

**SCHOOL  
OF  
NUCLEAR ENGINEERING**

**Purdue University**

**West Lafayette, Indiana 47907**



REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1986 to December 31, 1986

PURDUE UNIVERSITY REACTOR-1

PURDUE UNIVERSITY

West Lafayette, Indiana 47907

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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, 1986 to December 31, 1986.

During the reporting period a total of 644 persons visited the reactor facility. This number included 159 groups of which 131 visits were for the purpose of maintenance or surveillance testing.

## 2. PLANT DESIGN AND OPERATIONAL CHANGES

### 2.1 Facility Design Changes

There were no design changes to the facility in 1986.

### 2.2 Performance Characteristics

During 1986 the operations of the PUR-1 facility continued satisfactorily. No changes were identified during the visual inspection of the surfaces of two representative fuel plates. This included no evidence of corrosion or defects that might compromise the integrity of the cladding. Satisfactory fuel performance continued during the year.

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

No changes in the operating procedures of the facility were made during 1986.

### 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	-	5.03%
Shim-safety #2	-	2.68%
Regulating Rod	-	0.25%

The worth curves of the control rods were checked after the inspection and the excess was calculated to be 0.47%. The shutdown margin was determined to be 7.49% based on these values.

The control rod inspection was done on July 9, 1986 with no evidence of change or deterioration observed.

No experiment was placed in the reactor pool during the year that would require the determination of its reactivity during the initial criticality following its installation.

#### 2.4.2 Reactor Safety Systems

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

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

The electronic calibration of all safety channels was completed on September 16, 1986.

On October 8, 1986 the irradiation of gold foils for a power calibration was made. No significant change was identified from this calibration.

During the prestartup which precedes each run, the radiation area monitors and the continuous air monitor were checked for normal operation. During 1986 the calibration of the radiation area monitors was completed by March 17 and August 26 and the calibration of the continuous air monitor was completed by April 1 and September 30.

Following the control rod inspections the rod drop times were measured on July 9, 1986. The rod drop times fell between 529 and 536 milliseconds. These values are consistent with past measurements and are well within the specification limits of 1 second.

#### 2.4.3 Primary Coolant System

The weekly measurements of the pH of the primary coolant fell between 4.6 and 6.3 during 1986. The low readings were due to a temporary probe that was being used in the early part of the year while awaiting delivery of a new probe, but they are within specification limits of  $5.5 \pm 1.0$ .

During the restarting for each run the conductivity of the primary coolant is measured, and

never exceeded 1.33 micromhos-cm during the year. This represents a resistivity of more than 750,000 ohm/cm which exceeds the lower limit of 330,000 ohm/cm as given in the specifications.

According to the prestartup checklist the height of water above the core was 13 feet or greater for each reactor run. The specification of 13 feet of water was always either met or exceeded.

Monthly samples of the primary coolant was collected and analyzed by personnel from Radiological Control 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 0.06 and 0.13 inches of water were recorded weekly for the negative pressure in the reactor room and exceeded the minimum of 0.05 inches required by the specifications.

The semi-annual checks for the proper operation of the inlet and outlet dampers and the air conditioner were completed on May 8 and October 31, 1986. All worked satisfactorily.

On July 7, 1986 selected fuel plates were visually inspected. The surface condition of fuel plate #4-3-73 indicated no change from the last inspection, and the cladding of the other inspected plates revealed no change. All spare, unirradiated fuel plates were sent to Oak Ridge National Laboratory on February 20, 1986.

#### 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 or that required double encapsulation were submitted for irradiation.

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

No changes, or experiments which required authorization from the Commission pursuant to 10 CFR 50.59 (a) were performed during 1986.

2.6 Changes in Facility Staff

No changes in the facility staff occurred in 1986.

3. POWER GENERATION

Operation of the PUR-1 during 1986 consisted of 39 runs which generated 219,204 watt-minutes of energy and covered an integrated running time of 167.9 hours.

4. UNSCHEDULED SHUTDOWNS

During 1986 there were no unscheduled shutdowns.

5. MAINTENANCE

The only maintenance beyond the usual routine maintenance in 1986, was the replacement of the Sola power transformer on October 3.

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 amounts of radioactive effluents were released to the environs beyond our effective control, as measured at or prior to the point of such release.