PURDUE
UNIVERSITY

SCHOOL OF NUCLEAR ENGINEERING

15 June 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 46, 47, 52, 57, and 59. 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
Leah Jamieson; Purdue University College of Engineering
Jim Schweitzer, Purdue University REM
Ahmed Hassanein, Purdue NE

A020
NRR

REQUESTED ADDITIONAL INFORMATION IN RESPONSE TO RAIs

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

46. Section 1.4 of the SAR states the reactor is located in the Duncan Annex, but does not indicate if there are any shared facilities and equipment as described in NUREG-1537, Section 1.4. Examples of shared facilities include water purification systems; electrical supplies; heating, ventilation, and air conditioning (HVAC) systems; any subcritical assemblies, irradiation facilities, or hot cell located within the restricted area to which this SAR applies. Please describe the shared facilities and equipment or provide an explanation describing your reason(s) for not incorporating additional description of shared facilities into the SAR.

Response:

The reactor room is the defined facility restricted area. The HVAC system is, as described elsewhere in the SAR, isolated from the rest of the building HVAC. The reactor pool make-up water is drawn from the building water supply, but the water process system is a closed loop. The reactor room electrical supply is part of that of the rest of the building, but the reactor room circuits are separately fused. There are no other items such as subcritical assemblies, irradiation facilities or hot cells, which is why they weren't mentioned.

47. Section 1.6 of the SAR states the reactor operates about 90 times per year on average. Please describe the typical reactor operations during these "90 times per year" (i.e., typical operating power level and schedule). Also, indicate if these operations, including the facility's requested power uprate, are consistent with proposed operations described in the SAR and are consistent with the comparison to similar facilities as described in NUREG- 1537, Section 1.5.

Response:

The majority of reactor operations are for training/education activities in association with nuclear engineering laboratory classes. For example, two experiments that are performed are an approach to critical, and a control rod calibration. Most of the runs are very low power, where reactor power does not exceed 100 W. About 10-15% of the reactor operations are for irradiations or other research related work.

With the uprate, the number of research related work will likely increase somewhat with the expanded capabilities. All of this is similar to similar facilities, such as the Ohio State University Research Reactor (OSURR), with the main difference being OSURR has a much greater research share.

52. SAR Section 5.5 describes automatic pool water level control. Please describe how you would determine if the amount of make-up water to the reactor pool was excessive and indicative of a pool leak.

Response:

The automatic pool water level control is only activated when needed to replace evaporated coolant inventory, and the automation is solely to prevent overfill of the pool. Operations staff activate the system, and track the amount of water used each time in a log book. Data exists for facility water usage back to

about 1974. In looking at the last 15 years, the average weekly water usage has been 36.8±12 gallons. The data are presented in Figure 1. Weekly usage that exceeds the average value plus three standard deviations could indicate a leak.

