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

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, 1991 through June 30, 1992. The information in this report is compiled annually and is submitted to the USNRC in this specific 10 CFR 50.59(b) report, as well as in a special section of the OSTR annual report, which was submitted on October 29, 1992.

During the specified reporting period there were eight changes to the reactor facility and four changes to reactor procedures conducted pursuant to 10 CFR 50.59. There were three changes to 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 the provisions of 10 CFR 50.59 necessitated a change in the OSTR Technical Specifications or involved an unreviewed safety question as defined in 10 CFR 50.59(a)(2).

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1. <u>Changes to the Reactor Facility</u>:

   a. Addition of Ventilation Ducting for Reactor Bay Sample Decapsulation Hood

   b. Replacement of the GM Tube in the Reactor Water Radioactivity Monitor

   c. Replacement of the Reactor Water Radioactivity Monitor

   d. Replacement of the Primary Water Radioactivity Monitor (<u>Revision</u>)

   e. Modification to the Reactor Console Left Hand Drawer, Fuel Element Temperature Monitoring System, and to the Thermocouple Calibration Procedures for Fuel Temperature and Reactor Tank Water Temperature

   f. Replacement of an Air Flow Gauge on the Stack Effluent Monitor

   g. Replacement of the Isokinetic Sampling Probe on the Stack Effluent Monitor

   h. Automatic Shut-off of the D102 Hood Fan

2. <u>10 CFR 50.59 Changes to Reactor Procedures</u>

   a. Revisions to the OSU Radiation Center and TRIGA Reactor Emergency Response Plan and Emergency Response Implementing Procedures

   b. Change of Time Interval Between Transient Rod Calibrations

   c. Minor Procedural Revisions to OSTROP 26, "Procedures for the Use of External Monitoring and Recording Devices"

   d. <u>Temporary</u> Procedural Addition to OSTROP 26, "Procedures for the Use of External Monitoring and Recording Devices"

3. <u>10 CFR 50.59 Changes to Reactor Experiments</u>

   a. Revision of Reactor Experiment B-23

   b. Revision of Reactor Experiment B-30

   c. Second 1991-92 Revision of Reactor Experiment B-23

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
Director, Radiation Center

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Enclosure

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ATTACHMENT A

Changes to the OSTR Facility, to Reactor Procedures, and to Reactor Experiments Performed Pursuant to 10 CFR 50.59

The information contained in this section of the report provides a summary of the changes performed during the reporting period under the provisions of 10 CFR 50.59. For each item listed, we have included a brief description of the action taken and a summary of the applicable safety evaluation. **Although it may not be specifically stated in each of the following safety evaluations, all actions taken under 10 CFR 50.59 were implemented only after it was established by the OSTR Reactor Operations Committee (ROC) that the proposed activity did not require a change in the facility's Technical Specifications and did not introduce or create an unreviewed safety question as defined in 10 CFR 50.59(a)(2).**

1. 10 CFR 50.59 Changes to the Reactor Facility

There were eight changes to the reactor facility which were reviewed, approved, and performed under the provisions of 10 CFR 50.59 during the reporting period.

a. ADDITION OF VENTILATION DUCTING FOR REACTOR BAY SAMPLE DECAPSULATION HOOD

(1) Description

In order to provide better air flow through the reactor bay hood which is used to remove sample capsules from TRIGA irradiation tubes, the Health Physics staff and the OSU Physical Plant upgraded the ducting leading from the hood to the reactor bay exhaust system. Also, a larger absolute filter was added above the hood. The new ducting rises directly up the wall in the southeast corner of the reactor bay and takes a 45° angle to avoid the third floor windows and 4th floor door. The duct then penetrates the 4th floor wall and runs in the space between the reactor bay intake and exhaust ducts in D400 before entering the exhaust plenum.

(2) Safety Evaluation

Measurements and engineering analysis by Physical Plant and Radiation Center Staff indicated that the air flow through the hood was significantly improved as a result of the installation of the new ducting. This increased safety by providing more positive hood ventilation and better filtration than before. Therefore, in the event of a release of radioactive material in the hood, there will be negligible release to the reactor bay and the environment, and less likelihood of radioactive material inhalation by persons working at or near the hood.

