

July 8, 2011

Mr. Jere H. Jenkins  
Director of Radiation Laboratories  
Purdue University  
Nuclear Engineering Building  
400 Central Dr.  
West Lafayette, IN 47907-2017

SUBJECT: PURDUE UNIVERSITY - REQUEST FOR ADDITIONAL INFORMATION  
REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL  
APPLICATION (TAC NO. ME 1594)

Dear Mr. Jenkins:

The U.S. Nuclear Regulatory Commission (NRC) is continuing our review of your application for renewal of Facility Operating License No. R-87, Docket No. 50-182 for the Purdue University Reactor (PUR-1) dated July 7, 2008, as supplemented by letters dated June 3, and June 4, 2010. During our review of the documentation for your renewal request, questions have arisen for which we require additional information and clarification. Enclosed is a partial request for additional information. We are requesting a response to this request within 60 days of the date of this letter. Additional requests for information containing our remaining questions of a more complex nature have been sent under separate cover.

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 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." Following receipt of the additional information, we will continue our evaluation of your renewal request.

J. Jenkins

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If you have any questions regarding this review, please contact me at (301) 415-3724 or by electronic mail at [duane.hardesty@nrc.gov](mailto:duane.hardesty@nrc.gov).

Sincerely,

*/RA/*

Duane A. Hardesty, Project Manager  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-182

Enclosure:  
As stated

cc w/encl: See next page

Purdue University

Docket No. 50-182

cc:

Mayor  
City of West Lafayette  
609 W. Navajo  
West Lafayette, IN 47906

John H. Ruyack, Manager  
Epidemiology Res Center/Indoor & Radiological Health  
Indiana Department of Health  
2525 N. Shadeland Ave., E3  
Indianapolis, IN 46219

Howard W. Cundiff, P.E., Director  
Consumer Protection  
Indiana State Department of Health  
2 North Meridian Street, 5D  
Indianapolis, IN 46204

Leah Jamieson, Dean  
College of Engineering  
Purdue University  
400 Central Dr.  
West Lafayette, IN 47907

Mr. Ed Merritt  
Reactor Supervisor  
Department of Nuclear Engineering  
Purdue University  
400 Central Dr.  
West Lafayette, IN 47907

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

J. Jenkins

- 2 -

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Sincerely,

**/RA/**

Duane A. Hardesty, Project Manager  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-182

Enclosure:  
As stated

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OFFICE	PRLB:PM	PRLB:LA	PRLB:BC	PRLB:PM
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DATE	7/5/11	7/8/2011	7/7/11	7/8/11

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**OFFICE OF NUCLEAR REACTOR REGULATION**  
**REQUEST FOR ADDITIONAL INFORMATION**  
**FOR THE RENEWED FACILITY OPERATING LICENSE**  
**PURDUE UNIVERSITY RESEARCH REACTOR**  
**LICENSE NO. R-87**  
**DOCKET NO. 50-182**

The purpose of these questions is to assist the U. S. Nuclear Regulatory Commission (NRC) staff in determining that the renewal application from the Purdue University Research Reactor (PUR-1) meets the requirements of the regulations, in particular the regulations in Title 10 of the *Code of Federal Regulations* Parts 20 and 50. The questions are based on a review of your application using the NRC staff's standard review plan in NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors," Part 2, "Standard Review Plan and Acceptance Criteria."

We have divided our questions into three groups; questions with a 30-day requested response time, the below questions that may require outside resources for assistance in completion have a 60-day requested response time, and complex and computational questions that have a 90-day requested response time. The three groups of questions considered together result in a complete set of consecutively numbered questions. The numbering of the questions below starts where the previous request stopped.

You are requested, where appropriate, to provide specific references in the responses to prior analyses from previous Safety Analysis Reports (SARs) and to provide updates to assumptions and resulting conclusions of these analyses

For the following questions, we are requesting a response within 60 days of the date of this letter:

43. Please describe any changes that have occurred to the PUR-1 facility since the PUR-1 SAR dated July 7, 2008, was submitted to the NRC that may impact the safety conclusions of the SAR.
44. In your RAI response concerning decommissioning cost, dated June 4, 2010, you reference an "approved cost estimate for decommissioning under Purdue University's Radioactive Materials License" as the basis for the provided cost estimate. Please describe and explain the relationship between the decommissioning cost estimate for PUR-1 and cost estimate for decommissioning under Purdue University's Radioactive Materials License in determining the cost estimate for decommissioning PUR-1.
45. Pursuant to 10 CFR Part 55.59(a)(2), each licensee shall: "*Pass a comprehensive requalification written examination and an annual operating test.*" In your Requalification Plan, Section B you state that "*Completion of the biennial requalification program will consist of a written examination and a demonstration of operator proficiency in reactor operation.*"

- A. Please explain how the facility ensures that operator proficiency examinations are performed annually during the biennial requalification cycle in compliance with 10 CFR 55.59(a)(2) or update your plan accordingly.
- B. According to 10 CFR 55.53(h), licensees are required to complete a requalification program as described by 10 CFR 55.59. Regulation 10 CFR 55.59(a) states that each licensee shall:
- (1) *Successfully complete a requalification program developed by the facility licensee that has been approved by the Commission. This program shall be conducted for a continuous period not to exceed 24 months in duration.*
  - (2) *Pass a comprehensive requalification written examination and an annual operating test.*

