SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 25 TO

RENEWED FACILITY OPERATING LICENSE NO. R-106

THE OREGON STATE UNIVERSITY

DOCKET NO. 50-243

1.0 INTRODUCTION

By letter dated November 5, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18312A061), as supplemented by letters dated November 26, 2018 (ADAMS Accession No. ML18334A100), January 4, 2019 (ADAMS Accession No. ML19009A091), January 24, 2019 (ADAMS Accession No. ML19052A051), February 28, 2019 (ADAMS Accession No. ML19065A051), and May 23, 2019 (ADAMS Accession No. ML19149A363), the Oregon State University (OSU or the licensee) requested an amendment to the technical specifications (TSs) in Appendix A to Renewed Facility Operating License No. R-106. In its application, the licensee stated that, in 2018, the OSU TRIGA (Training, Research, Isotopes, General Atomics) Reactor (OSTR) experienced a significant increase in its measured instrumented fuel element (IFE) temperature and that it requests the license amendment in order to remove the IFE from the core and continue to operate OSTR in steady-state mode only. The licensee also committed that, if the amendment is approved, OSU would remove the IFE and install a spare fuel element in its grid plate location, as well as preclude transient operation modes while operating without an IFE.

The requested amendment would revise the OSTR TSs, Section 2, “Safety Limits and Limiting Safety System Setting,” Section 3, “Limiting Conditions of Operation,” and Section 4, “Surveillance Requirements,” to add power level as a limiting safety system setting (LSSS), and remove the requirement for fuel temperature measuring and safety channels and defer surveillance requirements while transient operation modes (i.e., square wave and pulse mode) are precluded. In a letter dated January 4, 2019, OSU stated that pulsing operations will be prevented by taking custody of the transient rod bracket. This transient rod bracket (i.e., mechanical interlock) is required by OSU TS 3.2.3, “Reactor Safety System,” to be installed and operable for conducting transient operations.

2.0 REGULATORY EVALUATION

The NRC staff reviewed OSU’s license amendment request. The NRC staff evaluated the proposed changes based on the regulations and guidance in:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, “Domestic Licensing of Production and Utilization Facilities,” Section 50.36, “Technical specifications,” which provides the requirements for TSs to be included in facility operating licenses, including research reactor licenses. 10 CFR 50.36(a)(1) requires that a summary statement of the bases or reasons for such specifications, other than those covering administrative controls, shall also be included in the application, but shall not become part of the TSs. 10 CFR 50.36(c)(1)(i)(A) requires that TSs include safety limits (SLs) for nuclear reactors that are limits upon important process variables that are found to be necessary to

reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity. 10 CFR 50.36(c)(1)(ii)(A) requires that TSs include LSSSs for nuclear reactors for automatic protective devices related to those variables having significant safety functions. Where an LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that an automatic protective action will correct the abnormal situation before a safety limit is exceeded.
10 CFR 50.36(c)(2), "Limiting conditions for operation," requires that TSs include limiting conditions for operation that specify the lowest functional capability or performance levels of equipment required for safe operation of the facility, including radiation monitoring systems for gaseous process and effluent streams. 10 CFR 50.36(c)(3), "Surveillance requirements," requires that TSs include requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within SLs, and that the limiting conditions for operation will be met.

- 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," which identifies licensing, regulatory, and administrative actions eligible for categorical exclusion from the requirement to prepare an environmental assessment or environmental impact statement.

- NUREG-1537, Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content," Appendix 14.1, Format and Content of Technical Specifications for Non-Power Reactors;" Section 2.2, "Limiting Safety System Settings;" Section 3.2, "Reactor Control and Safety Systems;" and Section 4, "Surveillance Requirements" (ADAMS Accession No. ML042430055), which provide guidance to licensees preparing research reactor applications and TSs.

- NUREG-1537, Part 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria," Chapter 14, "Technical Specifications," (ADAMS Accession No. ML042430048), which provides guidance to the NRC staff for performing reviews of the license amendment request.

