SCHOOL

OF

NUCLEAR ENGINEERING

Purdue University

West Lafayette, Indiana 47907

REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1982 to December 31, 1982

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 from January 1 to December 31, 1982.

The reactor is a tool available to all members of the academic, industrial and public sector who had need of its use during the year. Students continued to make use of it in laboratory courses by measuring reactor parameters, irradiating samples, and gaining operational experience. The reactor remains available to further advance the University's mission of educating the community.

Students and visitors have attended tours and demonstrations to assist in the educational mission. A total of over 700 persons visited the reactor in 59 distinct groups. Of this total, 82 visits by persons not assigned to the reactor operations group involved maintenance or surveillance duties.

2. PLANT DESIGN AND OPERATIONAL CHANGES

2.1 Facility Design Changes

The only facility design change involved replacement of a console panel that contained the clock, intercom unit, and the integrated operation time. No unreviewed safety feature was involved in this replacement.

2.2 Performance Characteristics

Reactor operations continued satisfactorily. Visual inspection of the surfaces of the fuel plates did not reveal any significant change. The fuel plate thickness was measured on two representative fuel plates, using a micrometer, with no appreciable change observed. Fuel performance remained satisfactory.

2.3 Changes in Operating Procedures Concerning Safety of Facility Operations

Operation of the continuous air monitor (CAM) has been verified in the past as a part of the hourly readings but the Committee on Reactor Operations approved documenting operability of the CAM prior to taking the reactor critical by a note in the log book at the completion of each complete prestartup. This became effective on November 23, 1982.

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 - .25% $\frac{\Delta k}{k}$

With an excess of .52% $\frac{\Delta k}{k}$ the shutdown margin was calculated to be 7.34% $\frac{\Delta k}{k}$.

Visual inspection of all control rods was completed on June 2, 1982 and no evidence to indicate any deterioration or change in the rods was apparent.

No new type of experiment was placed in the PUR-1 pool during the year that would require the original determination of its reactivity worth.

2.4.2 Reactor Safety System. Each reactor safety system had a channel test performed 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 at time intervals of less than 4 hours during operation.

An electronic calibration was completed on all safety channels on June 25, 1982. No appreciable changes were observed by these checks.

A gold foil was used to make a power calibration on August 4, 1982. No significant change was determined from this calibration.

The radiation area monitors were checked at least daily during operation, as part of the prestartup check that precedes each run. All three were operational before any run was started. These monitors were also calibrated on March 26, 1982 and September 3, 1982.

The calibration of the CAM was completed on March 26, 1982 and September 3, 1982.

The shim-safety rod drop times were measured on June 6, 1982 following the disassembly, inspection, and reassembly. All drop times fell between 0.497 and 0.584 milliseconds which is within the specified limit, and consistent with past values.

2.4.3 Primary Coolant System. During 1982 weekly measurements of the pH of the primary coolant fill in the range between 5.2 and 5.9. These values are within the specified limits of 5.5 ± 1.0.

The prestartup check that precedes each run includes measuring the coolant conductivity. The values for conductivity never exceeded 2.04 micromho-cm during the year. This represents a resistivity of more than 490,000 ohm/cm which is well above the lower limit of 330,000 ohm/cm specified in the technical specifications.

The prestartup check list also gives values of 13 feet of water or greater for each run completed in 1982, again in compliance with the technical specifications.

Monthly samples of the primary coolant are collected by Radiological Control personnel and analyzed for gross alpha and beta activity. No activity was found to indicate any change in the condition of the fuel plates.

2.4.4 Containment. The weekly readings taken of the negative pressure in the reactor room indicates values between 0.063 and 0.08 inches of water. This is greater than the 0.05 inch required by this specification.

The operation of the air conditioner is checked at the same time that the inlet and outlet dampers are checked since a single switch controls all these operations. Both systems operated correctly during tests conducted on April 30, 1982 and October 29, 1982.

On May 26, 1982 representative fuel plates were visually inspected and measured for thickness. No evidence of deterioration of the cladding was evident. Fuel plate #4-3-73 was inspected at the same time and gave no indication of any change in the surface imperfection located on it.

2.4.5 Experiments. All singly encapsulated samples involved such small quantities that the activity produced during the relative short irradiation times and low flux would have been 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

No changes in the facility staff occurred in 1982.

3. POWER GENERATION

During 1982 operation of the PUR-1 involved 35 runs which generated 470,454 watt-minutes of energy and included an integrated running time of 99 hours.

4. UNSCHEDULED SHUTDOWNS

During 1982 only two unscheduled shutdowns occurred. The number of unscheduled shutdowns is much lower this year when considered either on the basis of the total number or on a percentage basis. One unscheduled shutdown was caused by electronic noise in the instrument and the other was caused by composite safety amplifier (CSA) trouble.

Both of these causes are inherent in the design and the age of the instruments. Routine preventative maintenance is the best means of keeping these unscheduled shutdowns to a minimum, and we shall continue trying to keep these causes as low as possible.

5. MAINTENANCE

No maintenance was required beyond the usual routine maintenance.

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.