

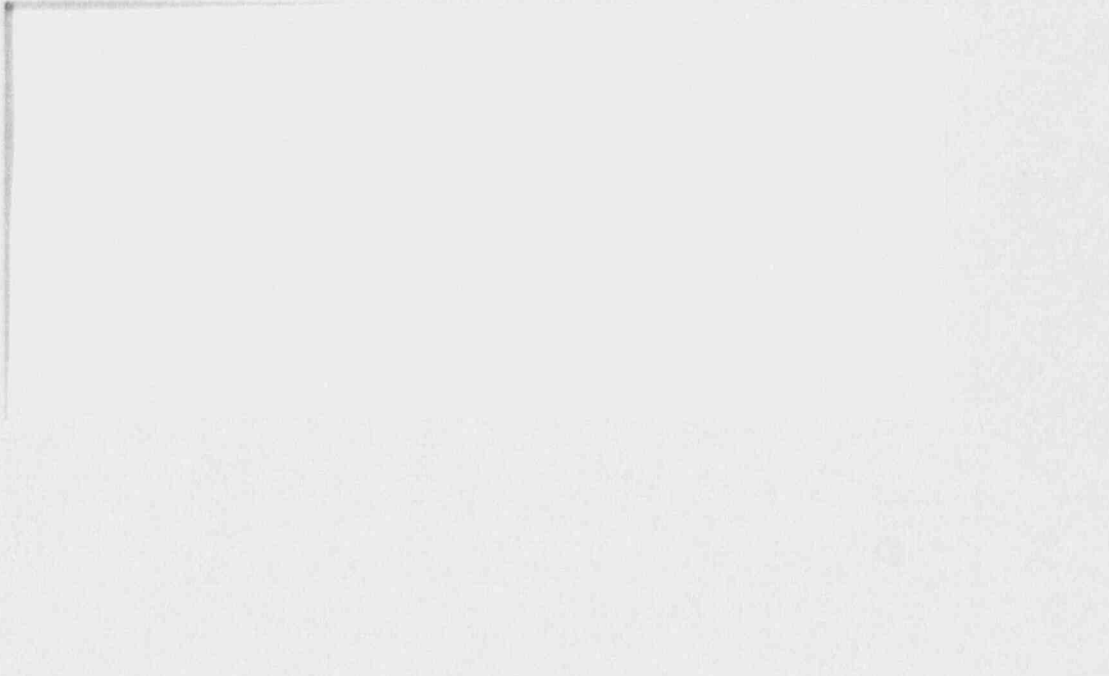
**SCHOOL  
OF  
NUCLEAR ENGINEERING**



**Purdue University**  
West Lafayette, Indiana 47907

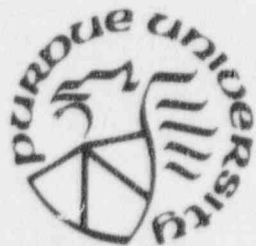


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REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1981 to December 31, 1981

PURDUE UNIVERSITY REACTOR-1

PURDUE UNIVERSITY

West Lafayette, Indiana 47907

March 1982

Prepared by

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Reactor Supervisor

## I. 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 from January 1 to December 31, 1981.

The reactor continued to be made available to all members of the academic, industrial and public community who had a need for its use during the year 1981. Students continued to measure reactor parameters, irradiate samples, and gain experience in reactor operation in the laboratory courses. These activities advance the University's mission toward community education.

Tours and demonstrations are scheduled to assist in this mission to educate both students and the general public. The number of distinct tour groups increased to 45 while the total number of visitors increased to 854 during 1981.

## 2. PLANT DESIGN AND OPERATIONAL CHANGES

### 2.1 Facility Design Changes

A catwalk with safety railing and access ladder was installed around the suspended room air conditioner to facilitate inspection and maintenance the air conditioner.

### 2.2 Performance Characteristics

Satisfactory performance of the reactor continues. A strict preventative maintenance minimizes problems with the reactor instrumentation. Visual inspection of the surfaces of the fuel and micrometer measurements of the plate thicknesses on May 20, 1981 did not reveal any significant change in the fuel plates. Performance of the fuel remained satisfactory.

2.3 Changes in Operating Procedures Concerning Safety of Facility Operations

No change in operating procedures concerning the safety of facility operation was made during the year.