- American National Standards Institute/American Nuclear Society (ANSI/ANS)-15.1-1990 (Revised in 2007), "The Development of Technical Specifications for Research Reactors," Section 2.2, "Limiting safety system settings," Section 3.2, "Reactor control and safety systems," and Chapter 4, "Surveillance requirements," which provides guidance, used by the NRC staff, on the parameters and operating characteristics that should be included in the TSs. Since the issuance of NUREG-1537 in 1996, ANSI/ANS-15.1-1990 was revised and the current version is ANSI/ANS-15.1-2007. The NRC staff used the guidance in ANSI/ANS-15.1-2007 for this review.

3.0 TECHNICAL EVALUATION

The OSTR experienced a significant increase in its measured instrumented IFE temperature that occurred after a pulse was conducted on May 21, 2018. OSU states it believes that the measured IFE temperature is an artifact of fuel cracking along with the position of the thermocouple in the IFE and do not represent actual temperature within the entire fuel element. OSU's concern is that the measured IFE temperature may exceed the LSSS in TS 2.2 of 510 degrees Celsius (°C) (950 degrees Fahrenheit (°F)) resulting in long-term shutdown of the OSTR. The TS changes proposed by the licensee are evaluated below.

3.1 TS 2.2, "Limiting Safety System Setting"

OSU proposed to add a sentence to TS 2.2, "Limiting Safety System Settings," to establish reactor power level as a LSSS if transient operation modes of the OSTR are precluded. This change would allow operation of the OSTR in steady-state mode without requiring the use of an IFE. The OSTR IFE contains three thermocouples used for measuring temperature of a single fuel element in the B-ring of the reactor core. Currently, the IFE is located in reactor core position B4. Additionally, the IFE thermocouples provide a temperature input to the reactor safety system that initiates an automatic protective action (i.e., scram) to terminate an abnormal condition before the temperature SL is reached.

The current TS 2.2 states:

> The limiting safety system setting shall be equal to or less than 510°C (950°F) as measured in an instrumented fuel element. The instrumented fuel element shall be located in the B-ring.

The proposed TS 2.2 states:

> The limiting safety system setting (LSSS) shall be equal to or less than 510°C (950°F) as measured in an instrumented fuel element. The instrumented fuel element shall be located in the B-ring. If transient operation modes (square wave and pulsing) are precluded, the LSSS instead shall not exceed 1.1 MW as measured by the calibrated power level channels.

The NRC staff evaluated the proposed revision using the guidance in NUREG-1537, Part 2, and ANSI/ANS-15.1-2007. Section 50.36 requires TSs to specify SLs and LSSSs. An SL is a limit upon important process variables necessary to reasonably protect the integrity of the physical barriers that guard against the uncontrolled release of radioactivity. If any SL is exceeded, the reactor must be shutdown. An LSSS for a nuclear reactor is defined as a setting for automatic protective devices related to those variables having significant safety functions. Where an LSSS is given for a variable on which an SL is placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before an SL is exceeded. ANSI/ANS-15.1-2007, Section 2.2, "Limiting safety system settings," states, in part, that LSSSs are chosen so that automatic protective action will terminate the abnormal situation before a SL is reached.

The principal physical barrier to the release of fission products for TRIGA reactors is the fuel element cladding. The most important parameter to maintain the fuel cladding integrity is the

fuel element temperature. A loss in the integrity of the fuel element cladding may occur if the fuel centerline temperature exceeds the SL. The SL for the OSTR is provided in TS 2.1, "Safety Limit-Fuel Element Temperature," which states:

> Specifications. The temperature in a TRIGA® fuel element shall not exceed 2,100° F (1,150° C) under any mode of operation.

OSU proposes to establish reactor power level as an LSSS if transient operation modes are precluded. As stated in its letter dated January 4, 2019, OSU plans to preclude transient operation by taking custody of the transient rod bracket. The Transient Rod Cylinder Position Bracket is a mechanical and electrical interlock required by OSTR TS 3.2.3 to be installed for conducting transient operation modes. This interlock is not required to be installed for steady-state mode of operation. The revision to TS 2.2 would specify that the transient operation modes are the pulse mode and square-wave mode operations. These modes are defined in TS 1.19, "Pulse Mode," and TS 1.31, "Square-Wave Mode (S.-W. Mode)," respectively.

