

**REPORT ON REACTOR OPERATIONS**

**For the Period  
January 1, 2011 to December 31, 2011**

**PURDUE UNIVERSITY REACTOR-1 (PUR-1)  
Facility Docket No. 50-182  
PURDUE UNIVERSITY  
West Lafayette, Indiana 47907**

**Prepared by  
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## **1. INTRODUCTION**

This report is submitted to meet the requirements set forth in the technical specifications of the Purdue University Reactor (PUR-1) and 10 CFR 50.59 for the period January 1, 2011 to December 31, 2011.

## **2. PLANT DESIGN AND OPERATIONAL CHANGES**

### **2.1 Facility Design Changes**

There were no design changes to the facility in 2011.

### **2.2 Performance Characteristics**

An extended unplanned maintenance outage was experienced at PUR-1 during the calendar year 2011. The reactor only available for operation for about 6 months of the year. During the visual inspection of the fuel no changes were identified. This inspection included any defects that might compromise the integrity of the cladding including any evidence of corrosion. Satisfactory performance of the fuel continued throughout the year.

### **2.3 Changes in Operating Procedures Concerning Safety of Facility Operations**

There were no changes to the operating procedures of the facility during 2011.

### **2.4 Results of Surveillance Tests and Inspections**

#### **2.4.1 Reactivity Limits**

The reactivity worths of the control rods were determined after the LEU was installed and were found to be as follows:

Shim-safety #1: 3.96%

Shim-safety #2: 2.19%

Regulating Rod: 0.229%

These values are consistent with previous reported values. The worth curves of the control rods were checked after the loading and the excess was determined to be 0.42%, and the shutdown margin was determined to be 1.77% based on these values.

The inspection of the control rods was completed on 16 September 2011 with no evidence of change or deterioration observed.

#### 2.4.2 Reactor Safety Systems

Each pre-startup check included a channel test for each safety system, provided the shutdown exceeded 8 hours or if the system was repaired or de-energized.

Each reactor safety system had a channel check performed at time intervals of 4 hours during operation.

On 12 July 2011, the electronic calibration of all safety channels was completed.

The required 2011 irradiation of gold foils for a power calibration was delayed into the following calendar year due to the extended maintenance outage.

During the pre-startup, which precedes each run, the radiation area monitors and the continuous air monitor were checked for normal operation. During 2011, the calibration of the radiation area monitors was completed on 28 January and 5 July and the continuous air monitor was completed on 28 January and 5 July.

The rod drop times were measured on 16 September 2011. The rod drop times fell between 550 and 602 milliseconds. These values are consistent with past measurements and are well within the specification limit of one second.

#### 2.4.3 Primary Coolant System

The weekly measurements of the pH of the primary coolant consistently gave readings between 4.7 and 5.4 during 2011. These values are within the specification limits of  $5.5 \pm 1.0$ . During the weekly checks and the pre-startup check, which precedes each run, the conductivity of the primary coolant was measured and the values never exceeded 1.39 micromhos-cm. This represents a resistivity of more than 719,424 ohm/cm, which exceeds the lower limit of 330,000 ohm/cm as given in the specifications.

The specification of 13 feet of water was always either met or exceeded, according to the pre-startup checklist that was completed prior to each reactor run.

Monthly samples of the primary coolant were collected and analyzed by personnel from Radiological and Environmental Management for

gross alpha and beta activity. No activity was identified in the samples, which would indicate failure of the fuel plates.

#### 2.4.4 Containment

Readings between 0.07 and 0.14 inches of water were recorded weekly for the negative pressure in the reactor room, except for one week when stairs in EE stairwell were replaced. No operations were conducted during that week.

The semi-annual checks for the proper operation of the inlet and outlet dampers and the air conditioner were completed on August 15 and December 29, 2011. All worked satisfactorily.

The annual inspection of the reactor took place on 16 September 2011. Visual inspection of the fuel via underwater camera showed no degradation of fuel elements or plates, with all channels observed being clear. Monthly testing of reactor coolant water was conducted. No evidence of fission products, which would have been the result of failed cladding, was found.

#### 2.4.5 Experiments

The mass of the singly encapsulated samples and the flux of the reactor are such that the complete release of all gaseous, particulate, and volatile components of the samples would not result in doses in excess of 10% of the equivalent annual doses as stated in 10 CFR 20.

No samples of unknown composition were irradiated in 2011.

### 2.5 Changes, Tests and Experiments Requiring Commission Authorization

During 2011 no changes, or experiments, which required authorization from the Commission pursuant to 10 CFR 50.59 (a), were performed.

### 2.6 Changes in Facility Staff

In January 2011, Ed Merritt retired as Reactor Supervisor. Ben Revis was promoted from Reactor Electronics Technician to Reactor Supervisor on a temporary basis. In May 2011, Mr. Revis was offered the position of Reactor Supervisor, but he turned down the job and left the university. Jere Jenkins, Facility Director was the only SRO on staff until June 2011, when Ed Merritt was brought back on a part-time basis as a reactor electronics technician to repair the console and instrumentation. Mr. Merritt continued in that capacity throughout 2011.

### **3. POWER GENERATION**

Operation of the PUR-1 during 2011 consisted of 48 runs, which generated 81,827 watt-minutes of energy and covered an integrated running time of 124.0 hours.

### **4. UNSCHEDULED SHUTDOWNS**

There were no unscheduled shutdowns in 2011.

### **5. MAINTENANCE**

There were 10 instances of non-routine maintenance during the reporting period. All involved standard like-for-like parts (I.C., relay, tube, input assembly and resistor) replacement, or substitution. All problems of this type can be expected in our aged equipment. No 10 CFR 50.59 related changes were made.

### **6. CHANGES, TESTS AND EXPERIMENTS**

No changes, tests or experiments were carried out without prior Commission approval pursuant to the requirements of 10 CFR 50.59 (b).

### **7. RADIOACTIVE EFFLUENT RELEASES**

No measurable amount of radioactive effluent was released to the environs beyond our effective control, as measured at or prior to the point of such release.

### **8. OCCUPATIONAL PERSONNEL RADIATION EXPOSURE**

No radiation exposures greater than 25% of the appropriate limits of 10 CFR 20 were received during the reporting period.