Section F. of the PUR-1 Requalification plan states that:

*“During intervals when the licensed operations crew consists only of senior operators who are instructors for topics in part a.1.b., the requalification program will be modified to exempt those senior operators from parts A and B.1. Parts B.2, C, D, and E will remain in effect.*

*When the licensed operations crew increases to include those who do not instruct in the program, the program will revert to its initial content. Operators may place a statement into the file stating that they have done a literature review and/or instructed the topics in Section A and B.1 in lieu of meetings and exams.*

*During intervals when the licensed operations crew consists of only one senior operator this operator will be exempt from parts A and B, part C would be documented in the console logbook and as stated in C.3, parts D and E will remain in effect.*

*In any of the requalification activities, exclusive of operations, additional methods may be used to accomplish the training requirement. These may include mail, electronic classroom or other methods may be used for training, meetings, testing or other required communication(s).”*

Please either (a) explain how this section meets the regulations of 10 CFR 55.33 and 10 CFR 55.59, (b) delete this section of the requalification plan, or (c) submit for an exemption for these requirements per 10 CFR 55.11.

- C. If the response to this question requires revisions to the PUR-1 Operator Requalification Plan, please submit the updated requalification plan to the NRC for review as part of the response.
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.

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.
48. NUREG-1537, Part 1, Section 1.7, states the applicant should briefly describe how they meet the requirements of the Nuclear Waste Policy Act of 1982, Section 302(b)(1)(B). Please provide details for the Purdue University Research Reactor (PUR-1) contract for disposition of fuel. Include the contract number and with whom the contract exists.
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.
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.
51. Section 3.5 of the SAR describes emergency procedures related to the air conditioner drain from the condensate holdup tank. Please describe the required actions if contamination is suspected and the method to dispose of any radioactive condensate if contamination is confirmed.
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.
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.
54. NUREG-1537, Part 1, Section 10 provides guidance for providing information on the administrative procedures used by the applicant to approve an experiment. These procedures should be discussed in detail in Chapter 10 of the SAR, summarized in Chapter 12, "Conduct of Operations," and included in the technical specifications. Please provide the experiment review and approval methodology and discuss the

experiment review and approval process.

55. Radiation exposure for reactor staff are provided in SAR Section 11.1.5 to show exposures are maintained below 10 CFR 20 and as low as reasonably achievable (ALARA). Please provide analysis data to support that the maximum exposed member of the public, at the closest residence to the reactor and at any other points of special interest (e.g., adjacent classrooms and offices, dormitories), as applicable, are maintained below regulatory limits and ALARA.
56. NUREG-1537, Section 11.1.4 provides guidance for radiation monitoring and surveying. SAR Section 11.1.6 addresses monthly wipe tests and water samples, but does not stipulate how the program avoids, prevents, and remedies the occurrence and spread of contamination. Please describe specific contamination control training and a contamination control program with provisions for recordkeeping sufficient in content and retention to support cleanup of contamination, maintenance, and planning for eventual decommissioning.
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.
58. NUREG-1537 states in part that important process variables reflecting the physical condition of the reactor should be monitored. Section 7 of the SAR describes the PUR-1 instrumentation, but does not discuss any potential impact of the proposed power uprate on safe operation of the system. Please discuss if any of the nuclear instrumentation used to monitor the power level of the reactor have to be recalibrated or replaced if the requested power uprate is granted. Also discuss any potential impacts of the power uprate on any nuclear or process parameters important to safe and effective operation of the PUR-1 reactor and facility.
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.



60. NUREG-1537, Section 8 discusses the need for emergency electrical power systems to systems that ensure radiation doses are maintained ALARA and are within the regulatory limits of 10 CFR Part 20. Please discuss pertinent design bases details related to emergency electrical power, such as:
- A. The status of the reactor ventilation system/exhaust during normal operation, and what would happen to the ventilation system in the event of a loss of electrical power to the facility during operations, maintenance, or fuel handling, or in the event of an emergency.
  - B. The reactor ventilation connections to the HVAC system for the rest of the Duncan Annex and including whether operation is continuous related to emergency electrical power.
  - C. The conditions under which reactor ventilation system/exhaust would be isolated, and whether it can be isolated under loss of electrical power to the facility.
  - D. The fail position for the reactor ventilation system/exhaust dampers related to a loss of electrical power.
61. Section 13.2.1 of the SAR states that the reactor staff would evacuate the facility within 1.5 minutes in the event of an accident. Please provide substantiation for this time estimate and discuss other pertinent details such as:
- A. Radiation alarms in the building to alert the occupants of events requiring evacuation.
  - B. An evacuation plan for students, faculty and staff and whether periodic evacuation drills are conducted to validate the stated evacuation times.
  - C. The responsible authority that would order and direct the building evacuation in the event in the reactor that would require an evacuation.
  - D. The exact areas that would be evacuated in the event in the reactor that would require an evacuation
  - E. The conditions, if any, that would require the entire building be evacuated and how long would it take to complete the evacuation. Also, include how the evacuation is verified complete.