Radiation Center Oregon State University Corvallis, Oregon 97331 (503) 754-2341

September 28, 1987

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Annual Report of Changes, Tests and Experiments Performed Under the Provisions of 10 CFR 50.59 for the Oregon State University TRIGA Reactor (OSTR), License No. R-106, Docket No. 50-243.

The following report is submitted in accordance with the requirements of 10 CFR 50.59(b) and 10 CFR 50.4, and covers the OSTR's annual reporting period of July 1, 1986 through June 30, 1987.

During the specified reporting period there were four changes to the OSTR facility and four changes to the OSTR facility procedures conducted pursuant to 10 CFR 50.59. There were no changes to existing reactor experiments, no tests, and no new experiments performed under the provisions of 10 CFR 50.59 during the current reporting period.

The individual changes being reported are listed below by category and by title, and are described in more detail in Attachment A. Regarding this attachment, you will note that it includes a brief description of each change followed by a summary of the safety evaluation conducted for the described change. As required, none of the changes performed under 10 CFR 50.59 involved a change in the OSTR Technical Specifications or an unreviewed safety question as defined in 10 CFR 50.59(a)(2).

1. Changes to the OSTR Facility:

   a. Cooling Tower Blow-Down Valving.

   b. Installation of an Automated Biocide and Corrosion Control Treatment System for the OSTR Secondary Water System.

   c. Replacement of the Existing Regulating Control Rod with a New Spare FLIP-Fueled Control Rod, and an Exchange of Core Positions for the Existing Shim and Safety Control Rods.

   d. Improvement in the Ventilation Exhaust Piping for the Rotating Rack.

2. Changes to OSTR Facility Procedures:

   a. Reactor Power Calibration Procedure Change.

   b. Revision of OSTROP 6.0, Administrative and Personnel Procedures.

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c. Clarification of the Terms "Reactor Facility" and "Radiation Center Complex," as Used in OSTROP 6.0.

d. Revision of the Charter of the Reactor Operations Committee as Contained in OSTROP 6.0.

We trust that you will find this year's report to be in good order. However, should you require more information or have questions regarding our report, please let me know.

Yours sincerely,

A. G. Johnson
Reactor Administrator, OSTR
Director, Radiation Center

AGJ:jrl
Enclosure
cc: Regional Administrator, Region V, USNRC, Walnut Creek, California
Standardization and Special Projects Branch, Division of Licensing, USNRC, Washington, D.C., ATTN: Mr. Al Adams
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STATE OF OREGON)
)ss
COUNTY OF BENTON)

A. G. Johnson, being first duly sworn on oath, deposes and says that he has affixed his signature to the letter above in his official capacity as Reactor Administrator; that in accordance with the provisions of Part 50, Chapter 1, Title 10 of the Code of Federal Regulations, he is attaching this affidavit; that the facts set forth in the within letter and attachment are true to his best information and belief.

A. G. Johnson
Reactor Administrator

Subscribed and sworn to before me, a Notary Public, in and for the County of Benton, State of Oregon, this 30th day of September, A.D., 1987.

Notary Public of Oregon

May 26, 1990
My Commission Expires

ATTACHMENT A

CHANGES TO THE OSTR FACILITY AND TO OSTR FACILITY PROCEDURES CONDUCTED PURSUANT TO 10 CFR 50.59

1. Introduction

The information contained in this attachment provides a summary of the changes performed during the reporting period under the provisions of 10 CFR 50.59. The items to be reported have been grouped into two categories, those dealing with changes to the facility itself and those dealing with changes to the facility's procedures. For each item listed in this attachment, a brief description of the change and a summary of the safety evaluation are included.

2. 10 CFR 50.59 Changes to the OSTR Facility

There were four changes to the facility which were reviewed and performed under the provisions of 10 CFR 50.59 during the reporting period. A summary of each change and its safety evaluation follows.

a. Cooling Tower Blow-Down Valving

Description

The solenoid valve in the cooling tower blow-down line was observed to be working incorrectly. This valve was designed to automatically turn on and turn off water flow through the blow-down line, and was the third one of its kind that had been installed. All three solenoid valves had chronic problems and responded in a similar manner such that the valve was observed to chatter at high blow-down flow rates and ineffectively maintain blow-down flow at low flow rates.