2.4 Results of Surveillance Tests and Inspections

2.4.1 Reactivity Limits. The reactivity worths of the control rods were:

Shim-safety #1 -  $4.98\% \frac{\Delta k}{k}$

Shim-Safety #2 -  $2.63\% \frac{\Delta k}{k}$

Regulating Rod -  $.28\% \frac{\Delta k}{k}$

With an excess of .48% the shutdown margin was calculated to be  $7.43\% \frac{\Delta k}{k}$ .

Visual inspection of the control rods was completed on June 9, 1981. There was no evidence to indicate any deterioration or change in the rods.

No new experiment was placed in the PUR-1 pool that required its reactivity worth to be determined.

2.4.2 Reactor Safety System. A channel test was performed on each reactor safety system during the prestartup check that precedes each reactor startup provided the shutdown exceeded 8 hours, or the systems had been repaired or de-energized.

A channel check of each reactor safety system was completed less than every 4 hours during operation.

On June 17, 1981, an electronic calibration was completed on all safety channels. No appreciable changes were revealed by these checks.

The power calibration by foil activation was completed on June 14, 1981. No significant change was indicated.

The prestartup check sheet that is completed prior to each run verified the operation of the radiation air monitors at least daily during operation.

These monitors were calibrated at intervals that did not exceed 7 months.

The rod drop times were measured on June 10, 1981, by the usual method following the inspection and reassembly of the control rods. All drop times fell between 0.547 and 0.580 milliseconds which is below the specified limit. These values are consistent with past values.

2.4.3 Primary Coolant System. The pH of the primary coolant was measured weekly and during 1981 the values ranged between 5.2 and 6.1. These values fall within the  $5.5 \pm 1.0$  in the specification.

Conductivity measurements were made weekly and during each complete prestartup check. During normal operation the conductivity readings of the pool water never exceed 1.24 micromho-cm during the year. This represents a resistivity of more than 806,000 ohm/cm, well above the lower limit of 330,000 ohm/cm.

Each complete prestartup check includes recording the level of the primary coolant. Records indicate the coolant level was always at or above 13 feet.

Monthly samples of the primary coolant were analyzed for gross alpha and beta activity. No activity was found which required any corrective action.

2.4.4 Containment. The negative pressure in the reactor room was also recorded weekly and indicated values between 0.06 and 0.13 inches of water.

The operation of the inlet and outlet dampers and the air conditioner are checked at the same times as they are controlled by the same switch. During tests conducted on April 30, 1981 and October 30, 1981, both systems operated correctly.

Representative fuel plates were visually inspected and measured for thickness on May 20, 1981. No evidence of deterioration of the cladding was revealed. The surface defect on fuel plate #4-3-73 showed no visible change during the past year.

2.4.5 Experiments. The quantity of all singly encapsulated samples was so small and both the reactor flux and irradiation time so low that the complete release of all gaseous, particulate, and volatile components of the samples would have been below the specified limits.

No samples submitted for irradiation required double encapsulation, and no samples of unknown composition were submitted for irradiation.

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

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

#### 2.6 Changes in Facility Staff

Dr. R. H. Johnson who held operators license number 4164-2 resigned as an employee of the university effective June 10, 1981.

### 3. POWER GENERATION

During 1981 the operation of the PUR-1 consisted of 46 runs which generated 1,130,487 watt-minutes of energy and included an integrated running time of 144.4 hours.

### 4. UNSCHEDULED SHUTDOWNS

During 1981 a total of five unscheduled shutdowns occurred. Three of these shutdowns gave Composite Safety Amplifier Trouble as the only indication of the cause. Operator error was the cause of the other two shutdowns.

#### 4.1 Composite Safety Amplifier

The CSA's are overly sensitive to electronic variations due to the fact that the spread between the operating voltages and the trip points is less than the spread for which they were designed. Either a slight drift in magnet current or electronic noise is more likely to induce an unscheduled shutdown than if the CSA's operated with the designed spread.

#### 4.2 Operator Error

One shutdown was caused by removing a sample from the drop tube before the trip point was raised as stated in the specifications. The other shutdown was caused by a student operator turning a range switch in the wrong direction. Both operators were instructed to be more attentive during operations.

### 5. MAINTENANCE

Maintenance was required on the primary water pump. The bearings and seals needed replacing after almost 19 years of nearly continuous operation. The bearings and seals were replaced and the pump was returned to service on May 20, 1981.

### 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.