Washington
State University

Nuclear Radiation Center, Pullman, Washington 99164-1300 / 509-335-8641

April 19, 1990

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Docket 50.27

Dear Sir:

In accordance with the requirements of paragraph 6.10(3)(b) of the Technical Specifications for the WSU modified TRIGA reactor and under the provisions of Section 50.90 of 10 CFR 50, application is hereby submitted to amend the Facility License and the Technical Specifications of Facility License No. R-76. The specific purposes of these amendments are to: 1) withdraw the application for amendment to the Facility License Technical Specifications of November 28, 1983, 2) submit a new set of amendments to replace those submitted on November 21, 1983, 3) redefine the maximum operating power level for the WSU TRIGA reactor to be consistent with the basic reactor license, 4) include sealed sources stored in the reactor pool in the Technical Specifications, and 5) correct some typographical errors in the Technical Specifications.

Sincerely,

W. E. Wilson

W. E. Wilson
Associate Director

Enclosure
WEW:crc

Approved: Bernard J. VanWie
B.J. Van Wie, Chair
Reactor Safeguards Committee

Approved: Robert V. Smith
Robert V. Smith, Vice Provost
for Research & Dean of the
Graduate School

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1) Amendment application of November 28, 1983.

The application for amendments to the Technical Specifications of Facility License No. R-76 submitted to the Commission on November 28, 1983 are hereby withdrawn in their entirety.

2) Amendment to Section 4.3.3 of the Technical Specifications.

Application is hereby made to amend Section 4.3.3 of the Facility Technical Specifications by replacing the wording of Section 4.3.3 with the following wording:

4.3.3 Radiation Monitoring System

Applicability: This specification applies to the surveillance monitoring for the area monitoring equipment, Argon-41 monitoring system and continuous air monitoring system.

Objectives: The objectives are to ensure that the radiation monitoring equipment is operating properly and capable of performing its intended function, and that the alarm points are set correctly.

Specification: All radiation monitoring systems shall be verified to be operable at least monthly at an interval not to exceed 60 days. In addition, the following surveillance activities shall be performed on an annual basis at intervals not to exceed 15 months: 1) the area radiation monitoring system shall be calibrated using a certified source; 2) a calibration of the A-41 system shall be done using at least two different calibrated gamma-ray sources; 3) a calibration shall be performed on the CAM in terms of counts per unit time per unit of activity using calibrated beta sources.

Basis: Experience has shown that monthly verification of Radiation Monitoring Systems' operability in conjunction with an annual more thorough surveillance is adequate to correct for any variations in the systems caused by a change of operating characteristics over a long time span.

----------End of Amendment----------

Justification:

This modification is desired to correct for the omission of a specific reference to the Argon-41 monitoring system and specific calibration requirements for each of the three different monitoring systems.

3) Amendment to Section 5.4 of the Technical Specifications.

Application is hereby made to amend Specifications (1), (2) and (3) of Section 5.4 of the Technical Specifications to read as follows:

Specifications:

(1) Function of Area Radiation Monitor (gamma-sensitive instruments): Monitor radiation fields in key locations, alarm and readout at control console.

(2) Function of Continuous Air Radiation Monitor (beta-, gamma-sensitive detector with particulate collection capability): Monitor radioactive particulate activity in the pool room air, alarm and readout at control console.

(3) Function of A-41 Monitor (gamma-sensitive instrument): Monitor A-41 content in reactor exhaust air, alarm and readout at control console.

----------End of Amendment----------

Justification:

This modification is desired to correct the wording error that implies that the A-41 monitor and CAM monitoring systems are calibrated in terms of concentration. They actually are calibrated in terms of activity and a calculation of the concentration may be made using information on the flow rate through these monitoring systems at the time of the readings. The actual monitoring systems as they exist today were reviewed and found to be adequate as indicated in the NRC written SER when the facility was relicensed.

4) Amendment to Section 3.12 of the Technical Specifications.

Application is hereby made to change the ALARA criterion at the end of Section 3.12(2) from "20%" to "two sigma or a 95% confidence limit."

----------End of Amendment----------

Justification:

The arbitrary 20% ALARA limit presently specified in Section 3.12(2) has no statistical bases and may be shifted by selection of appropriate off-site points for comparison. A more statistically significant and meaningful limit is to specify that the fence post dose at the closest point of extended occupancy shall not exceed the average off-site background by two sigma or two standard deviations. If the fence post dose falls within two sigma of the average off-site background, one

can assert with 95% confidence that the fence post dose is due purely to background radiation and that the operation of the reactor facility is not significantly contributing to the fence post dose at the point in question.

5) Amendment to Section 3.1 of the Technical Specifications.

Application is hereby made to amend the specifications paragraph of Section 3.1 to read as follows:

Specification: The reactor power level shall not exceed 1.1 Mw under any condition of operation.

6) Amendment to Facility License Section 2.C.(1).

Application is hereby made to amend Section 2.C.(1) Maximum Power level of the Facility License to read "1100 kilowatts" versus the present "1000 kilowatts."

----------End of Amendment----------

Justification:

Amendments 5) and 6) are desired to make the maximum power level as specified in the Facility License consistent with that specified in the Technical Specifications and yet allow testing of the power level trips. The present Technical Specification Limit is 1.3 Mw for testing whereas the license specifies 1000 Kw. This difference in maximum allowed power level creates a regulatory question that is removed by the proposed amendment. The facility intends to continue to limit steady-state power operation at the 1.0 Mw level with a buffer zone of .1 Mw for power fluctuations and power level trip testing. It is a well-documented fact that a TRIGA reactor with stainless steel clad fuel may be safely operated up to steady-state power levels of 1.5 Mw with natural convection cooling. (See Safety Analysis at end of this document.)