The original valve configuration on the blow-down line had the manual flow control (throttle) valve downstream of the solenoid (on/off) valve. Because the differential pressure across solenoid valves can affect their operation, the manual flow control (throttle) valve was relocated to a position upstream of the solenoid valve instead of after or downstream of the solenoid valve. The chattering problem was solved by the valve relocation.

Safety Evaluation

The valve change in the cooling tower blow-down line improved control of the flow rate of cooling tower blow-down, and will ultimately save money on chemicals and improve water conditioning. There are no safety implications relating to this change. Failure of either the manual flow valve or the solenoid valve in the open position would merely result in a loss of expensive water treatment chemicals due to excess blow-down. Failure of these valves in the closed position would result in a slow decrease in the cooling tower's water quality. This would be detected, at the latest, during the routine water-sampling program for the secondary cooling water, which is performed once or twice each week.

b. Installation of an Automated Biocide and Corrosion Control Treatment System for the OSTR Secondary Water System

Description

Biocide and corrosion control for the OSTR secondary water system has been effectively accomplished by the manual addition of chemicals. Although the manual method required the quantities of biocide and corrosion inhibitor to be estimated prior to addition, it was nonetheless quite successful, as indicated by water quality reports.

Even in view of a successful water quality program based on the manual addition of chemicals, the OSTR staff decided that better secondary water chemical balance and a cost savings could be achieved by the installation of an automated water condition monitor and chemical injection system. The use of such a system would also reduce the handling of water quality chemcials, which are potential skin irritants.

The biocide and corrosion control system which was installed is briefly described in the two numbered paragraphs which follow. The system utilized standard 1/2 inch inside diameter plastic and galvanized piping and valves, and the biocide and corrosion control segments each consisted of separate loops, but the loops were plumbed into the secondary water system at the same place downstream of the cooling tower pump.

1. Biocide Control System

Biocide control is achieved by using a MOGUL CHEM-VAC semi-automatic biocide injector system. This system consists of a complete piping and valving module which was plumbed into the secondary water system. The module consists of shut-off valves, a timer valve, a strainer, check valves and an injector that meters and feeds chemicals from a container into the secondary system.

2. Corrosion Control System

The secondary water system already had a bleed-off solenoid valve and a corrosion inhibitor chemical pump, both of which were operated manually. The current change involved the installation of a conductivity cell and associated electronics, which now automatically controls both the bleed-off valve and the chemical pump for the corrosion inhibitor. The conductivity cell was calibrated by the chemical company field representative to reflect the concentration of solids in the secondary water. The solids in the water are expressed in terms of cycles, and the cycle concentration determines the bleed-off frequency and duration. The corrosion inhibitor chemcial pump will operate only during bleed-off to replace the amount of chemical lost during that process.

Safety Evaluation

Safety considerations are addressed in the two separate evaluations which follow. However, one of the very important ways by which personnel safety is enhanced by these systems involves the elimination of the need for reactor operations personnel to handle the somewhat hazardous chemicals required for biocide and corrosion control. This is considered to be a significant improvement.

1. Safety Considerations--Biocide Control System

The biocide control system is a single loop which will use only a fraction (3-4 gpm) of the secondary water flow to drive the chemical injector. A potential chemical problem could exist if there was a back flow of secondary water into the biocide chemical storage container, which would then overflow onto the heat exchanger room floor. The MOGUL CHEM-VAC module has a check valve to prevent this backflow; however, an additional check valve was installed to provide <u>extra</u> protection against such an event. Such an overflow would not endanger the reactor.

If the biocide system fails such that it does not switch off as designed, then the worst impact would be the injection of all of the biocide (5 gallons) into the secondary water, followed by the injection system sucking air. This would be an expensive use of the biocide chemical, but there would be no detrimental effect on the secondary water system or to the reactor. If the biocide system fails so that no chemical is added, then this would be noticed when the next week's water sample showed a biological count higher than normal. However, no detrimental algae growth will occur in a one to two week time period.

2. Safety Considerations--Corrosion Control System

The corrosion control system is a closed loop which will carry a fraction of the secondary water past a conductivity cell. Considering a failure mode similar to that discussed above, if the system fails so that it continues to run, then the bleed-off of secondary water and the addition of corrosion inhibiting chemical would be continuous. Water would still be added by the normal make-up mechanism, and the only consequence would be the wasteful use of chemicals. The chemical pump has such a low pumping capacity that it is not likely to pump the container of corrosion inhibitor completely dry before the problem is noticed during the daily startup and shutdown checks of the reactor.