In addition, it was expected that there would be no effect on the total flow rates in and out of the reactor bay, and that the negative differential pressure in the bay would not be measurably changed. After the duct work was installed, the differential air pressure was checked and it was confirmed that it was within the normal limits. Air flow measurements were also made in the reactor bay stack which confirmed that the flow calibration of the stack monitor was still correct.

b. REPLACEMENT OF THE GM TUBE IN THE REACTOR WATER RADIOACTIVITY MONITOR

(1) Description

The response of the reactor water radioactivity monitor had become erratic during normal reactor operations. The cause of the erratic response was believed to be due to an aging GM detector in the monitoring system. Since the GM tube being used was no longer manufactured, the Scientific Instrument Technician proposed to replace the existing GM tube with a new GM tube which had similar response characteristics. This change also necessitated manufacturing a slightly different tube shroud so that the GM tube could be correctly inserted into the center of the water monitor tank.

(2) Safety Evaluation

The new GM tube was selected to have response specifications which were as close as possible to the old tube. In addition, the new tube was calibrated after insertion to establish its response characteristics prior to actual use. Use of the new GM tube should have simply restored the water monitor's response and stability and thus improved safety.

c. REPLACEMENT OF THE REACTOR WATER RADIOACTIVITY MONITOR

(1) Description

The GM tube used in the reactor water radioactivity monitor had aged to the point where it needed replacing; however, an exact replacement was not available. Therefore, the previous safety evaluation (item b) was written to allow a new GM tube with similar characteristics to be installed in the existing system. When the new tube was installed and tested, it was found to be insufficiently sensitive for operational needs. This was partially due to the fact that the console voltage supply to the GM tube was fixed at a value which did not ideally match the voltage requirements of the new tube. As a result, the old original GM tube was returned to service until a different solution could be found.

The Scientific Instrument Technician proposed using an Eberline RM-16 power supply and ratemeter to replace the existing water radioactivity ammeter, which in the process would allow use of the Eberline ratemeter's power supply to provide a high voltage of 900 VDC for the new GM tube (LND 725). This configuration had been bench tested and calibrated in the range up to 150 mR/h. The water high activity annunciator would be connected to the ratemeter and set to alarm at 50 mR/h. Finally, the old water activity monitor and wiring would be removed.

(2) Safety Evaluation

The proposed facility change would restore the water radioactivity monitor to full, functional reliability. Sensitivity would be approximately equal to or

greater than that provided by the existing system. No electrical safety implications for the reactor console were involved with this change. The main impact of the proposed change would be to improve system stability, eliminate false alarms and thereby increase reactor safety by maintaining operator alertness to the high water activity alarm.

Based on the OSTR's past and current modes of operation, the presence of high radioactivity levels in the reactor's primary water is associated with situations where it is expected that the reactor top continuous air monitor will usually alarm first, or in conjunction with any water radioactivity alarm, thereby providing extra assurance of detection.

d. REPLACEMENT OF THE PRIMARY WATER RADIOACTIVITY MONITOR (REVISION)

(1) Description

10 CFR 50.59 safety evaluations included as items b and c in this report discussed various aspects of the replacement of the primary water radioactivity monitor. This evaluation is a revision of item c and was needed because a different approach was ultimately used to replace certain components in the water radioactivity monitor.

The first change involved the use of a Tracerlab linear ratemeter and pre-amplifier instead of the Eberline RM-16 ratemeter which was located in the beam port #3 area. The Tracerlab ratemeter was already housed in the right-hand console side cabinet next to the ratemeters for the stack gas and stack particulate monitors, and was part of the original equipment purchased for the OSTR. However, this ratemeter had never been used operationally. The ratemeter was part of a water monitoring system which was not installed, and was originally equipped with a shielded detector containing a built-in pre-amplifier. The shielded detector was still not used, but the pre-amplifier was removed from the detector module and put into a separate box. This box was located near the new GM tube discussed in the previous 10 CFR 50.59 evaluations (items b and c).

As a result of the preceding changes, the new configuration for the water monitoring system consists of the new GM tube (LND 725) located inside a machined holder which fits in the center of the water monitoring chamber in the demineralizer system. The GM tube is attached to the pre-amplifier box, which in turn is connected to the Tracerlab ratemeter in the control room. This system was checked and found to be fully functional and suitable for the indicated purpose.

An additional change to the previous 10 CFR 50.59 evaluations (items b and c) involved system calibration. More specifically, the new system was calibrated so that the indicated gross count rate could be used to determine an approximate water radioactivity concentration in μCi/ml. This calibration was performed by first putting the new GM detector in its normal operational location inside the water chamber in the demineralizer loop after the reactor was shutdown. The control room Tracerlab ratemeter was then used to obtain a gamma counting rate (in gross cpm) at a specific time, which was correlated from a time standpoint with the gross μCi/ml of gamma emitters in a sample of reactor primary water. By making this comparison a number of times over a wide range of count rates, a calibration curve was obtained. The alarm point for the new system was set at a count rate which was just far enough above the maximum count rate normally encountered during routine operation to minimize the potential for false alarms.

