

**SCHOOL  
OF  
NUCLEAR ENGINEERING**



**Purdue University**

**West Lafayette, Indiana 47907**



**REPORT ON REACTOR OPERATIONS**

**For the Period**

**January 1, 1991 to December 31, 1991**

**PURDUE UNIVERSITY REACTOR-1**

**PURDUE UNIVERSITY**

**West Lafayette, Indiana 47907**

**June, 1992**

**Prepared by**

**F. M. Clikeman**

**Laboratory Director and Reactor Supervisor**

## 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, 1991 to December 31, 1991.

During the reporting period of 1991 a total of 548 persons visited the reactor facility. Those persons included 130 different groups, of which 77 groups were for the purpose of maintenance or surveillance testing, 11 groups were for class purposes, 28 groups were pre-scheduled tours, 5 groups were participants in our reactor sharing program and 9 were miscellaneous groups.

## 2. PLANT DESIGN AND OPERATIONAL CHANGES

### 2.1 Facility Design Changes

There were no design changes to the facility in 1991.

### 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 1991 although several operating procedures were rewritten and approved by CORO.

### 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 - 5.00%

Shim-safety #2 - 2.65%

Regulating Rod - 0.25%

The worth curves of the control rods were checked after the inspection and the excess was determined to be 0.44%. The shutdown margin was determined to

be 7.46% based on these values.

The inspection of the control rods was completed on July 17, 1991 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 October 22, 1991 the electronic calibration of all safety channels was completed.

The irradiation of gold foils for a power calibration was done on December 19, 1991. 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 1991 the calibration of the radiation area monitors and the continuous air monitor was completed on March 26 and September 13.

Following the control rod inspections, the rod drop times were measured on July 17, 1991. The rod drop times fell between 607 and 667 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 5.0 and 6.5 during 1991. These values are within the specification limits of  $5.5 \pm 1.0$ . In February, a new procedure for measuring pH in low conductivity water was introduced and now yields much more consistent readings.

During the prestartup check, which proceeds each run, the conductivity of the primary coolant was measured and the values never exceeded 1.40 micromhos-cm. This represents a resistivity of more than 714,000 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 prestarted 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 0.080 and 0.180 inches of water were recorded weekly for the negative pressure in the reactor room.

The semi-annual checks made in 1991 for the proper operation of the inlet and outlet dampers and the air conditioner were completed on May and October 1991. All worked satisfactorily.

Selected fuel plates were visually inspected on July 24, 1991. 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 1991 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

On December 31, 1990 Mr Eldon Stansberry retired from the University and as reactor supervisor. He will continue to be on call and will serve as a backup for F. Clikeman and E. Merritt

## 3. POWER GENERATION

Operation of the PUR-1 during 1991 consisted of 14 runs which generated 130,420 watt-minutes of energy and covered an integrated running time of 67.9 hours.

## 4. UNSCHEDULED SHUTDOWNS

Three unscheduled shutdowns occurred during 1991. All of these shutdowns were associated with the log N channel with noise in the channel generating false period indications in CSA-2. 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.