In its review and evaluation of the proposed TS 2.2 change, the NRC staff used pertinent information in the OSU safety analysis report (SAR) dated November 6, 2007 (ADAMS Accession No. ML080420546), as supplemented by letters dated February 11, 2008 (ADAMS Accession No. ML080730057), and June 20, 2008 (ADAMS Accession No. ML082350345). The NRC staff documented its review of the licensee's neutronic and thermal-hydraulic methodology and calculated results in this SAR in the NRC safety evaluation report (SER) on the conversion of the OSTR from highly-enriched uranium (HEU) to low-enriched uranium (LEU) fuel, which was appended to the letter, "Issuance of Order Modifying License No. R-106 to Convert from High- to Low-Enriched Uranium Fuel (Amendment No. 22) – Oregon State University TRIGA Reactor (TAC No. MD7360)," dated September 4, 2008 (ADAMS Accession No. ML082390775). In the conversion SER, the NRC staff concluded that the methodology and results for both the neutronic and thermal-hydraulic analysis are acceptable. The OSU conversion SAR explains that the RELAP5-3D code was used to calculate the maximum fuel centerline temperature for steady-state operation at 1.1 megawatt-thermal (MW(t)) using an assumed reactor pool water coolant inlet temperature of 49 °C (120 °F). OSU identified the limiting core as the in-core irradiation tube (ICIT) mode during the middle of life (MOL). OSU calculated the maximum fuel element power to be 18.52 kilowatt-thermal (kW(t)). OSU conversion SAR, Table 4-27, "Calculated Fuel Temperatures for Various Channel Powers in the LEU MOL ICIT Core," shows that an 18.52 kW(t) fuel element power results in a maximum fuel centerline temperature of 458 °C (855 °F) and a maximum fuel element cladding temperature of 131 °C (268 °F).

The analysis in the OSU conversion SAR, as supplemented, also indicates that the proposed TS 2.2 LSSS of 1.1 MW(t) results in a maximum fuel centerline temperature margin of 692 °C (1080 °F) to the 1150 °C (2100 °F) fuel element temperature SL in TS 2.1. NUREG-1537, Part 2, Section 4.6, "Thermal-Hydraulics Design," states that the LSSS should be chosen to maintain fuel integrity when safety systems protective actions are conservatively initiated at the LSSS. For an indicated IFE reading of 510 °C (950 °F), the maximum fuel centerline temperature is less than 600 °C (1112 °F). Based on the review of the conversion SAR, the NRC staff finds that proposed LSSS of 1.1 MW(t) results in a fuel element centerline temperature of 458 °C (855 °F) and is more restrictive than the current LSSS of 510 °C (950 °F) as measured by the IFE.

In Section 13.2.2, “Insertion of Excess Reactivity,” of the conversion SAR, OSU analyzed a reactivity transient starting at an initial power of 100 watts involving the simultaneous withdrawal of all four-control rods using a reactivity insertion rate of 0.284 dollars per second. OSU states that the total reactivity insertion for this event is 1.13 dollars. OSTR TS 3.1.4, “Pulse Mode Operation,” states the following:

> Specifications. The reactivity to be inserted for pulse operation shall be determined and limited by a mechanical block and electrical interlock on the transient rod, such that the maximum fuel element temperature shall not exceed 830 °C.

The transient rod is defined by the OSTR TS, Section 1.7.c, “Transient Rod,” as a control rod with scram capabilities that can be rapidly ejected from the reactor core to produce a pulse. In the conversion SAR, as supplemented by letter dated June 20, 2008, OSU calculated that a reactivity insertion of 2.30 dollars corresponds to a peak fuel temperature of 819 °C (1506 °F). This calculation provides the basis for the 830 °C temperature limit in TS 3.1.4. The NRC staff finds that the reactivity insertion of 1.13 dollars as a result of a withdrawal of shim, safety, regulating, and transient control rods is less than the reactivity insertion 2.30 dollars that provides the basis for TS 3.1.4 temperature limit for pulsing operations.

OSTR TS 3.2.3, Table 3, “Minimum Interlocks,” requires the Shim, Safety, and Regulating Rod Drive Circuit interlock to be operable during the steady-state mode of operation. This interlock prevents the simultaneous movement of control rods to ensure that reactivity insertions are performed in a controlled manner. The NRC staff finds that this interlock minimizes the reactivity insertion rate during steady-state mode.

