UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 11

FACILITY OPERATING LICENSE NO. R-106

OREGON STATE UNIVERSITY

DOCKET NO. 50-243

1.0 INTRODUCTION

By letter dated November 7, 1988, as supplemented on November 6, 1989, Oregon State University requested changes in Facility Operating License No. R-106 and the Technical Specifications for the Oregon State University TRIGA Research Reactor (OSTR). One requested change would increase the maximum authorized steady state reactor power level from 1000 kilowatts (thermal) (kW(t)) to 1100 kW(t). Also requested were changes to the Technical Specifications to reflect the increase in the authorized steady state power level. The licensee requested that the submittal due date for the facility annual report be changed from within 75 days following the 30th of June of each year to November 1st of each year. Changes were also requested that would correct three typographical errors and an error in grammar that appear in the Technical Specifications.

2.0 EVALUATION

2.1 Change in Maximum Authorized Steady State Power Level

Amendment No. 9 to Facility Operating License No. R-106 dated February 11, 1988, removed an inconsistency in the stated maximum steady state power level that existed between Technical Specification 3.1 and paragraph 2.C.(1) of the Facility Operating License. The Technical Specification allowed the reactor to be operated at power levels up to 1200 kW(t) to test safety circuits while the maximum power level authorized in the license was 1000 kW(t).

The licensee has requested that paragraph 2.C.(1) of the Facility Operating License, Technical Specification 3.1, and the bases for Technical Specification 2.2 be amended to increase the maximum authorized steady state power to 1100 kW(t). During a telephone conversation between the OSTR Director and the OSTR NRC Project Manager on November 20, 1989, it was agreed to amend Table I of the Technical Specifications to reflect the new power level.

The licensee intends to continue to operate the reactor at a routine steady state power of 1000 kW(t). Having an authorized steady state power level of 1100 kW(t) would allow greater operational flexibility. This change would allow the licensee to test the power level scram circuit by using reactor power which allows the entire system to be tested. Increasing the steady state power level would eliminate any possible regulatory question concerning the small power fluctuations that may occur when the servo system is controlling

the reactor in automatic mode and for the small uncertainties inherent in the reactor power channel calibration. This requested change also would eliminate the problem where the power scram is set per Technical Specifications at a power level that is a violation of the license. This results in potential reportable events and violations that are not significant from a safety viewpoint. All of the other reactor scram set points are designed to shutdown the reactor before a violation of the license occurs.

The steady state power level requested is within the bounds that have been analyzed and authorized at other TRIGA reactors (General Atomics Mark F at 1500 kW(t) and University of Texas TRIGA Mark II at 1100 kW(t)). The Safety Limits (SL) and Limited Systems Safety Settings (LSSS) for the reactor are not changed. The requested changes do not involve pulsing operations and do not involve any change to the existing Technical Specification reactivity limits.

Maintenance of integrity of the fuel cladding, the primary barrier against fission product release, is important for safe operation of the reactor. The primary mechanism for loss of cladding integrity in high-hydride stainless steel clad TRIGA fuel is excessive pressure generated from the dissociation of the hydrogen and zirconium in the fuel matrix. The magnitude of the pressure is a function of the fuel temperature and the fuel hydrogen to zirconium ratio. The safety limit of 1150°C for FLIP (Fuel Lifetime Improvement Program) fuel and 1000°C for standard fuel have been shown to ensure that pressure in the fuel elements will not exceed the cladding ultimate stress. The temperature of the fuel during steady state operation is dependent upon the heat transfer characteristics of the fuel and coolant. The licensee calculates that the maximum power level per element will increase from 16.98 kW per element to 18.68 kW per element for mixed (FLIP and standard fuel) cores and from 15.93 kW per element to 17.52 kW per element for FLIP cores as reactor power is raised from 1000 kW(t) to 1100 kW(t). This is within the values of 32 kW per element (General Atomic Torrey Pines TRIGA Mark III) and 22.24 kW per element (Texas A&M) that have been acceptable and shown not to result in fuel clad damage.

Loss of coolant studies have shown that infinite operation at a power level of 25 kW per element for FLIP fuel and 21 kW per element for standard fuel will result in fuel element temperatures of less than 938°C for FLIP fuel and 900°C for standard fuel when air is used to cool the elements. It has been shown that no cladding damage occurs at these temperatures. Because the increased power level per element in the OSTR continues to be within these acceptable limits, the evaluation remains valid for the projected 1100 kW(t) power level.