(2) Safety Evaluation

The applicable conclusions from the previous safety evaluations are still valid and are incorporated here by reference (10 CFR 50.59 Safety Evaluations: items b and c). There are no unfavorable safety implications associated with the change in electronics. The Tracerlab ratemeter is similar to those used in the stack gas and stack particulate monitors. These have been in use for many years, and have proven to be very reliable.

The change with respect to the method of calibration is technically much better than that previously used, and therefore increases the ability to

quickly estimate the water radioactivity concentration. Since the primary water radioactivity monitor is used strictly to estimate the gross gamma emitting radioactivity in the primary coolant, indications of abnormal radioactivity in the primary water would be promptly investigated by complete analysis of individual water samples, and by cross checking with other monitoring systems such as the reactor top continuous air monitor. This investigative policy represents no change from current radiation safety procedures. However, the water monitor's current calibration is improved and this will lead to a small increase in safety.

e. MODIFICATION TO THE REACTOR CONSOLE LEFT HAND DRAWER, FUEL ELEMENT TEMPERATURE MONITORING SYSTEM, AND TO THE THERMOCOUPLE CALIBRATION PROCEDURES FOR FUEL TEMPERATURE AND REACTOR TANK WATER TEMPERATURE

(1) Description

The failure of the second of three thermocouples in the instrumented fuel element left only one remaining thermocouple. While this met the Technical Specification requirements for reactor operation, practically it would not have allowed pulsing of the reactor. The original system for indication of fuel element temperature also had some limitations.

The amplifier in the reactor console's left-hand drawer did not have an active reference junction compensation. This meant that if the console temperature changed, a difference developed between the actual and the indicated fuel element temperatures. In addition, the design of the fuel temperature input electronics in the left-hand drawer was such that it would not accept emf inputs from a standard such as the Portametric Voltmeter Bridge, so that a direct calibration method was impossible. Finally, with the existing design, the electronics did not provide the flexibility to operate in pulse mode with only one functional thermocouple in the instrumented element.

The Scientific Instrument Technician proposed modifications and designed circuits to address the above limitations. This included the installation of a new amplifier in the left-hand drawer. This amplifier was designed to accept the output of the optional analog output unit card installed in the console's digital temperature indicator. The analog output unit produces an output of 1 mVDC for every 1°C indicated on the digital display. The result of these changes is that the left-hand drawer temperature meter reads the same thermocouple as that selected on the digital temperature indicator. In addition, the change enables the reactor to be pulsed because the new electronics provide the necessary fuel temperature input to the console chart recorder even if there is only one operational thermocouple in the instrumented fuel element.

The specific steps involved in the modification were:

(a) The A16 card in the left-hand drawer was replaced with the modified card.

(b) A cable was run from the left-hand drawer to the console's digital temperature indicator.

(c) The wiring from the trip test switch was disconnected and the fuel zero switch was removed from the left-hand drawer.

(d) A trimmer pot was installed in place of the fuel zero switch and the voltage divider was reconfigured for the calibrate switch. This allows the operator to check the left-hand drawer temperature circuitry by placing the calibrate switch in the calibrate position. The trimmer pot was adjusted to provide a full scale meter deflection as part of the alignment procedure.

System and circuit diagrams of the changes are shown in Figures IV.D.1 and IV.D.2.

(2) Conforming Procedural Changes

In addition to the facility changes described above, the reactor staff revised the parts of OSTROPs 15 and 16 which relate to how thermocouple

calibrations are made for fuel element temperature channels and reactor tank water temperature channels. The original procedure involved actually raising the water and fuel temperatures by operating the reactor, noting the indicated temperatures on the instrumentation, and comparing them with that measured by the Portametric.

A much better method scientifically, as well as procedurally, is to use the Portametric directly as a standard to **input** a known voltage to the temperature measuring instrumentation. This also eliminates the need to operate the reactor to calibrate the thermocouples.

(3) Safety Evaluation

The changes contribute to increased safety by eliminating all of the previously noted limitations of the original system in the console left-hand drawer. Safety is further enhanced by the fact that there are two fuel temperature displays on the console from the selected thermo- couple.

The new A16 card has an indicating function only, so that any failure of this circuit will result in an easily recognizable anomalous reading on the fuel temperature meter in the left hand drawer. The analog output from the digital temperature indicator is isolated so that it is not possible for a failure of the A16 card to cause a problem with the digital unit.