7) Amendment to add Section 3.14 to the Technical Specifications.

Application is hereby made to amend the Technical Specifications by adding Section 3.14 as given below to include all sealed sources stored in the reactor pool under the Facility License.

3.14 Sealed sources in the reactor pool

Applicability: This specification applies to any and all sealed sources stored in or used in the reactor pool.

Objectives: The objectives of this requirement are: 1) to ensure that any sealed source or sources that are stored or used in the reactor pool do not constitute any type of signi-

ficant hazard to the operation of the reactor, 2) that any such sealed source or sources do not create a significant environmental or personnel radiation exposure hazard, and 3) that any such sealed source or sources do not compromise the ALARA criteria of the facility.

Specification:

(1) Sealed sources shall only be stored and used in the east end or storage portion of the reactor pool and not in the portion of the pool in which the reactor core is normally situated. Sealed sources shall not at any time be stored or used closer than five (5) feet away from the face of an operating reactor core.

(2) All storage and use of sealed sources in the reactor pool shall be considered as an experiment and shall be reviewed and approved by the Reactor Safeguards Committee. A written operating procedure for the storage and use of sealed sources in the reactor pool shall be in effect under the requirements of 6.8.1.

(3) The radionuclide content of the reactor pool water shall be monitored monthly in order to detect a significant leak in the sources stored in the reactor pool. If the specific radionuclide content of the pool water exceeds 10 times the 10 CFR 20 Appendix B, Table II, Column 2 value, steps shall be taken to isolate the source of the activity and to mitigate the problem.

----------End of Amendment----------

Justification:

This amendment is desired to insure that the objectives stated above are met so that the health and safety of the public is protected when sealed sources are used in the reactor pool (see attached Safety Analysis).

(8) Amendment to add paragraph (e) under Technical Specifications, Section 6.10(3).

Application is hereby made to add Section (e) to paragraph 6.10(3) of the Technical Specifications as listed below:

(e) Radionuclide content of the reactor pool water in excess of the limits specified in Section 3.14(3) relating to Limiting Conditions of Operation.

----------End of Amendment----------

Justification:

This amendment is desired to include exceeding the limits specified in 3.14(3) in the 30-day written report requirements.

----------End of Amendment----------

9) Typographical error corrections in the Technical Specifications.

Application is hereby made to correct the following listed typographical errors in the Technical Specifications.

a) Change 3.5(2) to read "Section 1.4" instead of "Section 1.3."

b) Change the second from the last line in Section 6.6 from "RSO to "RSC."

c) Change the NRC address given in Sections 6.10(2), (3), (4) and (5) to read:

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Safety Analysis for Reactor Pool Water Radionuclide Limit

The maximum quantity of radioactive liquid that can be released into the sanitary sewage system is given by 10 CFR 20 Appendix B, Table I, Column 2. In the case of ^{60}Co which is currently the major type of sealed source stored in the reactor pool, the value in Table I, Column 2 is 20 times that given in Table II, Column 2. Accordingly, in the case of ^{60}Co, if the water in the reactor pool reaches the maximum level specified in the proposed Technical Specifications and subsequently all the pool water were to be dumped into the sanitary sewer, such dumpage would not exceed the limits for such dumpage without even taking credit for the dilution factor for the sewage system flow rate of the University. Thus, a worst case accident involving dumping of the reactor pool water into the sewage system would not endanger the health and safety of the public at the proposed radionuclide limit for contamination of the reactor pool by sealed sources in the reactor pool.

Safety Analysis for Change in Maximum Authorized Steady-State Power Level

At the present time an inconsistency exists in the stated maximum steady-state power level given in paragraph 2.C.(1) of the Facility Operating License and that stated in Section 3.1 of the Technical Specifications. The Facility License speci-

fies 1000 kW(t) but the Technical Specifications allows operation up to a power level of 1300 kW(t) for a short interval of time to test safety circuits. The only practical way to absolutely test a power level trip setting is to run the reactor power level up to the trip setting and see if the trip functions at the set level. In order to retain the trip testing capability and remove the inconsistency which is perceived as possibly causing a regulatory problem, an amendment request is being sumbitted to set the maximum authorized power level at 1100 kW(t) in both the Technical Specifications and the Facility License.

The licensee intends to continue to operate the reactor at a routine steady-state power level of 1000 kW(t). The higher authorized power level will, as in the past, be used only for power level trip testing.

The 1100 kW(t) 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), University of Texas TRIGA Mark II at 1100 kW(t) and Oregon State University TRIGA reactor at 1100 kW(t). The Safety Limits (SL) and Limited Systems Safety Settings (LSSS) for the reactor are not changed. The requested change does not involve pulsing operations and thus does 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 a TRIGA 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 limits of 1150°C for FLIP 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 density per element will increase from 18.5 kW per element to 20.4 in the FLIP Region of a mixed (FLIP and Standard fuel) core as the reactor power is raised from 1000 kW(t) to 1100 kW(t). The power density in the Standard fuel at the outer edge of mixed core remains essentially unchanged. 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 ele-

ment 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 WSU modified TRIGA reactor continues to be within these acceptable limits, the evaluation remains valid for the requested 1100 kW(t) level.

The design basis accident in the WSU modified TRIGA reactor is the loss of fuel clad integrity for one fuel element with the simultaneous loss of pool water which results in an airborne release of fission products. The calculation of the source term in the WSU modified TRIGA reactor analysis assumed a power level of 30 kW per element. Because the increased power level per element in the WSU modified TRIGA reactor continues to be within these acceptable limits, this evaluation is still valid for the requested 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 the 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 to operate at power levels up to 1500 kW(t) using natural convection cooling.