OSTR TS 3.2.3, Table 2, “Minimum Reactor Safety Channels,” requires that two operable Power Level channels be set to scram at 1.1 MW(t) or less, which helps ensure that the licensed power limit and the proposed value of the LSSS (TS 2.2) are maintained during steady-state operation. The OSTR is equipped with four channels that indicate reactor power level that consists of one Linear, one Log, and two Power Level measuring channels. As stated in OSU’s letter dated January 4, 2019, the scram setpoint for both Power Level safety channels is administratively set at 1.06 MW(t). Per Renewed Facility Operating License No. R-106, OSU is authorized to operate the OSTR at steady-state levels not in excess of 1.1 MW(t). The NRC staff finds that the setting of the high-power level scram at 1.06 MW(t) provides additional fuel centerline temperature margin to the SL in TS 2.1.

The NRC staff concludes that the proposed revision to TS 2.2, which adds a measured steady-state reactor power level not in excess of 1.1 MW(t) as an LSSS when transient operation modes (i.e., square-wave and pulse modes) are precluded, will automatically prevent the fuel centerline temperature (the hottest temperature in the fuel element) from exceeding the SL specified in TS 2.1 and therefore maintain fuel integrity. Because the LSSS is consistent with the guidance in NUREG-1537 and ANSI/ANS-15.1-2007 and continues to meet the requirements of 10 CFR 50.36(c)(1)(ii)(A), the proposed change is acceptable.

3.2 TS 3.2.2, “Reactor Measuring Channels”

OSU proposed to add a third statement after TS 3.2.2 that would remove the requirement for the Fuel Element Temperature measuring channel in TS 3.2.2, Table 1, “Minimum Measuring Channels,” if transient operation modes are precluded.

The proposed addition to TS 3.2.2 states:

> (3) The Fuel Element Temperature measuring channel is not required if transient operation modes (Square Wave and Pulse) are precluded, and if precluded, the Fuel Element Temperature measuring channel shall be considered removed from Table 1.

The NRC staff evaluated the proposed addition of the statement labeled “(3)” above, which would remove the TS 3.2.2, Table 1 requirement for the Fuel Element Temperature measuring channel during steady-state operation of the OSTR when transient operations modes are precluded. The NRC staff evaluated the proposed TS change using the guidance in ANSI/ANS-15.1-2007 and NUREG-1537, Part 1, Appendix 14.1. As stated above, the NRC staff found acceptable OSU’s proposed use a power level not in excess of 1.1 MW(t) as the LSSS in TS 2.2 when transient operation modes are precluded. Figure 4-64, “Hot Channel Properties,” in the conversion SAR shows that OSTR fuel element temperature increases when reactor power increases. The Fuel Element Temperature measuring channel provides temperature indication of a single fuel element at core position B-4 and can record the maximum fuel temperature during pulsing and square-wave mode. The Fuel Element Temperature measuring channel consists of an IFE and temperature indicator, and electronic data recorders. In addition to providing fuel temperature information, the Fuel Element Temperature measuring channel forms part of the reactor safety channel circuitry. An automatic protective action (i.e., scram) is initiated when fuel temperature in the IFE reaches the LSSS specified in TS 2.2 of 510 °C (950 °F).

Power Level measuring channels provide indications of reactor power level that are displayed on the reactor console for the operator. When OSU precludes transient operation modes, the Fuel Element Temperature measuring channel function is not needed for safe operation of the OSTR in steady-state mode because two independent and redundant Power Level measuring channels will provide signals to the Power Level safety channels to actuate the scram at 1.1 MW(t).

Based on the above, the NRC staff finds the removal of the Fuel Element Temperature measuring channel from TS 3.2.2, Table 1, when transient mode operations are precluded meets the 10 CFR 50.36(c)(2)(i) requirement that a limiting condition for operation specify the functional capability or performance levels of equipment required for safe operation of the facility. Therefore, the staff concludes that the proposed change to TS 3.2.2 is acceptable.

3.3. TS 3.2.3, “Reactor Safety System”

OSU proposed to add a third statement after TS 3.2.3 that removes the Table 2 requirement for the Fuel Element Temperature safety channel if transient modes are precluded.