If the system fails to operate at all, this fact will be noticed by the increased solids concentration in the weekly water sample. No significant deposition or scaling will occur during this time period and there will be no damage to the reactor due to a failure of the corrosion control system.

c. Replacement of the Existing Regulating Control Rod with a New Spare FLIP-Fueled Control Rod, and an Exchange of Core Positions for the Existing Shim and Safety Control Rods

Description

During routine control rod inspections in July of 1986, it was observed that rub marks on the surface of the regulating control rod (observed in previous years) appeared to be more noticeable than in the past. The rub marks appeared to be mainly in one location which corresponded to the spot where the rod surface rubbed against the grid plate. As a result, the OSTR staff decided to replace the regulating rod with a new unirradiated spare FLIP-fueled control rod.

In order to even out surface wear on the shim rod and safety rod surfaces, the staff also decided to reverse the in-core positions of these two control rods.

Safety Evaluation

Standard control rod removal procedures, as described in Oregon State TRIGA Reactor Operating Procedure (OSTROP) 12, were used to remove the old regulating rod and to insert the new control rod. The procedure for reversing the positions of the shim and safety rods also followed the standard (OSTROP) procedures; however, the old regulating rod was used during the reversing process to ensure that only one control rod was removed at a time. To achieve this, the shim rod was removed first, and the old regulating rod was inserted in its place. The safety rod was then removed and the old shim rod was inserted in its place. The final movement involved removing the old regulating rod (temporarily in the old shim rod location) and replacing it with what was the safety rod.

The exact magnitude of the change in control rod worth was difficult to establish precisely; however, it was clear that at all times during the changes the reactivity limits and shutdown margin would be well within the values specified in the OSTR Technical Specifications. It was expected that the safety and shim rods, when reversed in position, would be worth about the same as before because the fuel loading and burnup were about the same in both control rods. (Both rods actually increased in reactivity by about 10¢ each.) It was also expected that the worth of the new regulating rod would be greater than the old rod because the reactivity of the fueled portion of the old rod would have decreased due to burnup over the past ten years. (The new regulating rod actually increased 12¢ in reactivity.)

d. Improvement in the Ventilation Exhaust Piping for the Rotating Rack

Description

The OSTR rotating rack is ventilated with nitrogen gas to reduce argon-41 production in this irradiation facility. The ventilation exhaust flow from the rotating rack is passed through two absolute filters and is then discharged into the reactor's argon ventilation system at the argon manifold. The effluent from the argon manifold is again filtered through an absolute filter and is then discharged into the intake plenum of the reactor building exhaust fan. The exhaust line piping from the rotating rack to the argon manifold initially consisted of mainly tygon tubing connected to in-line filters, valves, and a flow meter.

Previous measurements of the exhaust flow rate between the rotating rack and the argon manifold, and observations of the tygon tubing indicated that the tygon tubing, especially that which was located downstream of the last in-line absolute filter, was soft and somewhat pinched, and consequently impeded the exhaust flow through the system. Therefore, the reactor operations staff decided to install rigid larger diameter pipe to replace the smaller more flexible tygon tubing. It was believed that this change would increase the ventilation flow through the system and would thereby make the system easier to purge with nitrogen gas.

The reactor staff investigated possible piping materials and piping routes, and decided to use mostly PVC pipe with short sections of flexible tygon tubing and hydraulic hose for certain connections. The staff also decided to relocate the absolute filters to shorten the piping run from the reactor top to the argon manifold, which is located on the first floor of the reactor bay.

As part of this modification, the staff also installed a new ventilation exhaust line adapter at the rotating rack loading chute. The new adapter connects the exhaust ventilation line for the rotating rack system to the first in-line filter, which is located at the loading chute. When the adapter and filter are connected at the loading chute, ventilation flow is induced through the entire rotating rack system and exhausted through the ventilation line.

Safety Evaluation

1. With the new ventilation exhaust line adapter and larger diameter, primarily rigid pipe, the ventilation flow through the rotating rack increased, making the system quicker and much easier to purge with nitrogen and thus reducing the argon-41 generation and discharge from the rotating rack.
2. With an increase in the ventilation flow rate through the rotating rack, the nitrogen being introduced into the rotating rack mixes more quickly and thoroughly. This reduces the need for an excess nitrogen flow, which was previously required to ensure adequate nitrogen purging of the rotating rack. This will result in a considerable savings in terms of nitrogen gas consumption.