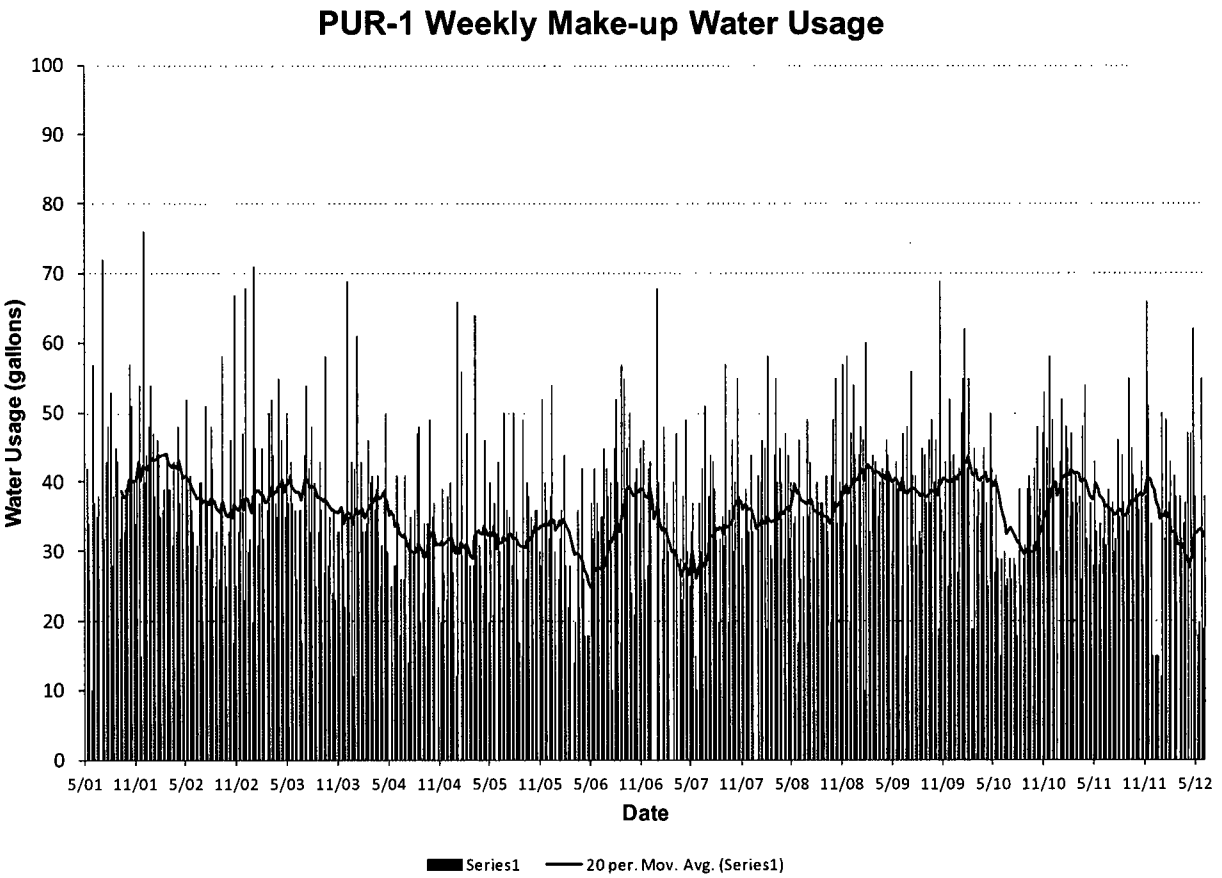

Figure 1: Weekly make-up water usage for PUR-1.

57. NUREG 1537, Part 1, Section 4.3, Reactor Tank or Pool states the applicant should present all information about the pool necessary to ensure its integrity and should assess the possibility of uncontrolled leakage of contaminated primary water.

- ***a. Section 5 of the SAR does not describe reactor pool level monitoring. Please discuss how reactor pool level is monitored, and if a leak develops in the reactor pool cooling system during off-hours, how it would be mitigated when approximately up to four feet of pool water could leak out?***
- ***b. Please discuss the typical radioactivity content of the pool, required responses from operator and/or university personnel, if a leakage is detected; Please discuss potential release pathways of reactor pool water leakage to the environment and the radiological impact of a release.***
- ***c. Please provide an estimate of the minimum detectable amount of leakage and an estimate of how long such a leak could exist before detection; any trends associated with the required make up water, and the physical means with which PUR-1 can detect small releases from the pool directly to the environment.***

Response:

Pool level is monitored by comparison of the pool level to a ruler at the top of the pool, and is observed at least once a week by reactor staff members. Make-up water usage is tracked in a log book on the console. In looking at the last 15 years, the average weekly water usage has been 36.8±12 gallons. The data are presented in Figure 1. Weekly usage that exceeds the average value plus three standard deviations could indicate a leak.

Over the 50 year operations history of PUR-1, there has been no detectable contamination in the primary water as a result of operations. And based on the construction of the pool, with its stainless steel tank liner with no penetrations below floor level, leakage of water to the environment is extremely unlikely (as noted in the 1988 SER for the PUR-1 license, see NUREG-1283). Observation of water level, and comparison to historical records should be adequate considering the risks involved.

59. ***NUREG-1537, Section 8 discusses the need for emergency electrical power systems to protect the public from radioactive releases. Please describe how the radiation protection system, including alarms, interlocks, and powered radiation monitors, functions without emergency power or if these systems do require power, describe how the facility and/or emergency responder personnel would monitor the radiation environment in the reactor building and in the rest of the Electrical Engineering Building if power were not available.***

Response:

Loss of power to the instrumentation and control systems of PUR-1 will result in a SCRAM since the shim-safety control rods are suspended by electro-magnets, thereby shutting down the reactor. Loss of power will also result in isolation of the reactor room, since the dampers will close. Battery powered survey meters and ionization chambers are available in the reactor room to ensure operations staff is aware of any possible radiation exposure hazards following a power outage. Emergency responder personnel at Purdue University also have battery operated survey meters and ionization chambers on their vehicles, should they be required.