SCHOOL

OF

NUCLEAR ENGINEERING

Purdue University

West Lafayette, Indiana 47907

REPORT ON REACTOR OPERATIONS

For the Period

January 1, 1980 to December 31, 1980

PURDUE UNIVERSITY REACTOR-1

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West Lafayette, Indiana 47907

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1. INTRODUCTION

This report describes the operation of the Purdue University Reactor (PUR-1) for the period from January 1 to December 31, 1980. The report is to meet the requirements set forth in 10 CFR 50.59 and in the PUR-1 Technical Specifications.

The reactor remained available to all persons in the academic, industrial or public domain during the year 1980. Laboratory classes continued to perform reactor experiments and irradiations while gaining experience in reactor operation. These uses assist the University in its mission of education to the community.

To help educate both students and the general public many tours and demonstrations were provided. The number of distinct tour groups remained at 33 during 1980, with a total number of 731 visitors.

2. PLANT DESIGN AND OPERATIONAL CHANGES

2.1 Facility Design Changes

No changes in the facility design were made during the year.

2.2 Performance Characteristics

The reactor continues to perform satisfactorily, especially since the number of unscheduled shut-downs have been reduced by more than 50%. The age of the instrumentation requires strict preventative maintenance but in all cases the instrumentation problems have been such as to fail in a safe manner, causing inconvenience, but no safety problems.

The fuel continued to perform satisfactorily as indicated by the inspection completed May 20, 1980. Visual inspection of the surfaces and micrometer measurements of plate thickness did not indicate any significant change in the fuel plate.

2.3 Changes in Operating Procedures Concerning Safety of Facility Operations

No change in operating procedures concerning the safety of facility operations 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 as follows:

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 .47% $\frac{\Delta k}{k}$ the shutdown margin was calculated to be 7.42% $\frac{\Delta k}{k}$.

No noticeable change was observed during the annual inspection of the control rods which was completed on May 22, 1980.

No new experiment was placed in the PUR-1 that required a determination of its reactivity worth.

2.4.2 Reactor Safety System. During each prestartup check a channel test was performed on each safety system channel. This was done for each reactor run that follows a shutdown greater than 8 hours.

A channel check of each reactor safety channel was performed at least once every four hours when the reactor was critical.

An electronic calibration was completed on all the safety channels on May 21, 1980. The results are in close agreement with previous checks.

Verification that the radiation monitoring equipment is operational was completed during the prestartup procedure that preceeded each reactor run.

Following the annual inspection of the control rods, THE ROD DROP times of the shim-safety rods were measured on May 22, 1980. All drop times fell between 564 and 583 milliseconds which is below the 600 millisecond maximum. These drop times are consistant with past drop times.

2.4.3 Primary Coolant System. In an attempt to minimize any variables, the pH of the primary coolant was measured before the skimmer was put into operation each Monday morning. Values between 5.5 and 5.9 were measured during 1980.

Conductivity of the pool water was recorded each Monday and never exceeded 1.35 micromho-cm during the year. This value corresponds to a resistivity greater than 740,000 ohm/cm.

The level of the primary coolant was recorded as part of the prestartup check list preceeding each reactor run. It was maintained at or above the 13 foot level during operation the entire year.

2.4.4 Containment. The weekly posting of the negative pressure in the reactor room indicated from 0.06 to 0.155 inches of water.

Semi annual checks of the isolation dampers on the INLET AND outlet ducts of the exhaust system were made in April and October. Checks of the shutdown of the air conditioning system, on the same control switch, were made at the same time. Both systems demonstrate~~d~~ correct operation during the checks.

The usual representative fuel plates were inspected on May 20, 1980. No evidence of deterioration of the fuel cladding was revealed by the visual inspection or the micrometer measurements that were taken. Fuel plate number 4-3-73, incorporated as the ninth fuel plate in fuel assembly F-4, showed no visible change in the surface defect that has been inspected annually since its discovery in 1967.

2.4.5 Experiments. Twentry nine singly encapsulated samples were irradiated during the year. Calculations indicated their activities were only a small fraction of the limits in the technical specifications.

No samples requiring double encapsulation were irradiated.

2.5 Changes, Tests, and Experiments Requiring Commission Authorization

No changes, tests, or experiments which required authorization from the Commission pursuant to 10CFR50.59(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 1979 consisted of 49 runs which generated 198,403 watt-minutes of energy covering an integrated running time of 128.7 hours.

4. UNSCHEDULES SHUTDOWNS

During the year a total of 9 unschedules shutdowns occurred. They were distributed as follows:

7 instrument noise

1 composite safety amplifier trouble

1 operator error

4.1 Instrument Noise

Following the installation of some shielded cable between the fission chamber and its preamplifier the unscheduled scrams caused by the startup channel instrument noise have been completely eliminated.

4.2 Composite Safety Amplifier

Operation of the CSA's closer to the trip points than they were designed to operate causes them to be overly sensitive to electronic variation. A slight drift or electronic noise induces an unscheduled shutdown. This cause was reduced from 17 to 1 unschedules shutdown during 1980.

4.3 Operator Error

One unscheduled shutdown was caused by a student operator trainee turning the range switch on the linear channel the wrong direction. The operator was instructed to be more attentive to the range change operation.

5. MAINTENANCE

There were no major maintenance projects during 1980. Maintenance consisted of the replacement of components such as relays, vacum tubes or resistors.

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 or discharged to the environs beyond the effective control of the Licensee as measured at or prior to the point of such release or discharge.

8. OCCUPATIONS PERSONNEL RADIATON EXPOSURES

No personnel received radiation exposures greater the 500 mRem (50 mRem for persons under 18 years of age) during the reporting period.