The procedural change has no safety implication, in that the Portametric is still the standard to which the other instrumentation is compared. The reactor will not now be operating during thermocouple calibration, and, therefore, there are no reactor safety implications from the operational viewpoint.

f. REPLACEMENT OF AN AIR FLOW GAUGE ON THE STACK EFFLUENT MONITOR

(1) Description

The stack effluent monitor has two air flow gauges in the system. The health physics staff removed the original flow gauge assembly (which was worn out) from the stack effluent monitor and replaced it with a new flow gauge. The new gauge was placed in line with the air flow after the gas monitoring chamber and before the low flow sensor as shown in Figure IV.D.3. In addition, the existing flow control valve was moved to a more accessible location near the flow gauges. The new gauge (gauge No. 2) was mounted onto the same stand which supports the other existing gauge (gauge No. 1).

(2) Safety Evaluation

The replacement of the flow gauge has no affect on reactor safety, but increases radiological safety. The purpose of the new flow gauge is to provide a more accurate method of determining whether or not there is any air leaking into the stack monitoring system. Air leaks into the system reduce the accuracy of the monitoring data and thus must be prevented. The logic associated with the two air flow gauges is as follows: Gauge No. 1 measures the air flow rate where the air enters the stack monitor, and gauge No. 2 measures the flow rate after the air has passed through all monitoring chambers. If the air flow rate on both gauges is the same, then there is good assurance that there are no air leaks into the system. However, if the second gauge reads higher than the first gauge then it is likely that air leaks exist. With this latter information, leaks can be quickly found and repaired. As part of this process, the new gauge will help obtain more accurate air flow readings than the original gauge, which was worn to the point of replacement.

Moving the flow control valve to a more accessible location has no effect on the system, it just makes it easier to adjust the flow. The original location

of the valve was low and down in the middle of the monitor's piping which made adjustment very awkward.

g. REPLACEMENT OF THE ISOKINETIC SAMPLING PROBE ON THE STACK EFFLUENT MONITOR

(1) Description

After installation of the new stack monitor air flow gauge described in the previous 10 CFR 50.59 safety analysis (item f), it was observed that when the monitor's air flow rate was set to sample the stack at the required isokinetic flow rate, the second flow meter located after the particulate and gas monitoring chambers read off scale. Extensive investigations determined that the higher reading on the second air flow gauge was not due to leakage of air into the monitor, but rather was due to the pressure drop across the particulate filter paper. It was also determined that this pressure drop (and the flow rate difference shown on the two flow gauges) becomes much less at flow rates slightly lower than the current isokinetic flow rate. Therefore, the reactor operations staff and the health physics staff replaced the stack sampling probe with one of identical design, but of slightly smaller diameter. The new probe reduced the volume flow rate (in CFM) required to maintain isokinetic sampling in the stack, and, as a result, both the intake and outflow air gauges remain on scale. At the new lower flow rate there is about a 1 CFM difference between the two flow gauges due to the filter-paper-induced pressure drop.

(2) Safety Evaluation

The safety evaluation included in 10 CFR 50.59 safety analysis included as item f is also valid for this change. Likewise, the goal is still the same: i.e., to have a stack monitor sampling system which makes it possible to determine if air leaks into the system have developed. Furthermore, air leaks are still indicated by observing changes in the air flow rates shown on the intake and outflow air gauges. However, it is now clear that even when there are no air leaks into the stack monitor the two flow gauges do not read

exactly the same. Equally important, however, is the fact that when there are no air leaks the difference between the readings on the two flow gauges is a known, constant value. Should this difference increase, an air leak may be indicated and can then be corrected if present.

A slight change in the internal diameter of the sampling probe has no effect on reactor safety. The velocity of the air in the probe and in the sampling line remains essentially the same and, therefore, sampling accuracy and the response time of the monitor remains the same.

The change in the air flow rate through the stack monitor necessitated a small change in the calibration factors for the monitor. Therefore, the probe change was followed immediately by the annual stack monitor calibration, which was about due anyway.

h. AUTOMATIC SHUT-OFF OF THE D102 HOOD FAN

(1) Description

A series of tests were performed which involved measuring air pressures in selected Radiation Center and reactor building rooms with various building ventilation fans and hood fans on and off. These tests showed that some degree of improvement in maintaining the reactor bay air pressure negative relative to surrounding rooms could be obtained if the D102 hood fan was turned off whenever the reactor bay ventilation fans went off. As a result of the test data, the reactor staff slightly modified the reactor building ventilation system to have the hood fan in D102 automatically shut off whenever the reactor bay ventilation fans go off. An alarm was installed in D102 to alert anyone using either hood or the pneumatic transfer system to the fact that the hood fan has gone off. Personnel will be instructed in their training to exit D102 in such an event.