The proposed addition to TS 3.2.3 states:

(3) The Fuel Element Temperature safety channel is not required if transient operation modes (Square Wave and Pulse) are precluded, and if precluded, the Fuel Element Temperature safety channel shall be considered removed from Table 2.

The NRC staff reviewed OSU's proposed addition of a sentence after the tables in TS 3.2.2, which would allow steady-state operation of the OSTR without the Fuel Element Temperature safety channel when transient operations modes are precluded. The NRC staff evaluated the proposed TS change using the guidance in ANSI/ANS-15.1-2007 and NUREG-1537, Part 1, Appendix 14.1. OSU proposed to use a power level not in excess of 1.1 MW(t) as the LSSS in TS 2.2 when transient operation modes are precluded. In proposing power level as the LSSS when transient operation modes are precluded, the Power Level measuring and safety channels provide the automatic protective function. Two Power Level measuring channels provide a signal to the Power Level safety channels that automatically initiates a protective action (i.e., scram) when either safety channel exceeds its power level setting to ensure the temperature SL in TS 2.1 is not exceeded. OSU states in its license amendment request that the two Power Level safety channels are independent and redundant of each other. TS 3.2.2, Table 2 requires a minimum of two operable Power Level safety channels for steady-state operation of the OSTR. TS 3.2.3, Table 2 requires that two Power Level safety channels for steady-state operation to automatically scram the OSTR at a setting of 1.1 MW(t) or less.

When OSU precludes transient operation modes, the Fuel Element Temperature safety channel is not needed for safe operation of the OSTR in steady-state mode because two Power Level safety channels will provide an automatic protective action to shut down the reactor and at a more restrictive setting than the Fuel Element Temperature safety channel setting.

Based on the above, the NRC staff finds the removal of the Fuel Element Temperature safety channel from TS 3.2.3, Table 2, when transient mode operations are precluded meets the 10 CFR 50.36(c)(2)(i) requirement that a limiting condition for operation specify the functional capability or performance levels of equipment required for safe operation of the facility. Therefore, the NRC staff concludes that the proposed change to TS 3.2.2, Table 2, is acceptable.

3.4 TS 4.2, "Reactor Control and Safety Systems"

OSU proposed an addition to TS 4.2, "Reactor Control and Safety Systems," to clarify that the surveillance requirements in TS 4.2.e and TS 4.2.f, may be deferred for the Fuel Element Temperature safety and measuring channel if transient operation modes of the OSTR are precluded. OSU also proposed to defer the surveillance requirements in 4.2.e for certain safety channels and interlocks in TS 3.2.3, Tables 2 and 3, required for square-wave and/or pulse mode only when transient operation modes are precluded. Additionally, OSU proposed to revise its TSs to require completion of the surveillances required by TS 4.2.e and f, prior to declaring the channels and interlocks operable.

The proposed addition to TS 4.2 states:

(1) Requirements relating to the Fuel Element Temperature Channel (Section 4.2.e, Fuel Element Temperature SCRAM test, and Section 4.2.f, Fuel Element Temperature Measuring Channel calibration) may be deferred if transient operation

modes (Square Wave and Pulse) are precluded. They shall be completed prior to declaring the Fuel Element Temperature Measuring Channel operable.

(2) For Section 4.2.e, the safety channel and interlocks from Table 2 and 3 that are only required for Square Wave and/or Pulse modes may be deferred if transient operation modes (Square Wave and Pulse) are precluded. They shall be completed prior to declaring the safety channel and interlocks operable.

The referenced surveillance requirements in TS 4.2, Specifications e and f, state the following:

e. A channel test of each items in Table 2 and 3 in section 3.2.3 shall be performed semi-annually.

f. A channel calibration of the fuel temperature measuring channel shall be performed annually.

The NRC staff evaluated the proposed additions to TS 4.2, which would defer surveillance requirements, but require their completion prior to declaring the channels and interlocks operable, using the guidance in ANSI/ANS-15.1-2007 and NUREG-1537, Part 1. The guidance in NUREG-1537, Part 1, Appendix 14.1, Section 4, states, in part, the following:

> If the reactor is not to be operated in a particular mode (i.e., pulse mode) for an interval that exceeds the surveillance interval for that particular mode, surveillances not required for safety while the reactor is operated in other modes may be deferred, but must be performed before the reactor is considered operational in the mode in which the surveillances were deferred.

