PURDUE
UNIVERSITY

SCHOOL OF NUCLEAR ENGINEERING

13 July 2012

Document Control Desk
US Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Attn: Ms. Cindy Montgomery, Research & Test Reactors (NRR/DPR/PRLB), Mailstop O12 D20

SUBJECT: PURDUE UNIVERSITY - REQUEST FOR ADDITIONAL INFORMATION REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL (TAC NO. ME 1594), RESPONSES TO RAIs (ML103400115 and ML103400250)

Dear Ms. Montgomery:

Enclosed please find the responses to the Request for Additional Information regarding the Purdue University Reactor License Renewal dated 6 July 2011. Included with this submission are responses to questions 49, 50, 53, 64, and 72. Should you have any questions or require further information, please don't hesitate to call me at 765.496.3573, or e-mail at jere@purdue.edu.

I hereby certify under penalty of perjury with my signature below that the information contained in this submission is true and correct to the best of my knowledge.

Very respectfully,

Jere H. Jenkins
Director of Radiation Laboratories

Attachments: As described.

Cc: Duane Hardesty, USNRC Project Manager for PUR-1
Leah Jamieson; Purdue University College of Engineering
Jim Schweitzer, Purdue University REM, CORO Chair
Ahmed Hassanein, Purdue NE

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REQUESTED ADDITIONAL INFORMATION IN RESPONSE TO RAIs

REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL (TAC NO. ME 1594)

49 SAR Section 2.3.2 indicates that buildings at Purdue are designed to withstand the wind load of 17 pounds per square foot from the data indicating a maximum wind zone of 80 miles per hour. Please provide an evaluation of a safety analysis that indicates the safety margin of the Duncan Annex wind load rating relative to the maximum wind load.

Response:

The information provided in the SAR as submitted was transferred from the 1988 SAR approved by the NRC. Further investigation and discussions with Purdue Facilities engineers yielded the following information.

1. Per the original drawings, the design roof live load was 30 PSF. The design wind load was not stated, however, 20 PSF would be a reasonable assumption. The drawings are dated 1940. The 1927 UBC (uniform building code) required a 20 PSF wind load.
2. Historically, the design wind speed for this area had been 80 mph. Referencing the 1982 UBC, wind stagnation pressure at 30' was 17 PSF for 80 mph wind, and 21 PSF for 90 mph wind. This pressure is then modified by other factors including importance factor (type of facility), exposure factor (surrounding physical obstructions), Topographic factor (surrounding topography). Also, wind pressures are higher at edges and corners, and increase with elevation. Historically, a uniform snow load of 30 PSF was used for this area.
3. Currently, ASCE 7 is referenced by 2006 IBC as amended by 2008 Indiana Building Code as the standard for structural loads for buildings including snow and wind. Design wind speed for this area is now 90 mph, and ground snow load for this area now is 20 PSF, which is then modified for other factors including importance, exposure, thermal, and drift.
4. These loads and the corresponding design would typically have a factor of safety above 1.5, but the safety factors will vary depending on the type of member (roof, wall, etc.) and material under consideration. In other words, the structure could sustain loads 1.5 times the design loads (this is conservative) and not fail.

Based on the fact that the Duncan Annex building was originally designed as a high voltage laboratory, and the building is windowless, constructed with steel reinforced concrete, concrete block and brick, and the reactor itself is contained in a pool constructed with steel reinforced concrete, lined with a stainless steel tank, it is very unlikely that high winds or snow loads could lead to core damage.

50. NUREG 1537, Part 1, Section 3.2 provides guidance on describing the design for the protection from meteorological conditions. Please indicate the maximum snow and ice load that the PUR-1 facility roof must be capable of withstanding to ensure safe reactor operation is not jeopardized. Please provide reference to local building codes, standards or other criteria as part of your response.

Response:

Please see the answer to Question 49 above.

53. NUREG-1537, Part 1, Section 10 provides guidance for providing information on the experimental facilities, the experimental program and its intended use. Please provide a description of the general focus of the experimental program (radiation science, medical, materials testing, teaching, etc.), the experimental facilities, the basic type of experiments that are irradiated (incore, thermal column, external beam, etc.), any limiting experimental characteristics (e.g., reactivity, contents) monitoring and control of the experiments, and the interaction between the experiment and the reactor control and safety systems.

Response:

Section 10.2 describes the experimental facilities that exist for PUR-1, and they are also discussed in Chapters 4 and 13. The general scope of the experimental program is for teaching, training and radiation science. For teaching and training, reactor experiments such as "Approach to Critical" and "Control Rod Worth" are routinely performed with senior undergraduate and graduate nuclear engineering students under the direction of reactor operators. Radiation science experiments focus primarily on activations, training, and some material testing.

Reactivity and content limitations for experiments are described in the Technical Specifications, and accident analyses for the experiments (for failure of experiments with reactivity worth, as well as reactivity worth changes that would result from failure of experiments with reactivity worth or flooding of a dry drop tube are described in Chapter 13

64. SAR, Section 2.5.2 states "it is highly unlikely that any reactor water would be lost during any severe seismic activity" but no indication is provided that damaging seismic activity to other structures, systems or components (SSC) is unlikely. Please provide an evaluation of a safety analysis indicating that if any seismic activity were to occur, the radiological consequences are bounded, indicate where the analysis occurs in the SAR or justify why an analyses is not required.

Response:

The reactor building and reactor infrastructure was built to seismic code in existence at the time. Due to the low probability of seismic activity, and limited damage to Purdue buildings that would result from seismic activity, core damage would be negligible. The only overhead equipment in the room that could potentially fall into the pool as a result of seismic activity would be the overhead crane, which is not parked over the pool when not in use, as a rule, and is used only rarely, generally less than once every three years.

72. NUREG-1537, Section 9.3 provides guidance for fire protection systems and programs at the facility. SAR section 9.3 discusses the fire protection system as being "appropriate for the types of fires that could be encountered in the reactor room." However, Section 9.3 of the SAR does not discuss methods to detect, control, or extinguish fires. Please indicate the means the facility has for preventing, detecting, and combating fires and the facility compliance with the local national fire codes. Please provide an evaluation of the safety analysis for fire protection with sufficient information describing potential radiological consequences of a fire will not prevent safe reactor shutdown or result in a fire-related release of radioactive material or if such a release is possible, that release of radioactive

material would not cause radiation exposure that exceeds the requirements of 10 CFR Part 20.

Response:

The reactor and the building where the reactor is located are intrinsically fireproof, and in the event of a fire no special precautions are required. The fire protection system for the reactor facility is typical of those at most university low-power research reactors. There are two portable fire extinguishers in the reactor room located at either end of the room. These extinguishers are inspected annually by personnel from the Purdue University Fire Department (PUFD) to verify they meet fire codes as required. A fully functional campus fire station, manned 24 hours/day, is located on campus (~1/2 mile from the reactor) and is available on short notice to assist in case of a fire.

If a fire should occur while the reactor is in operation, the reactor would be shut down and the supervisor, or alternate, would be notified. Normal fire procedures for the building are in place and are expected to preclude accumulation of flammable materials. If a fire occurs when the reactor is not in operation and reactor personnel are not present, the reactor pool will be adequate to prevent core damage for an extended period of time, until building fire alarms are tripped and PUFD responds.

There is no sprinkler system in the reactor room due to the potential damage to the reactor I&C system that could result from leaks or failure of a sprinkler head. Fire inspectors visit the facility on a 3-5 year rotation to verify that the reactor room meets applicable fire codes.