(2) Safety Evaluation

There are no direct *reactor* safety implications associated with the proposed change, and the change does n affect the ventilation system directly serving the reactor. However, the purpose of the change was to increase overall radiation safety by ensuring that the air pressure in the reactor bay remains negative relative to the air pressure in the adjacent rooms. The change helps to accomplish this objective which in turn helps to ensure that if there were a release of radioactive material into the reactor bay there would be no leakage of the material out of the bay.

2. <u>10 CFR 50.59 Changes to Reactor Procedures</u>

There were four changes to reactor procedures which were reviewed, approved, and performed under the provisions of 10 CFR 50.59 during the reporting period.

a. REVISIONS TO THE OSU RADIATION CENTER AND TRIGA REACTOR EMERGENCY RESPONSE PLAN AND EMERGENCY RESPONSE IMPLEMENTING PROCEDURES

(1) Description

A number of minor changes to the Radiation Center and TRIGA Reactor Emergency Response Plan and Emergency Response Implementing Procedures (ERIPs) were needed as a result of the annual exercise and the annual review of the emergency plan. These changes are listed below.

<u>Emergency Plan Changes</u>

Title Page — The last revision date was changed from February to July 1991.

Page 3-2 — Under **Benton County Sheriff's Department**, "the City of Corvallis Police Department" was replaced with "OSU Police and Security."

Under **Benton County Emergency Services**, "Corvallis Fire or Police personnel" was replaced with "OSU Police and Security."

Page 3-9 The list of people potentially available for the radiological assessment team was revised to:

Geochemist
Health Physicist
Neutron Activation Analysis Specialist
OSU Radiation Safety Officer
Radiation Protection Technologist
Radiation Specialists from the Radiation Safety Office
Reactor Operator
Reactor Supervisor
Scientific Instrument Technician
Senior Reactor Operator(s)

Page 3-11 The line of succession for the Historian was revised to: Radiation Center Office Specialist 1 (Position 380), Radiation Center Office Specialist 1 (Position 611), Radiation Center Office Specialist 2.

Page 3-14 The Figure was replaced with a new one which has heavier frame lines.

Page 7-8 In 7.2.3 b), "OSU Campus Security" was replaced with "OSU Police and Security" in two locations.

Under **Severe Natural Phenomenon**, a new paragraph was added: "If the situation is severe and widespread, the OSU President may declare a disaster and the OSU Disaster Management Plan will be put into effect. The OSU Disaster Management Plan is consistent with this Radiation Center and TRIGA Reactor Emergency Response Plan."

Page 7-11	In 7.3.1 d), "OSU Campus Security" was replaced with "OSU Police and Security."
Page 8-1	In 8.1 d), "two telephones with seven outside lines," was replaced with "two independent telephones."
Page 8-3	In 8.2.2 b), "Radiation Center Stockroom" was replaced with "Health Physics Laboratory."
	In 8.2.3 a) iii), "Room A138 of the Radiation Center Complex" was replaced with "the Health Physics Laboratory."
Page 8-4	In 8.2.5 b), "at three positions" was deleted.
Page 8-5	In 8.2.5, d) was revised completely to read: "A dual float operated microswitch is used to annunciate a low reactor tank water level. This is activated when the water level drops about two inches. The same floats activate a high water alarm when the reactor tank water level rises about one inch above normal."
Page 8-6	In 8.3.2, "Radiation Specialist" was replaced with "Health Physicist."
Page 8-8	8.4 a) i) was revised completely to read: "Telephones: The Radiation Center Complex has approximately fifty telephones, each with its own independent line. The main reception area (and hence ESC) telephones can handle eight simultaneous calls, and include displays which provide information about the calls. The telephones will continue to function in the event of a power loss to the Radiation Center."

Page 8-9 8.4 a) iii) was revised to read: "Portable Citizen's Band radios.

In 8.4 b), "OSU Campus Security" was changed to "OSU Police and Secı ˙ty "

Page 10-1 In 10.1 b) v), "OSU Campus Security" was changed to "OSU Police and Security."

Page A-3 Figure A.2 was replaced with a revised version which includes a grid system.

Page A-4 Figure A.3 was replaced with the latest revision of the RC floor plan.

Emergency Response Implementing Procedure Changes

ERIP 3 (also OSTROP 1.)

Title Page Revision number was changed to 4 and the latest revision date was changed to 7/91.

Page IV.1.10 1.10 a. was revised to read: "The reactor tank water level is monitored by dual floats that are mechanically linked to low water level and high water level microswitches. The floats will trip the appropriate microswitches if the water level drops about two inches or rises about one inch."