ANSI/ANS-15.1-2007 provides also guidance for research and test reactors. ANSI/ANS-15.1-2007, Section 4, “Surveillance requirements,” states the following on surveillance testing prior to returning a system to service:

> Appropriate surveillance testing on any technical specification required system shall be conducted after replacement, repair, or modification before the system is considered operable and returned to service.[1]

The NRC staff evaluated the proposed addition of the statement labeled “(1)” above to defer a TS 4.2.e surveillance requirement for the Fuel Element Temperature instrument listed in TS 3.2.3, Table 2, which verifies operability of the Fuel Element Temperature scram that is set equal to or less than 510 °C (950 °F) as measured in the IFE when transient operation modes are precluded.

As noted above in Section 3.1 of this SER, the NRC staff finds OSU’s use of a power level not in excess of 1.1 MW(t) in TS 2.2 is more restrictive than the fuel element temperature of 510 °C (950 °F) if transient operation modes of the OSTR are precluded. TS 3.2.2, Table 1, requires two Power Level measuring channels for steady-state operation mode of the OSTR. Additionally, TS 3.2.3, Table 2, requires two Power Level safety channels for steady-state operation mode. The Power Level measuring channels provides a signal to the Power Level safety channels. TS 4.2.e requires that a channel test of the Power Level safety channel

[1] Extracted from American National Standard ANSI/ANS-15.1-2007 with the permission of the publisher, the American Nuclear Society.

(i.e., scram test) be performed on a semi-annual frequency to verify operability. The Power Level safety channels provide an automatic protective function (i.e., scram) at 1.1 MW(t) or less to ensure the facility will be within the temperature SL in TS 2.1. The NRC staff concludes that the surveillance for the Fuel Element Temperature safety channel is not required for safety while the reactor is operated in steady-state mode because the Power Level safety channels provide an automatic protective action and the setting is more restrictive than the Fuel Element Temperature setting to maintain necessary quality and ensure fuel centerline temperature will not exceed the SL in TS 2.1 of 2100 °F (1150 °C). Further, the NRC staff concludes that the limiting conditions requiring two Power Level measuring and safety channels for steady-state operation will continued to be met. Therefore, the NRC staff concludes that the deferral of the channel test of TS 4.2.e for the Fuel Element Temperature scram listed in TS 3.2.3, Table 2, is acceptable.

Additionally, OSU proposed to revise TSs to allow it to defer the TS 4.2.f surveillance requirement associated with the calibration of the Fuel Element Temperature measuring channel. OSU proposes to complete the surveillance requirement prior to declaring the Fuel Element Temperature measuring channel operable. The required surveillance for TS 4.2.f ensures that gradual degradation of the Fuel Element Temperature measuring channel will be detected and verifies that the Fuel Element Temperature measuring channel is operable. TS 4.1.a requires that the Power Level measuring channels be calibrated on an annual basis, which is the same surveillance periodicity as the Fuel Element Temperature measuring channel. The NRC staff concludes that the calibration surveillance for the Fuel Element Temperature measuring channel is not required for safety while the reactor is operated in steady-state mode because the Power Level measuring channels are calibrated on the same periodicity and provide a signal to the Power Level safety channels.

Based on the above, the NRC staff finds that deferring the surveillance requirement of TS 4.2.f while transient operation modes are precluded is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, Section 4, and meets the 10 CFR 50.36(c)(3) requirements that the necessary quality of systems is maintained, that the facility operation will be within the safety limit, and the limiting conditions for operation will be met. Therefore, the staff finds this change acceptable.

