from the facility operation?

    b) If there are other isotopes, evaluate the scenario where Ar-41 is the only effluent release versus when there are other isotope effluent releases from the reactor operation.

8. The current TS 4.6.1 requires that the facility radiation monitors and the evacuation alarm system "SHALL be channel tested monthly not to exceed 6 weeks. They SHALL be verified to be operable by a channel check daily . . ., and SHALL be calibrated annually, not to exceed 15 months." In the proposed TS 4.6.2, the only requirement for the evacuation alarm is that "the evacuation alarm SHALL be verified audible annually not to exceed 15 months." Respond to the following to address the differences between the current TS and proposed TS in relating to the facility's evacuation alarm's operability:

    a) What constitutes an evacuation verify protocol?

    b) How do you verify the evacuation alarm's operability?

    c) Clarify the technical difference between the terminologies of a "verify" and a "test" and justify that the evacuation alarm verification can meet the objective of the current TS 4.6.1.

    In addition, based on your revised SAR Section 6, the RBHVES is intended to perform the same function as the emergency exhaust system (EES) described in Section 1.3 of the SAR utilizing one or more of four separate exhaust fans. Fresh air can now be supplied by the RBHVES in addition to the previously assumed leakage around doors and penetrations. Respond to the following questions specifically applicable to RBHVES system:

9. Prior to installation of the RBHVES the facility exhaust system (FES) provided sufficient flow to ensure negative pressure is maintained with the operation of a single fan, so no monitoring of relative pressure was required. Use of this system requires a flow balance to ensure the negative pressure is maintained.

    a) Describe how this flow balance was performed on RBHVES to ensure adequate negative pressure in the reactor bay for the initial installation.

    b) How is this flow balance adjusted and how frequently is that adjustment required?

    c) Are the licensed reactor operators capable or expected to make these adjustments?

    d) Does a senior reactor operator (or other senior licensed staff) supervise or approve the flow balance adjustments?

    e) Identify the minimum pressure differential (negative reactor bay pressure) required to ensure adequate radiological control and the basis for that determination.

10. Your response No. 2 to NRC's RAI dated January 7, 2013, and the revised PSU SAR Chapter 6, described most of the components in the RBHVES system. Pressure sensors were not mentioned in this description.

    a) Are there any pressure sensors installed or related to the RBHVES? If you do not have pressure sensors describe how you ensure that the air pressure in the reactor bay is lower than the surrounding building or the atmosphere as stated in the SAR and TS bases.

    b) Describe, in detail, the displays, sensors (including location), controls, and information available to the operator for the RBHVES.

    c) Explain the expected operator action when the negative reactor bay air pressure appears to be compromised based on the RBHVES indications.

    d) What is the radiological consequence when the reactor bay negative pressure is not maintained?

    e) If pressure sensors are present how sensitive are they to normal personnel movement in and out of the reactor bay and does this tend to create nuisance alarms for the operator?

    f) Does the RBHVES control contain any supervisory logic?

11. In the revised SAR Section 6.2.1 "Confinement," it states that the confinement isolation dampers were programmed to close on loss of control power.

a) Describe the motive force to close these dampers on loss of power. If it is an energy storage device, describe this energy storage device including how long the charge can be maintained.

b) What speed will the dampers move (relative to how they are normally powered) when relying on the energy storage device to close?

c) What surveillance is performed to ensure the system functions as expected on loss of external alternating current power?

12. The RBHVES isolates on conditions that cause the building evacuation alarm to be sounded. This is required to ensure that the EES controls the release path or airborne radiation during accident conditions. What testing has been performed to ensure the confinement isolation dampers provide sufficient isolation to the reactor bay from the RBHVES to prevent it from compromising the intended release path?

13. Review of the revised SAR Section 6.0 revealed that the RBHVES (multiple components or control system failure) has the potential to pressurize the confinement. Consistent with Title 10 of the *Code of Federal Regulations* Section 50.36(c)(2)(ii)(C) propose a TS for maintaining the reactor bay at a negative pressure relative to the remainder of the building or the atmosphere consistent with the bases for TSs 3.4 and 3.5. If credit is being taken for the pressure sensors, include a surveillance with a frequency for testing and calibration of these sensors and associated alarm responses. The proposed TS should be a replacement for the existing TS requiring at least one facility exhaust fan to be running. If it is not being proposed, provide justification.

14. In the SAR Section 6.2.1, it states “[W]hen the evacuation alarm is activated, any operating RBHVES fans are shutdown, associated confinement isolation dampers shut, and the EES system starts.” Describe how the signal from the evacuation alarm interfaces with the RBHVES. What type of isolation has been provided to ensure the integrity of the signal and to prevent system feedback from preventing other automatic actions that are required when the evacuation alarm sounds?