The design basis accident in the OSTR is the loss of fuel clad integrity for one fuel element with the simultaneous loss of pool water which results in an airborn release of fission products. The calculation of the source term in the OSTR analysis assumed a power level of 24 kW per element. Because the increased power level per element in the OSTR continues to be within these acceptable limits, this evaluation is still valid for the projected 1100 kW(t) power level.

Accidental introduction of excess reactivity into the reactor at 1100 kW(t) results in a smaller pulse than at 1000 kW(t) because higher initial power level (initial fuel temperature) results in lower powered pulses. This is due to the increase in the prompt negative reactivity feedback mechanism in the fuel that occurs with higher fuel temperature. Therefore, this accident continues to be within acceptable limits.

Cooling the reactor during operation is not a concern. TRIGA reactors are currently licensed at operate at power levels up to 1500 kW(t) using natural convection cooling. The Technical Specification limit on bulk coolant temperature of 120°F is not changed.

In addition to the change in license condition 2.C.(1), Technical Specification 3.1 concerning maximum power during steady state operation is amended to reflect the increase in power level. Based on a telephone conversation between the OSTR Director and the OSTR NRC Project Manager on November 20, 1989, Table I of the Technical Specifications which lists the minimum reactor safety channels and scram set points is amended to reflect the new power level. While the actual scram set point in the Table is not changed, the wording is changed from "SCRAM @ 110%" (of 1000 kW(t) or 1100 kW(t)) to "SCRAM @ 1100 kW(t) or less." Finally, the bases of the LSSS in Technical Specification 2.2 is changed to reflect the new power level.

From our review of the licensee's submittal and the operational experience of other TRIGA reactors, the staff concludes that operation of the OSTR at steady state power levels not in excess of 1100 kW(t) is acceptable.

2.2 Change in Annual Report Submittal Date

The licensee has requested a change in Technical Specification 6.7.e which requires the submittal of an annual report to the NRC. The specification currently requires that the annual report shall be submitted "within 75 days following the 30th of June of each year." Because of difficulties in such areas as job turnaround time at the University printing department, the licensee has had to produce two versions of the annual report to meet the Technical Specifications submittal date. The annual report is used to meet the requirements of more than the NRC and amending the due date will allow the licensee to produce one report. It is requested that Technical Specification 6.7.e be amended to require submittal of the report by November 1 of each year. This will not change the reporting year but will increase the period between the end of the reporting year and the submittal of the report to NRC by approximately 45 days. All of the other reporting requirements remain unchanged insuring that events with safety significance will continue to be reported promptly. The staff concludes that this change is acceptable.

2.3 Correction of Errors

The licensee requests that three typographical errors and an error in grammar that appear in the Technical Specifications be corrected. The first concerns Technical Specification 2.1.b which states that: "The temperature in a standard TRIGA fuel element shall not exceed 1380°F (1000°C) under any condition of operation." The temperature 1380°F is a typographical error of the conversion of degrees C to degrees F. The proper value is 1830°F.

In the bases of Technical Specification 2.2, a correction in grammar is made. The phrase "which has been" is changed to "which have been."

An error appears in Technical Specification 6.4.b where reference to a Reactor Safety Committee appears. Oregon State University does not have a Reactor Safety Committee. The correct title of the committee responsible for the reactor is the Reactor Operations Committee. Changing this section of the Technical Specifications will make it consistent with the balance of the Technical Specifications where the title Reactor Operations Committee is used.

Finally two specifications are numbered as Technical Specification 6.7.b. The second of these two specifications is correctly renumbered 6.7.c.

The staff concludes that these changes are editorial in nature and do not affect the safe operation of the reactor.

3.0 ENVIRONMENTAL CONSIDERATION

3.1 Change in Maximum Authorized Steady State Power Level

This portion of the amendment involves changes in the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20 and changes in inspection and surveillance requirements. The staff has determined that this portion of the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and there is no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this portion of the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this portion of the amendment.

3.2 Change in Annual Report Submittal Date and Correction of Errors

We have determined that this portion of the amendment is in the category of recordkeeping, reporting, and administrative procedures and requirements. Accordingly, this portion of the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(10). Pursuant to 10 CFR 51.22(b), no environment impact statement or environmental assessment need be prepared in connection with the issuance of this portion of the amendment.

4.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously evaluated, or create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a margin of safety, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities, and (3) such activities will be conducted

in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or the health and safety of the public.

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Dated: December 21, 1989