The University of Oklahoma

SCHOOL OF AEROSPACE, MECHANICAL
AND NUCLEAR ENGINEERING
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October 11, 1982

U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76012

Re: Annual Report for the period 1 July 1981 to 30 June 1982 for license R-53 in accordance with 10CFR 50.59(b).

The following information is submitted in accordance with the Federal Regulation requirement that an annual report on the operation of our reactor facility be submitted to the Nuclear Regulatory Commission:

1) There have been four changes in our facility design. They are the following:

   a) The replacement of the drive sprockets on Safety Rod #1 and 2 (attachment A)

   b) Installation of a Water Cooler into the Reactor's Water Purification System (attachment B)

   c) Installation of a Flow Meter into the Reactor's Wate. Purification System (attachment C)

   d) The plumbing of the Subcritical Assembly into the Reactor Pool Water Purification System (attachment D)

There were no changes in performance characteristics or operating procedures related to reactor safety during the reporting period. All surveillance tests and inspections were within their normal ranges of approved values or conditions.

2) The reactor was operated 32 times for a total of 223.6 watt-hours.

3. There was a total of four inadvertent scrams for the reporting period. There were no emergency shutdowns. The inadvertent scrams were the result of reactor operator errors and accidental trips of interlock (Earthquake).

4) No major maintenance operations were performed during the reporting period.

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5) There were no major changes to the facility procedures, tests, or experiments for the reporting period.

6) No radioactive effluents were released or discharged to the environs beyond our effective control except for the accidental transference of reactor pool water to the subcritical assembly (attachment E)

7) No environmental surveys were performed outside our facility.

8) There were no unusually high radiation exposures to the facility personnel or laboratory visitors. All the radiation and contamination surveys conducted by the University's Health Physicist were within normal ranges of acceptable values.

9) There were a few changes in our facility organization and personnel. They were as follows:

   a) As of June 30, 1982, two members of the Reactor Safety Committee (RSC) left the University and resigned from the committee. They were Dr. Duaine G. Lindstrom (Chairman of the RSC) and Dr. David Anderson.

   b) Dr. Edwin Klehr has been recommended as the new Chairman (RSC) to be effective June 1, 1982.

   c) Two new members have been recommended for the RSC and they are Dr. Emin Yilmaz and Dr. Craig Jensen. The appointment of Dr. Yilmaz is to be effective June 1, 1982 and Dr. Jensen is to be effective September 1, 1982.

   d) Mr. John F. Farrell our Nuclear Instrument Technican and Reactor Operator resigned effective June 1, 1982.

Sincerely,

Johnny James

Johnny James
Reactor Supervisor

JJ/ec

Replace of the Sprocket on Safety Rod #1&2 Drive Motors

The safety rod drive mechanism consists of an electric motor connected via a chain drive to a lead screw which raises the safety rod. The travel time for removal of the safety rods is approximately three minutes. By replacing the one inch drive sprocket on the motor shaft with a two inch sprocket the removal speed is increased. In a test on Safety Rod #1 the resulting change was from two minutes fifty-six seconds to one minute forty seconds. There seems to be no overload on the motor based on a current measurement.

Cutting the safety rod removal time approximately in half will save quite a few minutes in the checkout time needed to startup the reactor. Frequently, restarts are necessary. Since the purpose of the Safety Rods is to shutdown the reactor, and not to control the reactor, the removal speed does not affect the safety aspect of their intended function and tests have not suggested any other problems. Please note that this change does not apply to the control rods.

Installation of a Water Cooler into the Reactor's Water Purification System

A water cooler has been connected to the reactor pool water and purification system to enable the reactor pool water to be cooled. The purpose of cooling the water is to control the reactivity of the reactor. Reactivity is decreased approximately 0.02% for every degree increase in the reactor water temperature. The technical specification of our current reactor license limits the minimum water temperature to 15°C. The Water Temperature Interlock is tested every 6 months and is set to trip at slightly above 15°C. Since the pool water temperature reaches as high as 27°C it is quite important that control of the water temperature be possible.

The cooler consists of an old drinking fountain unit which has been hooked into the purification system by connecting the water outlet, via garden hoses, to the cooler and the cooler outlet back into the reactor tank. Based on tests there is some restriction in the cooler which decreases the system flowrate but acceptable flowrate can be maintained through the entire system. The cooler is normally turned off but is left connected into the purification system. When lower pool water temperature is needed the cooler is turned on and within a day or two the desired cooling is attained.

As long as the reactor water temperature and the purification flowrate are maintained above minimum limiting conditions of operation, no operational problems has appeared in the tests.

It is now planned to plumb the cooling system with more permanent plastic pipe.

Attachment C

The Installation of a Flow Meter Into the Reactor's Water Purification System

A flow meter has been installed into the reactor's purification system. The flow meter consists of an inline turbine which sends electronic pulses to a readout device mounted in a console panel. The meter is calibrated to approximately the number of gallons per minute flowing in the circulation loop.

