PURDUE
UNIVERSITY

SCHOOL OF NUCLEAR ENGINEERING

30 Jan 2012

Document Control Desk
US Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Attn: Ms. Cindy Montgomery, Research & Test Reactors (NRR/DPR/PRLB), Mailstop O12 D20

SUBJECT: PURDUE UNIVERSITY - REQUEST FOR ADDITIONAL INFORMATION REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL (TAC NO. ME 1594), RESPONSES TO RAIs DATED 6 JULY 2011 (ML101460429)

Dear Ms. Montgomery:

Enclosed please find the responses to the Request for Additional Information regarding the Purdue University Reactor License Renewal dated 6 July 2011. Included with this submission are responses to questions 3, 4, 7, 10, 17, 19, 20, 22, 24, 29, 34, and 40. This completes the question set included in the above referenced letter, as summarized in the table below.

Letter dated	Questions addressed
11/15/2011	1, 2, 5, 6, 8, 9, 14, 26, 32,
01/04/2012	11, 12, 13, 15, 16, 18, 21, 23, 25, 27, 28, 30, 31, 33, 35, 36, 37, 38, 39
01/30/2012	3, 4, 7, 10, 17, 19, 20, 22, 24, 29, 34, 40

A revised version of the Technical Specifications with the changes required by these responses will be submitted 7 February 2012.

Should you have any questions or require further information, please don't hesitate to call me at 765.496.3573, or e-mail at jere@purdue.edu.

I hereby certify under penalty of perjury with my signature below that the information contained in this submission is true and correct to the best of my knowledge.

Very respectfully,

Jere H. Jenkins
Director of Radiation Laboratories

Attachments: As described.

Cc: Duane Hardesty, USNRC Project Manager
Leah Jamieson; Purdue University College of Engineering
Jim Schweitzer, Purdue University REM
Ahmed Hassanein, Purdue NE

AD2D
NRR

REQUESTED ADDITIONAL INFORMATION IN RESPONSE TO RAIs DATED 6 JULY 2011 (ML101460429)

REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL (TAC NO. ME 1594)

3 TS 1.32 and TS1.33: The Reactor secured and Reactor shutdown definitions provided in TS 1.32 and TS 1.33 differ from the definitions the NRC has previously found acceptable. The definitions for Reactor Secured and Reactor Shutdown are provided in ANSI/ANS- 15.1-2007, Section 1 as tailored by NUREG-1537. The following are definitions, from guidance provided in NUREG 1537, Appendix 14.1, deemed acceptable:

Reactor secured: A reactor is secured when:

1. Either there is insufficient moderator available in the reactor to attain criticality or there is insufficient fissile material present in the reactor to attain criticality under optimum available conditions of moderation and reflection;

2. Or the following conditions exist:

a. The reactor is shutdown, as required by TS 1.33, and;

b. The requirements of the reactor secure procedure are met.

Reactor shutdown: A reactor is shutdown when the following conditions exist:

a. The minimum number of neutron absorbing control devices is fully inserted or other safety devices are in shutdown position, as required by TS;

b. The console key switch is in the off position, and the key is removed from the lock;

c. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods;

d. No experiments are being moved or serviced that have, on movement, reactivity worth exceeding the maximum value allowed for a single experiment, or one dollar, whichever is smaller.

Note: For subparagraph d., a single value should be chosen to specify the smaller value of either "one dollar" or "the maximum value allowed for a single experiment." Do not specify both options in the definition.

Please evaluate PUR-1 TS 1.33 against the suggested definitions for Reactor secured and Reactor shutdown and propose TS changes or justify your current definitions.

The definitions for Reactor Secured and Reactor Shutdown are to be changed as follows (as suggested in ANSI 15.1-2007 with some minor modifications for operations at PUR-1, none of which change the intent):

1.32 Reactor secured: A reactor is secured when:

a. Either there is insufficient moderator available in the reactor to attain criticality or there is insufficient fissile material present in the reactor to attain criticality under optimum available conditions of moderation and reflection;

b. Or the following conditions exist:

i. The minimum number of neutron absorbing control devices is fully inserted or other safety devices are in shutdown position, as required by technical specifications;

ii. Electrical power to the control rod circuits is switched off via the console key switch, and the switch key is in proper custody.

iii. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods;

iv. No experiments are being moved or serviced that have, on movement, reactivity worth exceeding the maximum value allowed for a single experiment.