Page IV.1.11 1.11 was revised completely to read:

1.11 Rod Withdrawal Prohibit

a. There are two conditions which will result in rod withdrawal prohibit annunciation. These are the low source count rate condition and the

detector current selector switch (DCSS) condition as described below.

b. The count rate meter for the reactor startup source is set to give the rod withdrawal prohibit annunciator when the count rate from the startup source detector decreases to about five counts per second.

c. When the DCSS is in a position to measure the current from the percent power channel or the safety channel using the picoammeter, the rod withdrawal prohibit annunciator is also lit. The switch is normally in one of these positions only during the performance of the reactor start up checks. Therefore, this condition is unlikely to occur during normal operation.

d. When the rod withdrawal prohibit annunciator is energized, an interlock will prohibit control rod movement.

e. The console operator will not attempt to start the reactor with the rod withdrawal prohibit annunciator energized.

f. If such an annunciator is received while the reactor is operating, the console operator will not be able to move the control rods, except to drop the rods in the process of scramming.

The console operator will:

1. Scram the reactor.
2. Notify the Reactor Supervisor.

(2) Safety Evaluation

Due to the fact that several of the textual changes previously listed were the result of a single common cause, it is appropriate to evaluate the previously listed changes by topic rather than individually.

In several places "OSU Campus Security" was replaced with "OSU Police and Security" and in one location "the City of Corvallis Police Department" was replaced with "OSU Police and Security." These changes were necessitated by the fact that the Oregon State Police recently assumed an armed response force role on campus. The changes in the emergency plan were consistent with those made in the physical security plan. They merely update the plan and in no way reduce its effectiveness. The number of officers potentially available and the police agency response time remains the same.

The listing of those potentially available for the radiological assessment team was revised to reflect changes in the job titles of the affected personnel. The quality of the people remains the same and their number is increased by one. Similarly, the line of succession for the Historian remains the same, but was updated to reflect the new state classification of their position titles. These changes do not reduce the effectiveness of the plan in any way.

A number of the figures and personnel listings contained in the emergency plan and in the implementing procedures are in routine use at the Radiation Center and are continually being updated. During the annual review of the plan and procedures it is appropriate to add the latest versions of these figures and listings. Two figures were changed as a result of the 1991 emergency exercise. It was recognized that page 3-14 would be clearer to read if the frame lines were printed a little heavier than the other lines, and Figure A.2 was revised to add more detail and include grid lines. These latter changes were made to make it easier to refer to particular locations when making radiological measurements around the Radiation Center Complex. The grid lines are not at uniform distances, but coincide with

distinguishable features such as the edges of the roads and buildings. These changes enhance the emergency plan by enabling greater efficiency in radiological assessment and radio communication.

The university now has a Disaster Management Plan and, therefore, this is now mentioned in the appropriate section of the emergency plan. As noted, the Disaster Management Plan is consistent with the OSU Radiation Center and TRIGA Reactor Emergency Response Plan. Planning at the greater university level can only enhance the university's response in the event of an incident at the Radiation Center.

The Oregon State System of Higher Education completely changed its telephone system. This necessitated wording changes in the emergency plan. The new phone system is a significant improvement over the old system and will contribute positively to the effectiveness of the emergency response plan.

A rearrangement of offices and equipment resulted in extra radiological assessment supplies being kept in the Health Physics Laboratory and not in the stockroom. The amount and type of supplies remains the same.

The instrumented fuel element in the reactor has three thermocouples for measuring fuel temperature. To operate the reactor, only one of these is required by the Technical Specifications. Therefore, the reference to the three positions on page 8-4 was deleted. The required ability to measure fuel temperature will always be maintained, and hence the emergency plan effectiveness is not compromised by this change.

A new dual float system was installed to detect low and high reactor water levels. This necessitated wording changes to the relevant descriptive sections of the emergency plan, but these changes do not reduce the effectiveness of the plan. The safety evaluation of the new float system was included in a previous 50.59 safety analysis.

The number of Citizen's Band radios is being increased and, therefore, the reference to a specific number was deleted. More radios will enhance communications capability and hence increase the effectiveness of the emergency plan.

The addition of the detector current selector switch (DCSS), necessitated a change to OSTROP 1 (ERIP 3). The DCSS addition was previously reviewed under a 50.59 safety analysis and, therefore, this was just a conforming procedural change.

b. CHANGE OF TIME INTERVAL BETWEEN TRANSIENT ROD CALIBRATIONS

(1) Description

Several years ago, the frequency of transient rod calibrations was changed from annual to semi-annual and then to quarterly. The changes in the calibration frequency were made because the transient rod worth was increasing slightly as the core reactivity changed and the reactor was being routinely pulsed using the transient rod at or near the maximum allowable pulse reactivity insertion. Therefore, it was felt that a more frequent calibration was necessary to provide greater assurance that pulse reactivity insertions were accurate and to ensure that the $2.55 limit on such reactivity insertions was not exceeded.