The present flow meter system does not work very well because small pieces of trash catch in the turbine wheel stopping it from turning. It is planned to replace the current system with a new or different type of flow meter which will be more reliable.

The purpose of having a flow meter for the purification system is to be aware of stoppages and reduced flow rates in the system. When the flow rate is decreased the response of the Water Monitor is also affected. Since the Water Monitor is a safety channel and does have a scram potential it is important to know the system is operating satisfactorily.

In the Spring of 1982, the above described flow rate measuring device was removed from the system due to the fact that it could not be maintained in an operational state.

Attachment D

Plan to Plumb the Subcritical Assembly into the Reactor Pool Water Purification System

The subcritical reactor consists of a large stainless steel tank which holds approximately 350-400 gallons of water. If the water is not kept purified a corrosion and an organic growth problem occurs. A non pure system would eventually ruin the fuel element grid plate and the fuel element tubes. To keep the water purified, we fill the tank with distilled water initially. The original subcritical system had a small purification system of its own but is unable to maintain the tank in the condition which is needed. By plumbing the subcritical tank into the reactor's purification system we will have the capability to maintain the subcritical tank's water at a level which will eliminate the problems.

The subcritical assembly has been moved to the north wall of the reactor laboratory. The plumbing will consist of the necessary 3/4" plastic pipe and valves to connect the tank into the purification system so that either of the systems can be operated. Attached is a simplified diagram of the plumbing installation. The valving will be arranged so that whenever the reactor is to be operated the subcritical will be isolated from the purification system. It will be standard operating procedure for the reactor operators to ensure that the proper valves have been opened and closed (reactor check our procedure will be revised) before reactor startup. The purity of the reactor's water will always be maintained to such a level so that we are always within the technical specifications of the current reactor license. The subcritical has now been cleaned and filled with distilled water. It is important that the system be tied to the purification system as soon as possible.

Attachment E

TO: Dr. C. W. Terrell
Reactor Director

SUBJECT: Accidental Transference of Reactor Pool Water to the Subcritical Assembly

FROM: J. James - Reactor Supervisor
J. Farrell - Reactor Staff

DATE: December 16, 1981

On Monday, November 30, 1981, at approximately 10:15 A.M. while starting the check-out of the reactor for an irradiation, water was noticed on the floor along the North wall of the Reactor Laboratory. An investigation revealed the water was coming from the subcritical assembly. The subcritical assembly was overflowing onto the floor. On Wednesday, November 25, 1981, the subcritical assembly had been connected into the reactor purification system with plastic piping. A check of the reactor pool revealed a considerable loss of water. The reactor pool water was approximately 2 feet below the normal operating level. The reactor pool water has been transferred into the subcritical assembly causing the tank to overflow onto the floor and into a nearby floor drain.

An analysis of the piping system indicated the valve on the outlet side of the pump (going to the subcritical assembly) did not seat properly. A small flow of water was able to leak past the valve and after 4 days, approximately 250 gallons of water leaked onto the reactor laboratory floor. Almost all the water drained into a floor drain (sanitary sewer) located on the North wall of the reactor laboratory and next to the room's air handling unit.

Water from the subcritical assembly was drained into the reactor pool until the reactor pool was filled to its normal level. To ensure that no further loss of water would occur, the backup valves located at the subcritical assembly were closed. Closing both valves shut off the transfer of water.

After the reactor tank had been filled to its normal level a decision was made to try and simulate the conditions as they were on Monday morning in order to check the radiation levels over the reactor pool. The reactor pool water was pumped into the subcritical assembly in order to lower the reactor water level to approximately 2 feet below normal. Radiation measurements were taken at the top of the reactor tank and at the surface of the water. A G-M meter and an ionization meter were used to measure the radiation levels. Both meters indicated a reading of approximately 0.2 to 0.3 mR/hr at the tank surface and ~0.5 mR/hr at the water surface. These readings clearly document the fact that no radiation hazard resulted due to the loss of water in the reactor pool. The measured radiation levels were probably higher than the levels which occurred from the loss of water due to the fact that the reactor had been shutdown from a 45 minute 15 watt run for only 1 hour and 20 minutes (12-1-81).