The NRC staff evaluated the proposed addition of the statement labeled “(2)” above to defer the surveillance requirements in TS 4.2.e for a safety channel and certain interlocks listed in TS 3.2.3, Tables 2 and 3. Specifically, OSU proposes to defer the surveillance requirements for the following safety channel and interlocks in TS 3.2.3:

- Table 2 – Minimum Reactor Safety Channels
  - Preset Timer (for pulse mode)

- Table 3 – Minimum Interlocks
  - 1kW Pulse Interlock (for pulse mode)
  - Shim, Safety, and Regulating Rod Drive Circuit (for pulse mode)
  - Transient Rod Cylinder Position (for pulse and square-wave mode)

These reactor safety channel and interlocks listed above in TS 3.2.3, Tables 2 and 3, are only required for pulse and/or square-wave mode of operations and the TSs do not require them for steady-state mode of operation. OSU proposed operation of the OSTR in steady-state mode without the IFE when transient operation modes are precluded. Because the TSs do not require

this reactor safety channel and interlocks when the OSTR operates in a steady-state mode when OSU precludes transient operation modes, continues to meet the 10 CFR 50.36(c)(3) requirements that the necessary quality of systems is maintained, and that the facility operation will be within the safety limit. Therefore, the staff finds that the deferral of these surveillance requirements of TS 4.2.e are acceptable.

The proposed changes would require OSU to perform the surveillance requirements in TS 4.2.f and TS 4.2.e prior to declaring the channels and interlocks operable. The NRC staff finds that performing the surveillances required by TS 4.2.e and TS 4.2.f, prior to declaring both the Fuel Element Temperature measuring channel and the safety channel and interlocks operable because these channels and interlocks are not required for safety during steady-state mode and that the surveillance requirements for the Power Level safety channels remain unchanged, the proposed TS is consistent with the guidance in ANSI/ANS-15.1-2007, Section 4, and NUREG-1537, Part 1, Appendix 14.1, Section 4. Further, the NRC staff finds that the proposed TS meets the 10 CFR 50.36(c)(3) requirement that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. Therefore, the proposed change is acceptable.

3.5 Technical Specifications Bases Changes

Consistent with 10 CFR 50.36(a)(1), OSU provided revised basis statements related to proposed TSs 2.2, 3.2.2, 3.2.3, and 4.2. The NRC staff concludes that the TS bases explains the reasons for the proposed TSs.

3.6 Conclusion

The NRC staff evaluated OSU's proposed changes to the OSTR TSs in the license amendment request, as supplemented, and using the information provided by OSU in support of the HEU to LEU conversion activities. The NRC staff finds that the proposed revisions to TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 that add a power level not in excess of 1.1 MW(t) as an LSSS, remove the requirement for the Fuel Element Temperature measuring and safety channels for steady-state operation mode when transient operation modes are precluded, and defer the channel test and calibration surveillance requirements in 4.2.e and 4.2.f for the Fuel Element Temperature measuring and safety channel along with certain safety channels and interlocks in TS 4.2.e (TS 3.2.3, Tables 2 and 3) not required for steady-state operation are consistent with the applicable guidance in NUREG-1537 and ANSI/ANS-15.1-2007. The changes also meet the 10 CFR 50.36(c)(1), (2), and (3) requirements. The TSs include limiting safety system settings for automatic protective devices related to variables having significant safety functions and the LSSS enables an automatic protective action that will correct the abnormal situation before a SL is exceeded. Also, the TSs include limiting conditions for operation specify the lowest functional capability or performance levels of equipment required for safe operation of the facility and include surveillance requirements relating to testing, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within SLs, and that the limiting conditions for operation will be met. Therefore, based on its review, the NRC staff concludes that the proposed revisions to the OSTR TSs are acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.22(b), no environmental assessment or environmental impact statement is required for any action within the category of actions listed in 10 CFR 51.22(c), for which the

Commission has declared to be a categorical exclusion by finding that the action does not individually or cumulatively have a significant effect on the human environment.

4.1 Regulatory Evaluation

This amendment revises TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 and thus involve changes to a requirement in the installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20. The issuance of this amendment meets the requirements for the categorical exclusion under 10 CFR 51.22(c)(9) provided that:

(i) *The amendment involves no significant hazards consideration*; [10 CFR 51.22(c)(9)(i)]

The regulations in 10 CFR 50.92(c) states that a license amendment involves no significant hazards consideration if operation of the facility, in accordance with the proposed amendment, would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated [10 CFR 50.92(c)(1)]*; or*