The reactor operations staff changed the transient rod calibration frequency back to annual.

(2) Safety Evaluation

The original decision to increase the calibration frequency for the transient rod was not safety related, but was made out of a desire to assure compliance with the Technical Specifications. Similarly, decreasing the calibration frequency for the transient rod is not related to safety, but was done because the potential for exceeding the pulse reactivity limit is no longer present.

First, the Table IV.D.1 shows that the transient rod worth has remained essentially constant within the measurement error of about ± 2¢ for the past four years or more. Clearly, based on these data an annual calibration provides an equally accurate assessment of current control rod worth.

Second, the reactor is no longer routinely pulsed to $2.55. With respect to this, there is a mechanical transient rod limiter set at $2.50, and the OSTR currently has an operational policy that pulses will be kept below about $2.00. In addition, the reactor is now only pulsed a few times a year.

c. MINOR PROCEDURAL REVISIONS TO OSTROP 26, "PROCEDURES FOR THE USE OF EXTERNAL MONITORING AND RECORDING DEVICES"

(1) Description

The Scientific Instrument Technician purchased a small digital voltmeter for use in the control room in association with OSTROP 26. This avoids the need for the reactor operations staff to borrow the technician's instrument. However, in following OSTROP 26 as it was written, it was not possible to use the new voltmeter and obtain a stable zero reading during the initial test for computer voltage feedback to the reactor console. The "phantom voltage" actually measured with the new voltmeter oscillated around zero due to the sensitive nature of the voltmeter and the high impedance at the test location. As a result of this, OSTROP 26 was changed to require turning the TEST VOLTAGE switch to the ON position before testing the voltage. This action inserts a resistor in the test circuit and stabilizes the voltage, enabling it to be read accurately.

(2) Safety Evaluation

The change has no unfavorable reactor safety implications. It was made to ensure that systems connected to the reactor console for purposes of monitoring reactor parameters do not have any effect on the reactor. The revision makes the test procedure more consistent and makes it possible to read voltages more accurately because turning the TEST VOLTAGE switch

to the ON position prior to testing voltages inserts a resistor in the test circuit, making the voltage more stable. The net effect of the proposed change increases safety.

d. <u>TEMPORARY</u> PROCEDURAL ADDITION TO OSTROP 26, "PROCEDURES FOR THE USE OF EXTERNAL MONITORING AND RECORDING DEVICES"

(1) Description

As part of a reactor laboratory class (NE457) project, a variable operational amplifier was temporarily inserted between a fuel element thermocouple and the computer data acquisition system (CDAS). The reactor was then pulsed in an attempt to determine any difference in the time delay of the peak reactor fuel temperature as measured by this system and as measured by the normal pulse temperature monitoring system. The amplifier increased the thermocouple signal from about 20 mV to about 7.5 V. Due to the fact that this activity was part of a class project, the addition to OSTROP 26 was temporary. The period of validity of the proposed change was 30 days from the date of approval as indicated by the signature of the ROC Chairman. This time period has now passed.

(2) Safety Evaluation

In normal operation of the CDAS during the pulsing mode, only one thermocouple is monitored. The modified procedure resulted in two thermocouples measuring the fuel temperature and, therefore, provided redundant fuel temperature data. The amplifier was only connected between the thermocouple and the CDAS and, therefore would not impact the reactor console or normal fuel temperature measurements during pulsing in any way. In addition, all of the normal procedures required in OSTROP 26 were completed, thereby providing further assurance that there was no influence of the CDAS on the reactor console.

3. 10 CFR 50.59 Changes to Reactor Experiments

There were three changes to reactor experiments which were reviewed, approved, and performed under the provisions of 10 CFR 50.59 during the reporting period.

a. REVISION OF REACTOR EXPERIMENT B-23

(1) Description

Reactor Experiment B-23 was revised in order to broaden the scope of the experiment. In particular, the revised experiment allows the insertion of shielding materials into any of the thermal column's removable stringers to alter the gamma ray or neutron radiation fields. The experiment was also brought up-to-date by incorporating the applicable standard paragraphs now used for all reactor experiments. In addition, a greater variety of samples are authorized for irradiation in the new experiment B-23. For example, small animals are now specifically included, and there is no limitation on the mass of samples inserted into thermal column stringer locations. Key provisions of the existing experiment were retained.

