

**SCHOOL  
OF  
NUCLEAR ENGINEERING**

**Purdue University**

**West Lafayette, Indiana 47907**



**REPORT ON REACTOR OPERATIONS**

**For the Period**

**January 1, 1990 to December 31, 1990**

**PURDUE UNIVERSITY REACTOR-1**

**PURDUE UNIVERSITY**

**West Lafayette, Indiana 47907**

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**Prepared by**

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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, 1990 to December 31, 1990.

During the reporting period of 1990 a total of 563 persons visited the reactor facility. Those persons included 138 different groups, of which 75 groups were for the purpose of maintenance or surveillance testing, 12 groups were for class purposes, 21 groups were pre-scheduled tours, 6 groups were participants in our reactor sharing program and 24 were miscellaneous groups.

## 2. PLANT DESIGN AND OPERATIONAL CHANGES

### 2.1 Facility Design Changes

There were no design changes to the facility in 1990.

### 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

No changes in the operating procedures of the facility were made during 1990.

### 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 - 4.99%

Shim-safety #2 - 2.64%

Regulating Rod - 0.25%

The worth curves of the control rods were checked after the inspection and the excess was determined to be 0.41%. The shutdown margin was determined to be 7.48% based on these values.

The control rod inspection was done on July 12, 1990 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.

On August 27, 1990 the electronic calibration of all safety channels was completed.

The irradiation of gold foils for a power calibration was done on October 11, 1990. No significant change was identified from this irradiation.

During the prestartup which precedes each run, the radiation area monitors and the continuous air monitor were checked for normal operation. During 1990 the calibration of the radiation area monitors and the continuous air monitor was completed on March 17 and September 28.

Following the control rod inspections, the rod drop times were measured on July 12, 1990. The rod drop times fell between 533 and 580 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 4.8 and 6.3 during 1990. These value are within the specification limits of  $5.5 \pm 1.0$ .

During the prestartup check, which proceeds each run, the conductivity of the primary coolant was measured and the values never exceeded 1.48 micromhos-cm. This represents a resistivity of more than 675,000 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 prestated check list that was completed prior to each reactor run.

Monthly samples of the primary coolant was 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 0.035 and 0.135 inches of water were recorded weekly for the negative pressure in the reactor room. The weekly readings from June 18 to July 9 were recorded at 0.035 inches which is below the minimum value of 0.05 set by the technical specifications. During this time, the reactor was not operated and on July 9, the calibration was checked and the fluid level of the gauge was found to be low. The instrument was recalibrated and the reading was 0.13 inches, well above the level required for operation. All other weekly readings were between 0.055 and 0.135 inches.

The semi-annual checks made in 1990 for the proper operation of the inlet and outlet dampers and the air conditioner were completed on April 11 and October 30, 1990. All worked satisfactorily.

Selected fuel plates were visually inspected on July 11, 1990. 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.

No samples of unknown composition or that required double encapsulation were submitted for irradiation.

## 2.5 Changes, Tests and Experiments Requiring Commission Authorization

During 1990 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

During the year Mr. Edward Merritt successfully passed the examinations for his operators license. On December 31, Mr Eldon Stansberry retired from the University and as reactor supervisor. He will continue to be on call and intends to maintain his operating license. Professor F. Clikeman will assume the duties of reactor supervisor.

## 3. POWER GENERATION

Operation of the PUR-1 during 1990 consisted of 29 runs which generated 258,938 watt-minutes of energy and covered an integrated running time of 59.8 hours.

## 4. UNSCHEDULED SHUTDOWNS

Two unscheduled shutdowns occurred during 1990. Both of these shutdowns were associated with the log N channel with noise in the channel generating false period indications. Voltage checks and routine maintenance corrected these problems.

All of these unscheduled shutdowns were on the conservative side of safety and no unsafe condition existed at the time of shutdown.

## 5. MAINTENANCE

Only routine maintenance was required during the reporting period.

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