1.33 Reactor shutdown: The reactor is shut down if it is subcritical by at least one dollar in the reference core condition with the reactivity worth of all installed experiments included.

Justification: To bring TS into alignment with ANSI/ANS-15.1-2007 and NUREG 1537.

4 TS 1.36 and TS 6.6.2: ANSI/ANS-15.1-2007, Section 6.7.2 provides a schedule of events that require special reports. The Reportable Occurrence definition in PUR-1 TS 1.36 that addresses these special reports does not appear to be consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.7.2. Additionally, per NUREG-1537, Appendix 14.1, TS 6.6.2 should state that special written reports should be sent to the NRC document control desk and special telephone reports of events should be made to the NRC Operations Center. Please propose changes to the TS or provide an explanation describing your reason(s) for not incorporating the changes.

The definition of Reportable Occurrence is removed from the Technical Specifications, and left to T.S. 6.6.2, which brings the TS into closer alignment with ANSI/ANS 15.1 and NUREG 1537.

The following section will be added to the technical specifications:

6.6.2 Non-Routine Reports

a. Special Reports

Special reports are used to report unplanned events as well as planned major facility and administrative changes. The following schedule shall be incorporated in the specifications:

(1) There shall be a report not later than the following working day by telephone and confirmed in writing by facsimile or similar conveyance to licensing authorities, to be followed by a written report to NRC Document Control that describes the circumstances of the event within 14 days of any of the following:

(a) operation with actual safety system settings for required systems less conservative than the limiting safety system settings specified in the technical specifications,

(b) operation in violation of limiting conditions for operation established in the technical specifications unless prompt remedial action is taken as permitted in Sec. 3,

(c) a reactor safety system component malfunction that renders or could render the reactor safety system incapable of performing its intended safety function. If the malfunction or condition is caused by maintenance, then no report is required.

(d) an unanticipated or uncontrolled change in reactivity greater than 0.6% Δk/k,

(e) abnormal and significant degradation in reactor fuel or cladding, or both, coolant boundary,

(f) an observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to reactor safety;

Justification: To bring TS into alignment with ANSI/ANS-15.1-2007 and NUREG 1537.

7 TS Section 3.0: NUREG-1537 states the content of the TSs follow ANSI/ANS 15.1 guidance. ANSI/ANS-15.1-2007 Section 3.5 provides specifications for the ventilation systems. Section 3 of the PUR-1 TSs does not contain Limiting Conditions for Operation of the Ventilation Systems as referenced by ANSI/ANS-15.1-2007. Please propose TS changes for the ventilation system limiting conditions for operations (LCOs) or provide an explanation describing your reason(s) for not incorporating the changes.

The ventilation system for the reactor room is always on, except during maintenance and testing. Maintenance and testing do not generally occur during operations.

The PUR-1 TS do contain an LCO for operation of the ventilation system, TS 3.4. The TS 3.4.a.1 was changed in response to Q11, and is shown here.

3.4 Confinement

Applicability - This specification applies to the integrity of the reactor room.

Objective - The objective is to limit and control the release of airborne radioactive material from the reactor room.

Specification -

a. During reactor operation the following conditions will be met:

1. The reactor room will be maintained at a negative pressure of at least 0.05 inches of water with the operation of the room exhaust fan.

10 TS 3.3: ANSI/ANS-15.1-2007, Section 3.3 provides a list of minimum operating equipment or operating limits, or both, for the limiting conditions for operations for the coolant systems. PUR-1 TS 3.3 specifies the limiting conditions for operations for the water chemistry and coolant level specifications. PUR-1 TS 3.3 does not contain specifications for the reactor pool coolant system parameters listed in ANSI/ANS 15.1, Section 3.3, such as pool temperature (core cooling) or leak or loss-of-coolant detection. Please propose TS changes to meet the specification operating limits for the coolant system by ANSI/ANS 15.1, Section 3.3 or provide an explanation describing your reason(s) for not incorporating the changes.

The appropriate items from ANSI 15.1-2007, Sec. 3.3 are included in the TS 3.3, namely pH and resistivity (as suggested in 3.3(9) of ANSI 15.1), and coolant level limits (as suggested in 3.3(3) of ANSI 15.1). None of the other systems mentioned in ANSI 15.1-2007, Sec. 3.3 are applicable to PUR-1.