(2) Safety Evaluation

The implications of incorporating the standard paragraphs for experiments were evaluated in previous modifications to experiments B-3 and B-11 and, therefore, are not re-evaluated here. However, they clearly enhance safety by including performance requirements common to all experiments.

The insertion of shielding materials to modify the gamma and neutron fields, in general, reduces the intensity of these fields and, hence, samples irradiated in the thermal column behind the shields receive less fluence than those irradiated under experiment B-3.

Shielding materials, supporting equipment and samples fully inserted into a thermal column stringer are still sufficiently far removed (27 inches of graphite) from the reactor core to be neutronically decoupled from the core. Therefore, there are no measurable reactivity effects due to this experiment.

The activation of shielding materials, supporting equipment and samples irradiated in the thermal column will be estimated by the experimenter as part of the Irradiation Request. Thus, the reactor operations and health physics staffs will be aware of the potential dose rates associated with these irradiated materials prior to performing an irradiation under this experiment. Therefore, these individuals will be able to make appropriate arrangements before removing the items from the thermal column. The health physics implications are, therefore, no different than any other experiment which is run using the reactor.

There is no need for a sample mass limitation in this experiment due to there being no reactivity considerations and due to the fact that the neutron fluxes are low enough to virtually eliminate unexpected high levels of activation in irradiated materials. However, as noted previously, estimates of induced radioactivity in samples, shielding and supporting equipment will be included on the Irradiation Request which must be approved by the Senior Health Physicist and the Reactor Supervisor prior to performing the irradiation.

Irradiation of small animals in a thermal column stringer has no reactor safety implications. All applicable university regulations with respect to animal research will be followed.

b. REVISION OF REACTOR EXPERIMENT B-30

(1) Description

Following a review of approved OSTR experiments, the Reactor Operations Committee adopted the recommendations of the Reactor Administrator with respect to certain experiments. In addition to recommending that some experiments be moved to an inactive status, there was a recommendation that experiment B-30 be revised to incorporate applicable parts of the now standard wording relating to the conditions and limitations imposed on reactor experiments. Experiment B-30 was, therefore, revised accordingly.

The changes to Reactor Experiment B-30 are detailed below:

(a) Encapsulation in half-dram vials was changed to 2/5 dram vials. 2/5 dram vials are the standard vials used, and "half-dram" was probably just a colloquialism for these.

(b) Information relating to the purpose of the irradiation (such as INAA) was deleted. The purpose of the irradiation is not relevant to the safety issues. Reasons for irradiations have been deleted from all of the newly revised and/or reformatted reactor experiments.

(c) The discussion of the original test irradiations was deleted. These tests were a condition of the original approval. They have been performed and results shown to be satisfactory many years ago.

(d) Standard wording relevant to this experiment was included. The new standard wording is present in the second, third and last paragraphs in the new experiment description.

(2) Safety Evaluation

The revised B-30 experiment is essentially the same as that which has been approved, in existence, and in use since 1976. Therefore, there are no additional safety issues requiring consideration. The incorporation of the standard paragraphs slightly enhances safety by reminding experimenters of applicable Radiation Center and OSTR procedures and requirements.

c. SECOND 1991-92 REVISION OF REACTOR EXPERIMENT B-23

(1) Description

The reactor staff was asked to amend Reactor Experiment B-23 to allow the center irradiation cavity in the thermal column to be enlarged. When needed, this enlargement can be achieved by removing the two graphite stringers directly adjacent to the thermal column's central stringer (stringer #5). One or both of the adjacent stringers can be removed <u>after</u> the central stringer

(stringer #5) is removed. Once the central stringer is removed, it is very easy to slide out the two adjacent stringers. Therefore, the two adjacent stringers do not need to have threaded holes in their ends in order to remove them.

(2) Safety Evaluation

There are no undesirable reactor safety implications created by this change. Because of the distance from the reactor core, any change in neutron reflection has a very minor effect on reactivity. Prior to the first use of the revised experiment the core excess reactivity was measured with no stringers removed and then with all three of the stringers removed to determine any reactivity effect due to the change. The difference was within the measurement error and therefore not significant.

The thermal column shield door is more than adequate to maintain low dose rates in the reactor bay even with the three stringers removed. This was demonstrated before the first use of the amended experiment by a radiation survey in the area outside the closed thermal column door with the three stringers removed and the reactor at 1 MW.

Dose rates at the outer face of the thermal column were higher with three stringers removed compared to only one removed; however, the same radiological controls are needed in both cases. Therefore, the change does not present a new situation, but researchers just wait a longer time after reactor shutdown before retrieving experiments. Health physics staff provide the access control until the radiation environment has been characterized and a standard entry protocol established.