SCHOOL

OF

NUCLEAR ENGINEERING

Purdue University

West Lafayette, Indiana 47907

REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1983 to December 31, 1983

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 to December 31, 1983.

Visitors during the year totaled 748 persons. These visitors included 77 tour groups and 66 visits for maintenance or surveillance tests.

2. PLANT DESIGN AND OPERATIONAL CHANGES

2.1. Facility Design Changes

There were no design changes to the facility in 1983.

2.2. Performance Characteristics

Operations of the PUR-1 facility continued satisfactorily during 1983. No change could be identified during the inspection of the fuel plates. This inspection included a visual inspection of the surfaces of two representative fuel plates for defects, and measuring the plate thickness with a micrometer to verify cladding integrity. Fuel performance continued satisfactory 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 1983.

2.4. Results of Surveillance Tests and Inspections

2.4.1. Reactivity Limits

The reactivity worths of the control rods were as follows:

center; 1 c n. Shim-safety #1 - 5.02% $\frac{\Delta k}{k}$ Shim-safety #2 -
2.67% $\frac{\Delta k}{k}$ Regulating Rod - .25% $\frac{\Delta k}{k}$

With an excess of .53% $\frac{\Delta k}{k}$ as determined during the run following control rod inspection the shutdown margin was calculated to be 7.41% $\frac{\Delta k}{k}$.

On May 24, 1983 a visual inspection of all control rods produced no evidence of deterioration or change.

During 1983 no experiment was placed in the reactor pool that would required the determination of its reactivity during the initial criticality following its installation.

2.4.2. Reactor Safety Systems

During the prestartup check that precedes each reactor startup, each reactor safety system had a channel test performed on it 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 less than 4 hours during operation.

The electronic calibration of all safety channels was completed on July 1, 1983.

A power calibration by gold foil irradiation was completed on July 8, 1983. No significant change was identified from this calibration.

During the prestartup check that precedes each run the radiation area monitors and the continuous air monitor were checked for normal operation. The radiation area monitors were calibrated on March 31, and September 2 during 1983 while the continuous air monitor was calibrated on March 31, and September 9, 1983.

Following the control rod inspections the rod drop times of the sim-safety rods were measured on May 25, 1983. All rod drop times fell between 0.537 and 0.573 milliseconds which is consistent with past measurements and well within specification limits of 1 second.

2.4.3. Primary Coolant System

The value of the pH of the primary coolant fell between 5.1 and 5.9 during the weekly measurements of 1983, which are within specification limits of 5.5 ±1.0.

The coolant conductivity was measured during the prestartup for each reactor run. The maximum value never exceeded 1.35 micromho-cm during 1983. This represents a resistivity of more than 740,000 ohm/cm which exceeds the lower limit of 330,000 ohm/cm as given in the specifications.

During 1983 the height of water above the core was 13 feet or greater for each reactor run according the prestartup check list. This met or exceeded the requirement of 13 feet of water in the specifications.

Radiological Control Personnel collected and analyzed monthly samples of the primary coolant for gross alpha and beta activity. No activity of either kind to indicate fuel plate failure, was found in the samples.

2.4.4. Containment

The negative pressure in the reactor room was recorded weekly. Values between 0.055 and 0.13 inches of water exceeded the 0.05 inches stated in the specification.

The inlet and outlet dampers are checked along with the air conditioner semi-annually. These components were checked on April 29, 1983 and October 28, 1983 and all operated as designed.

Representative fuel plates were visually inspected and measured for thickness on June 3, 1983. No indication of change was identified in fuel cladding. No change in the surface of fuel plate #4-3-73 was identified.

2.4.5. Experiments

The flux of the reactor and the quantities of singly encapsulated samples were so small 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 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, tests or experiments which required authorization from the Commission pursuant to 10 CFR 50.59 (a) were performed during 1983.

2.6. Changes in Facility Staff

No changes in the facility staff occurred in 1983.

3. POWER GENERATION

The operation of the PUR-1 during 1983 consisted of 39 runs which generated 297,400 watt-minutes of energy and covered an integrated running time of 115.1 hours.

4. UNSCHEDULED SHUTDOWNS

A total of 7 unscheduled shutdowns occurred during 1983. Composite safety amplifier (CSA) trouble was the indicated cause in 5 of these shutdowns, while a power interruption caused 1, and operator error during a range change caused the other.

The CSA's were designed to trip at 150% power but they are required by the technical specifications to trip at 120% power. By operating closer to the trip points than they were designed to operate, the CSA's are more susceptible to unscheduled shutdowns due to fluctuations in power supplied to the facility or variations in mating the magnet and the shim-safety rod. Preventive maintenance minimizes unscheduled shutdowns but a more permanent solution must await instrument modernization.

The loss of building power is beyond the control of the reactor operations personnel.

A student operator turned the range switch on the linear channel the wrong direction which caused a ''scram''. More attention to details by student operators should reduce the number of unscheduled shutdowns due to this cause.

5. MAINTENANCE

No maintenance beyond the usual routine maintenance was required in 1983.

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.