As discussed in Section 3 of this safety evaluation, the proposed changes to TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 would use power level of 1.1 MW(t) as the LSSS when transient mode operations are precluded and defer certain surveillance requirements associated with the Fuel Element Temperature channel and other channels and interlocks required to be operable for transient mode operations. This amendment does not change the licensed power level, fission product inventory, or design features and does not change any potential release paths from the facility. The previously evaluated accident that could be affected by this amendment is the failure of the fuel element cladding if the SL were exceeded. This accident scenario was previously evaluated in the 2007 conversion SAR by postulating the maximum hypothetical accident (MHA). The evaluation of other categories of postulated fission product release accidents at the OSTR show that the MHA is bounding. The postulated MHA assumes that the release of fission products from a TRIGA fuel element to the unrestricted environment results in radiological consequences that bound all credible fission product release accidents. The deferral of surveillances does not increase the probability of an accident because this equipment is not required for safety during steady-state operation. Additionally, the proposed use of a power level as the LSSS is more restrictive than using the LSSS as measured by the IFE and does not increase the probability of an accident. Therefore, the NRC staff finds that this amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated [10 CFR 50.92(c)(2)]*; or*

The postulated accident associated with the proposed power level LSSS not in excess of 1.1 MW(t) is a loss in the integrity of the fuel element cladding that may occur if the fuel temperature exceeds the SL. The proposed use of a power level as the LSSS is more restrictive than the LSSS as measured by the IFE. The proposed changes to TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 do not create the possibility of a new or different accident previously evaluated, including the MHA, because the proposed changes add a power level of 1.1 MW(t) as an LSSS when transient

operations are precluded and defer surveillances that are needed during transient modes of operation and not needed for steady-state operations. These TS changes do not authorize installation of new equipment or significantly change the operation of the facility. In addition, there is no change to the licensed power level or fission product inventory. As a result, this amendment does not change potential release paths from, or any accident previously evaluated at, the facility. Therefore, the NRC staff finds that the proposed changes to TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 do not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) *Involve a significant reduction in a margin of safety* [10 CFR 50.92(c)(3)].

As discussed in Section 3 of this safety evaluation, the proposed changes to TS 2.2, TS 3.2.2, TS 3.2.3, and TS 4.2 would use power level of 1.1 MW(t) as the LSSS when transient mode operations are precluded and defer certain surveillance requirements associated with the Fuel Element Temperature channel and other channels and interlocks required to be operable for transient mode operations. The proposed use of a power level as the LSSS is more restrictive and provides greater margin of safety than the LSSS measured by the IFE. In addition, the surveillance requirements are not needed for steady-state operations and must be completed prior to declaring the channels and interlocks operable for transient operations. Therefore, the NRC staff finds that this amendment does not involve a significant reduction in a margin of safety.

(ii) *There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and* [10 CFR 51.22(c)(9)(ii)]

The addition of a power level not in excess of 1.1 MW(t) as an LSSS and the deferral of surveillance requirements that are not necessary for safe operation during steady-state operations do not affect or significantly change the types or amounts of fission products generated by the OSTR. This amendment does not change the licensed power level of not in excess of 1.1 MW(t) or reactor design features. This amendment still requires that measuring channels, safety channels, and interlocks for transient mode operations be operable when such modes are resumed. For these reasons, the NRC staff finds that this amendment does not significantly change the types or increase the amounts of any effluents that may be released offsite.

(iii) *There is no significant increase in individual or cumulative occupational radiation exposure* [10 CFR 51.22(c)(9)(iii)].

The amendment will require a power level not in excess of 1.1 MW(t) as the LSSS when transient operation modes are precluded and defers surveillance requirements that are not necessary for safe operation during steady-state mode operations. This amendment does not change the licensed power level or the facility design and does not increase the individual or cumulative in radiation exposure. TS 6.3, “Radiation Safety,” which is not altered by this amendment, still requires the implementation of a radiation safety program as required in 10 CFR Part 20 to ensure that individual and cumulative occupational radiation exposure is as low as is reasonably achievable. Therefore, the NRC staff finds that there is no significant increase in individual or cumulative occupational radiation exposure.

4.2 Conclusion

Accordingly, the NRC staff has determined that issuance of this amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area under 10 CFR Part 50. The NRC staff has determined that amendment involves no significant hazards consideration as well as no significant increase in the amounts, and no significant increase in the types, of any effluents that may be released offsite, and there is no significant increase in individual or cumulative occupational radiation exposure. Therefore, the amendment meets the eligibility criteria for a 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 amendment.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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