

**SCHOOL
OF
NUCLEAR ENGINEERING**

Purdue University

West Lafayette, Indiana 47907



REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1993 to December 31, 1993

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, 1993 to December 31, 1993.

During the reporting period of 1993 a total of 381 people visited the reactor facility. Those people included 98 different groups, of which 64 groups were for the purpose of maintenance or surveillance testing, 9 groups were for class purposes, 16 groups were pre-scheduled tours, 5 groups were participants in our reactor sharing program and 4 groups were classified as miscellaneous groups.

2. PLANT DESIGN AND OPERATIONAL CHANGES

2.1 Facility Design Changes

There were no design changes to the facility in 1993.

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.

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 - 4.96%

Shim-safety #2 - 2.61%

Regulating Rod - 0.24%

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 7.41% based on these values.

The inspection of the control rods was completed on Aug. 9, 1993 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 Aug. 4, 1993 the electronic calibration of all safety channels was completed.

The irradiation of gold foils for a power calibration was done on October 18, 1993. The calibration indicated that the actual power was 15% below the indicated power level at 100 watts and that the system was nonlinear in a conservative direction.

During the prestartup which precedes each run, the radiation area monitors and the continuous air monitor were checked for normal operation. During 1993 the calibration of the radiation area monitors and the continuous air monitor was completed on March 29 and September 27.

Following the control rod inspections, the rod drop times were measured on Aug. 10, 1993. The rod drop times fell between 533 and 562 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 5.1 and 5.5 during 1993. These value are within the specification limits of 5.5 ± 1.0 .

During the weekly checks and the prestartup check which proceeds each run, the conductivity of the primary coolant was measured and the values never exceeded 1.50 micromhos-cm. This represents a resistivity of more than 666,000 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 0.06 and 0.18 inches of water were recorded weekly for the negative pressure in the reactor room.

The semi-annual checks made in 1993 for the proper operation of the inlet and outlet dampers and the air conditioner were completed on April 22 and August 31. All worked satisfactorily.

Selected fuel plates were visually inspected on Aug. 9, 1993. 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 1993 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

There were no changes in the Facility Staff during the year.

3. POWER GENERATION

Operation of the PUR-1 during 1993 consisted of 21 runs which generated 146,338 watt-minutes of energy and covered an integrated running time of 46.1 hours.

4. UNSCHEDULED SHUTDOWNS

No unscheduled shutdowns occurred during 1993.

5. MAINTENANCE

With the exception of the failure of a bearing on the water pump, only routine maintenance was required during the reporting period. The bearing failure was noted on Dec. 28 and the pump was turned off. The failure ultimately resulted in about four gallons of reactor water leaking onto the reactor room floor. The water was vacuumed up, tested for any radioactivity and then released to the drains. The pump bearings were replaced and the pump returned to service in 1994.

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. INCIDENTS

On May 18, 1993, a sample of Mn_2SO_4 spilled onto the reactor room floor after it had been removed from the reactor. The calculated amount of activity was about 1 microcurie of Mn-56. Surveys of Professor Clikeman, who was handling the sample, and Trent Mays, the Radiation Control technician, showed no contamination of any personnel. Although the spill could have been cleaned up immediately, it was decided to cover the spill and leave it over the weekend since Mn-56 has a 2.56 hour half life. The spill was checked on May 20 and the only activity found came from the tape used to hold the sample vial to the sample holder. The area was decontaminated and wipe tests were made by the Radiation Control Group. No activity was found. No radioactivity was released from the reactor room and no personnel received a measurable dose of radiation. The incident was reviewed by CORO and recommendations made to use sealed source vials in the future for all powder and liquid samples.

8. 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.