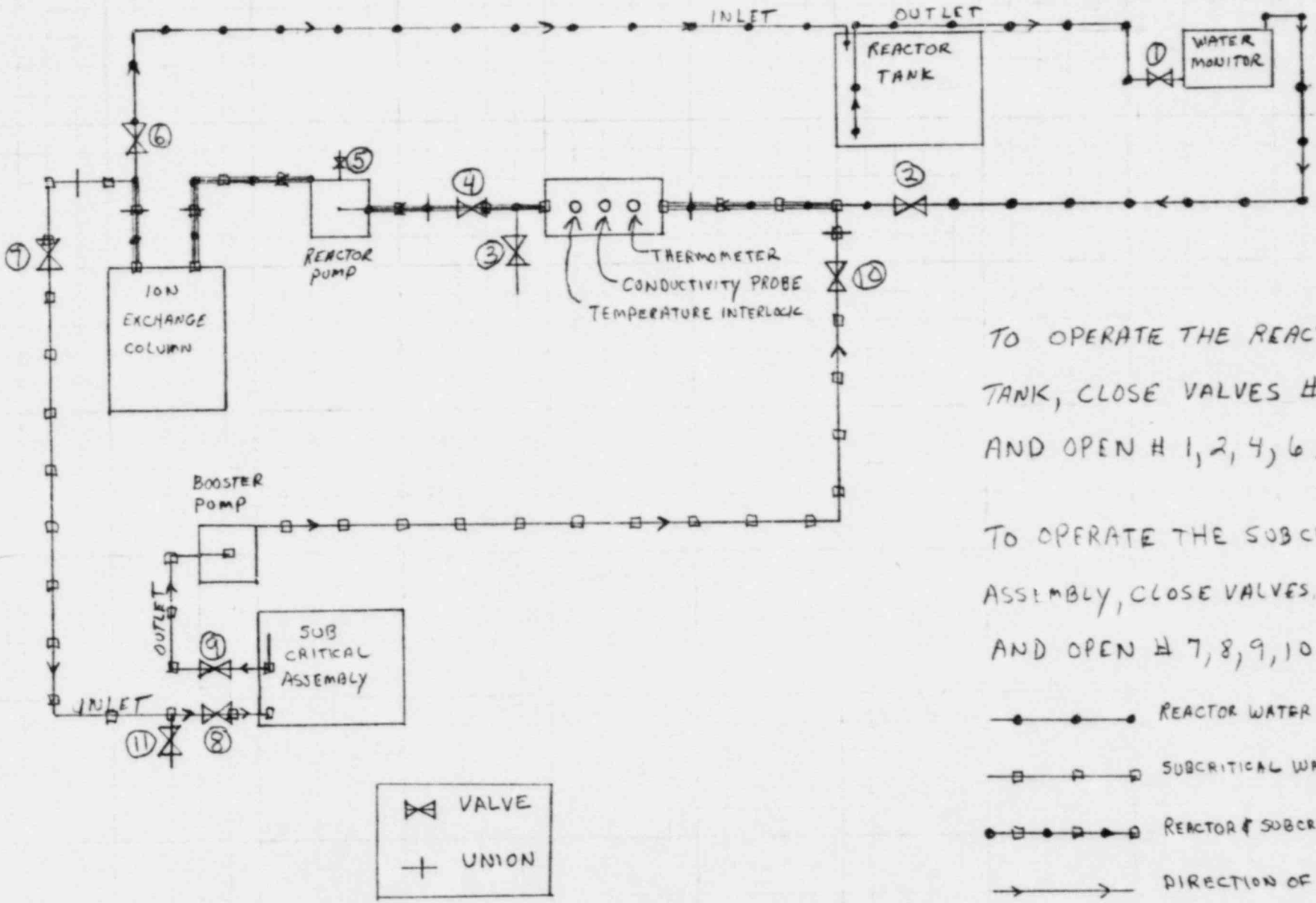
Smear wipes were taken of the sewer drain and floor area around the subcritical assembly. All the smear wipes indicated no activities (Alpha and Beta) above normal background. To check for gamma activity a 4 liter reactor water sample was taken on Friday, December 4, 1981, after a 1 hour reactor run on December 3. Waiting 24 hours after the reactor run would simulate the radioactivity in the pool water near the time the leakage started on November 25th. The result of the analysis of the water indicated an almost unmeasurable quantity of radioactivity (Ge Li detector in a low background shield detected only a weak x_e 135 peak). This analysis verified that the water released into the sewer system contained no radioactive material in excess of the Nuclear Regulatory Commission's effluent release limits. Also, from past operating experience, the reactor pool water activity level will return to a normal background reading within approximately 12 to

15 hours after reactor shutdown. The reactor had been last operated on Tuesday, November 24, and the subcritical assembly was not connected into the reactor's system until Wednesday afternoon, November 25. The reactor water activity would have been back to its normal background level before the subcritical assembly was connected.

There appears to be no reason to contact the NRC about this incident. No reactor technical specifications were violated. No radioactive material release limits to the environment were exceeded and no unusual radiation levels existed because of the water loss.

After a thorough review, the following steps will be taken to ensure that this type of incident will not occur again: (refer to attached drawing)

1) Valve #7 will be replaced or repaired
2) A test of the pump outlet side will be done to ensure no leakage through any of the valves.
3) When the subcritical assembly is to be isolated from the reactor system, valves #7, 8, 9, 10 will be closed.
4) No new valves or piping will be installed without a check for proper operation.



TO OPERATE THE REACTOR TANK, CLOSE VALVES # 7,8,9,10 AND OPEN # 1, 2, 4, 6.

TO OPERATE THE SUBCRITICAL ASSEMBLY, CLOSE VALVES # 2,6 AND OPEN # 7, 8, 9, 10.

REACTOR WATER

SUBCRITICAL WATER

REACTOR & SUBCRITICAL

DIRECTION OF FLOW

PIPING SYSTEM AS OF 12-15-81 J James