

March 31, 2016

Cindy Montgomery  
U.S. NRC  
One White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

RE: Submission of 2015 Annual Report for PUR-1, Docket Number 50-182

Dear Ms. Montgomery:

Enclosed please find one copy of the Annual Report for the Purdue University Research Reactor, PUR-1, for the operating year 2015.

Should you have any questions or require further information, please contact me at 765.494.5764, or by e-mail at [clive@purdue.edu](mailto:clive@purdue.edu).

Thanks,



Clive Townsend  
PUR-1, Reactor Supervisor

A02D  
NRR



**REPORT ON REACTOR OPERATIONS**

**For the Period  
January 1, 2015 to December 31, 2015**

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

**March 2016**

**Prepared by  
Clive Townsend, Reactor Supervisor**

## **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, 2015 to December 31, 2015.

During the reporting period of 2015, a total of 1428 people visited the reactor facility. Those people included many different groups for the purpose of classroom instruction, pre-scheduled tours, and our reactor sharing program.

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

### **2.1 Facility Design Changes**

There were no design changes to the facility in 2015.

### **2.2 Performance Characteristics**

The overall status of the PUR-1 facility was sustained satisfactorily during the reporting period. However, due to staffing rollover in 2013, continued issues with channel 1, and new issues with channel 3, PUR-1 did not achieve criticality until September of this year.

A visual inspection of a representative fuel assembly was conducted in May of this period and no abnormalities were noted. Monthly surveillances of process water showed no fission product contamination, thereby verifying fuel integrity.

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

Standard Maintenance Procedure (SMP)-2 (Rod Position Indicating System Calibration) was written to provide a series of steps for the calibration of the Rod Position Indicating System. Standard Operating Procedure (SOP)-1, the Prestart Checklist, was reformatted and transcribed to clarify several changes which had been made over time. Similar formatting and updating or clarifying of terminology was completed for SOP-2 (Reactor Startup, Operation, Shutdown and Securing). SOP-1 and SOP-2 was approved by the CORO on August 27, 2015.

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

#### **2.4.1 Reactivity Limits**

The reactivity worths of the control rods were determined. The measured values are:

**Shim-safety #1: 4.11%**

**Shim-safety #2: 1.80%**  
**Regulating Rod: 0.276%**

These values are consistent with prior reported values. The worth curves of the control rods were checked after the current loading and the excess reactivity was determined to be 0.42%, and the shutdown margin was determined to be 1.38% based on these values.

#### 2.4.2 Reactor Safety Systems

On March 20, 2015, the electronic calibration of all safety channels was completed. This was not performed during 2014 due to extended maintenance down-time.

Power calibration using gold foils was performed in late September and October of 2015 during Run #3108. The gold foils indicated a power level very near the indicated power level. The calculated final power level error encompassed the indicated power level.

During the reporting period, the radiation area monitors and the continuous air monitor's PMS were maintained and checked for normal operation. The three area monitors and the CAM were each calibrated on January 25, 2015 and July 22, 2015.

The rod drop times were measured on May 7, 2015. The rod drop times fell between 503 and 539 milliseconds. These values are consistent with past measurements and are well within the specification limit of one second.

The air system isolation was tested on February 11, 2015 and July 23, 2015 and correct operation of the louvres was observed. The Condensate Valve was also inspected at this time.

#### 2.4.3 Primary Coolant System

The weekly measurements of the pH of the primary coolant consistently gave readings between 4.5 and 4.9 during 2015.

During the weekly checks the conductivity of the primary coolant was measured and the values never exceeded 1.56 micromhos/cm. This represents a resistivity of more than 357,000 ohm-cm, which exceeds the lower limit of 330,000 ohm-cm as given in the specifications.

The specification for coolant height above the core to be 13 feet was always either met or exceeded.

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 which would indicate failure of the fuel plates was identified in the samples.

#### 2.4.4 Containment

Readings between -0.08 and -0.13 inches of water were recorded weekly for the negative pressure in the reactor room.

#### 2.4.5 Experiments

No experiments or samples of unknown composition were irradiated in 2015.

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

During 2015, there was one facility change which was made under 10 CFR 50.59. This did not require prior authorization. An LED light was added to the circuit that powers the reactor water make-up solenoid valve to indicate the solenoid valve has been energized (opened) and provides a visual indicator that the water make-up system is adding water to the pool.

### 2.6 Changes in Facility Staff

As of September 1, 2016, Clive Townsend was hired to perform the duties of Reactor Supervisor and to train to be a Senior Reactor Operator (Level 3).

## 3. POWER GENERATION

Operation of the PUR-1 during 2015 consisted of 31 runs which generated 183,806 watt-minutes of energy and covered an integrated running time of 91.2 hours.

## 4. UNSCHEDULED SHUTDOWNS

Due to extreme noise issues in Channel 1, many unscheduled shutdowns were experienced in early 2015 through October of 2015 during maintenance and refurbishment of reactor components. Following completed maintenance and reworking rod drives, very noticeable improvements in reliability were found and by the end of 2015, no low-power level noise spikes were noted.

## **5. MAINTENANCE**

As noted in Section 4, extensive maintenance was completed on the reactor instrumentation systems through the first eight months of 2015. This maintenance work involved cleaning and re-soldering many wire connections, re-routing noise causing cable to different areas of the instrumentation cabinets, and working of the rod drives.

The HEPA filter for the room supply and exhaust air was checked upon during normal maintenance checks on February 11, July 27, September 23 and December 1, 2015. Filters were replaced as needed.

## **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.