3. 10 CFR 50.59 Changes to OSTR Facility Procedures

There were four changes to facility procedures reviewed and approved under 10 CFR 50.59 during the reporting period. A description of these changes follows.

a. Reactor Power Calibration Procedure Change

Description

The reactor power calibration procedure was changed to a new method which involves accurately measuring the water temperature before and after a short run at 1 MW. The 1 MW run is made with the reactor tank isolated (i.e., all pumps off) and a stirrer in the tank. This new calibration procedure was already approved under 10 CFR 50.59 as a test (Aug. 14, 1985). The only changes from the August 1985 approval involve the length of time at 1 MW (now up to 30 minutes instead of 10 minutes) and the method of slinging the stirrer from the crane.

Safety Evaluation

Increasing the time at 1 MW from 10 minutes to 30 minutes allows more operational flexibility. Occupancy in the reactor bay is prohibited during the time the reactor is operating for a power calibration and therefore the increased dose rates on the reactor top from ^{16}N evolution do not contribute to personnel dose. Dose rates in the control room and other offices are normal.

Changing the method of slinging the stirrer has no safety significance; it is merely necessary due to the purchase of a lighter stirrer with a different configuration.

b. Revision of OSTROP 6.0, Administrative and Personnel Procedures

Description

As a corrective action for the event reported to the Nuclear Regulatory Commission in a letter dated March 6, 1987, OSTROP 6.0 was revised to include a reactor operating limitation. The new limitation states that whenever a surveillance and maintenance item required by the Technical Specifications cannot be successfully completed so as to fully achieve the objective of the applicable Technical Specification the first time the item is tested or otherwise checked, then the reactor will not be operated, except as needed to perform the test or check. Additionally, normal routine operation of the reactor will not be permitted to resume until the requirements of the Technical Specifications have been fully and completely met and the results approved by the reactor supervisor. (Normal routine operation of the reactor does not include operation needed to perform a test or check necessary to meet a Technical Specification requirement.)

Safety Evaluation

Adding this limitation will increase safety by ensuring that any abnormal situations discovered during the routine surveillance and maintenance required by the Technical Specifications will result in the reactor being shut down until the problem is corrected.

c. Clarification of the Terms "Reactor Facility" and "Radiation Center Complex," as Used in OSTROP 6.0

Description

OSTROP 6.0 contains the administrative procedures used in the operation of the Oregon State TRIGA Reactor. One of these procedures states that "at least two persons must be present in the reactor facility while the reactor is operating." In order to clarify this statement so as to incorporate the original intent of the reactor operations staff and the Reactor Operations Committee (ROC), the ROC reviewed the matter and concluded that the words "reactor facility" should be changed to "Radiation Center Complex," (meaning the Reactor Building or the attached Radiation Center Building).

Safety Evaluation

The main reason for having two persons in the general area while the reactor is operating is for possible assistance with safety related items, in addition to enhancing the ease of certain operational functions. If the reactor operator requires assistance, the second person in the Radiation Center Complex can easily be contacted by telephone, by intercom, or by a public address system which covers the entire complex. In any situation where the reactor operator needs to contact the designated second person, it is just as easy to contact someone in the Radiation Center Building as it is in the Reactor Building, and response time is essentially the same from either location. Therefore, safety is not compromised by this clarification of an acceptable location for the second person.

d. Revision of the Charter of the Reactor Operations Committee as Contained in OSTROP 6.0

Description

The Charter of the OSTR Reactor Operations Committee (ROC) was revised in order to eliminate editorial errors, to improve clarity, and to more accurately state the Committee's current operating policies and procedures. The Charter had not been revised since 1982, and as a housekeeping item it needed to be updated to more accurately reflect minor changes in Committee operations.

Safety Evaluation

The revisions to the ROC's Charter do not conflict with ROC requirements stated in the OSTR Technical Specifications, and do not reduce the Committee's level of involvement in overseeing the OSTR's operations. The fact that the new revisions actually clarify the Committee's current method of operation and, in fact, add new surveillance and approval requirements is an enhancement to OSTR safety.