

REPORT ON REACTOR OPERATIONS

**For the Period
January 1, 2005 to December 31, 2005**

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

March 2006

**Prepared by
E. C. Merritt
Reactor Supervisor**

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1. INTRODUCTION

This report is submitted to meet the requirements set forth in 10 CFR 50.59 and the technical specifications of the Purdue University Reactor (PUR-1) for the period January 1, 2005 to December 31, 2005.

During the reporting period of 2005 a total of 1518 people visited the reactor facility. Those people included 243 different groups, of which 78 groups were for the purpose of maintenance or surveillance testing, 25 groups were for class purposes, 133 groups were tours, and 7 groups were participants in our reactor sharing program.

2. PLANT DESIGN AND OPERATIONAL CHANGES

2.1 Facility Design Changes

There were no design changes to the facility in 2005.

2.2 Performance Characteristics

The operation of the PUR-1 facility continued satisfactorily during the reporting period. During the visual inspection of the surfaces of two representative fuel plates, 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 during the year.

2.3 Changes in Operating Procedures Concerning Safety of Facility Operations

There was one change to the operating procedures of the facility during 2005. A new procedure was approved to allow easier conversion of an untried to a tried experiment.

2.4 Results of Surveillance Tests and Inspections

2.4.1 Reactivity Limits

The reactivity worths of the control rods were determined to be as follows:

Shim-safety #1 – 4.50%
Shim-safety #2 - 2.53%
Regulating Rod - 0.25%

These values are consistent with previous reported values. The worth curves of the control rods were checked after the inspection and the excess was determined to be 0.45%. The shutdown margin was determined to be 2.07% based on these values.

The inspection of the control rods was completed on October 7, 2005 with no evidence of change or deterioration observed.

Twelve experiments were placed in the reactor pool during the year that required the determination of its reactivity during the initial criticality following its installation. The result was at most one one-thousandth of the allowable reactivity worth in the Tech. Specs.

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 March 15, 2006, the required 2005 electronic calibration of all safety channels was completed.

The required 2005 irradiation of gold foils for a power calibration was done on March 21, 2006. The calibration indicated that the actual power was below (i.e., conservative) the indicated power level (i.e. the actual power being 609 watts when the indicated power level was at 750 watts).

During the pre-startup, which precedes each run, the radiation area monitors and the continuous air monitor were checked for normal operation. During 2005, the calibration of the radiation area monitors was completed on March 2 and July 29 and the continuous air monitor was completed on February 16 and July 15.

Following the control rod inspections, the rod drop times were measured on October 7, 2005. The rod drop times fell between 525 and 580 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 5.0 and 5.6 during 2005. These values are within the specification limits of 5.5 ± 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 2.1 micromhos-cm. This represents a resistivity of more than 476,000 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 0.11 and 0.30 inches of water were recorded weekly for the negative pressure in the reactor room.

The semi-annual checks made in 2005 for the proper operation of the inlet and outlet dampers and the air conditioner were completed on January 3, 2005 June 27, 2005 and December 21, 2005. All worked satisfactorily.

Selected fuel plates were visually inspected on October 7, 2005. The surface condition of fuel plate #4-3-73 indicated no change from the last inspection, and the cladding of the other inspected plates identified no changes.

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.

All samples of unknown composition were held to less than 10 grams. These consisted of hair, fingernails, dirt and plant material. Twelve experiments that required reactivity evaluation were carried out during the reporting period. The resulting reactivity worth change was negligible for all samples.

2.5 Changes, Tests and Experiments Requiring Commission Authorization

During 2004 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

The laboratory director Mr. Jere Jenkins obtained his SRO license on August 17, 2005. Otherwise, there were no changes in the Facility Staff during the year. There are currently two licensed operators, at the facility.

3. POWER GENERATION

Operation of the PUR-1 during 2005 consisted of 79 runs, which generated 406,232 watt-minutes of energy and covered an integrated running time of 114.6 hours.

4. UNSCHEDULED SHUTDOWNS

Four unscheduled shutdowns occurred during 2005. March 30 and May 24, rods dropped leaving no indication as to the cause, October 6, Channel 3 was rotated the wrong direction. Operators will need to be more observant during student operations. December 6 there seemed to be excessive noise on channel 1 scrambling the reactor during subcritical counting. This was most likely electronic noise of unknown origin.

5. MAINTENANCE

There were twelve instances of non-routine maintenance during the reporting period. Eight had to do with standard parts replacement, or substitution (5-tubes, one relay, spare detector in an area monitor, channel 2 console meter). Three problems were not resolved to the root cause. One problem was resolved to dust accumulation at a high voltage terminal. All could be expected with our instrumentation.

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.