As determined in NUREG-1283, the Safety Evaluation Report for PUR-1, Section 14.4,

> "The reactor pool is designed to prevent unintentional drainage. The pool is constructed of a stainless steel liner and set in a second steel tank with the interstitial region filled with sand. The tank rests on a concrete pad about 4.6 m below the floor of the reactor room, which is in the basement of the building. The pool has no drains or coolant pipes that could open or break. Therefore, a sudden loss of coolant is considered to be extremely unlikely. Furthermore, if the pool drained instantaneously, while the reactor was operating, the loss of water (moderator) would shut down the reactor."

The pool water level is checked at least weekly, and before every startup. And historical records of makeup water use are maintained. Substantive changes in makeup water volumes would be identified each time makeup water is added, and compared to historical data. Therefore, a leak or loss-of-coolant detection system is not required.

No changes will be made to TS 3.3.

17 TS Section 4.0: ANSI/ANS-15.1-2007, Section 4 states that for each surveillance requirement (SR), it should be specified if the surveillance activity can or cannot be deferred during reactor shutdown, as well as, guidance pertaining to deferred SR that must be performed prior to reactor operations.

(a) a. Please identify those surveillances that may be deferred during reactor shutdown, and;

(b) b. Identify systems and/or components that require surveillance after any addition, modification, or maintenance before declaring that system operational in accordance with the original specifications to which the systems were designed and fabricated.

This is already done in TS 4.1 and 4.2. For 4.3, the following changes are made:

a. The pH of the primary coolant shall be recorded monthly, not to exceed six weeks. This cannot be deferred during reactor shutdown.

b. The conductivity of the primary coolant shall be recorded monthly, not to exceed six weeks. This cannot be deferred during reactor shutdown.

c. The reactor pool water will be at or above the height of the skimmer trough whenever the reactor is operated.

d. The primary coolant shall be sampled monthly, not to exceed six weeks, and analyzed for gross alpha and beta activity. This cannot be deferred during reactor shutdown.

19 TS 4.3. TS 4.3(d) specifies a monthly primary coolant sampling requirement for gross alpha and beta activity. Please update the TS to indicate under which modes of reactor operation monthly sampling is required. Also, consider whether a corresponding LCO for this surveillance is required in TS 3.3

This was already answered in the response to Q17. An LCO is not necessary.

20 TS 4.4(d): TS 4.4(d) specifies inspection requirements for the fuel cladding. Per the guidance of ANSI/ANS-15.1-2007, fuel inspections, if appropriate, are normally included as part of reactor core parameters (Section 3.1 / Section 4.1). Please consider moving TS 4.4(d) for inspecting fuel assemblies into a separate TS from confinement surveillance. Additionally, please identify the Section 3 LCO that establishes the minimum performance level for this surveillance or add an LCO, if needed.

TS 4.4.d has been moved to TS 5.2.5, as recommended in ANSI 15.1 Sec 5.3.

5.2 Fuel Assemblies

5.2.5 Representative fuel assemblies shall be inspected annually for channel blockage or plate deformation, with no interval to exceed 15 months.

22 ANSI/ANS-15.1-2007, Section 4.7.2 provides for dosimetry monitoring of effluents at the boundary of the facility and for environmental monitoring, e.g., sampling of soil, vegetation, or water in the vicinity of the facility. TS 6.6.1.a.4. discusses results of surveillances required by these TSs, but the PUR-1 TS do not appear to contain any such surveillance requirements. Please propose TSs to address these requirements, reference where the requirements exist, or provide an explanation describing your reason(s) for not incorporating the changes.

PUR-1 is a small training reactor, and generates no effluents. The TS 6.6.1 discusses the annual report requirements, which is similar to the requirements outlined in ANSI 15.1-2007 6.7.2. The annual reports have summarized that PUR-1 releases no effluents.

24 TS 5.3. Guidance in ANSI/ANS-15.1-2007, Section 5.3 states there should be requirements for periodic fuel inspection and conditions for operation, as appropriate for operation of the reactor with damaged fuel. Please update the TS to establish surveillance for fuel condition and limiting conditions for operation when and if the reactor can operate with damaged fuel (LCO) or justify why these are not required.

A description for surveillance of the fuel condition is already provided for in 4.4.d (now 5.3.6) and 4.3.d.

Based on the long successful history of fuel integrity at PUR-1, the excellent control of water chemistry with no evidence of fuel degredation, and the fact that coolant water is tested monthly to verify fuel integrity, PUR-1 does not see an LCO for operation with damaged fuel as necessary.

29 TS 6.1.11, TS 6.1.14: ANSI/ANS-15.1-2007, Section 6.1.3(3) provides guidance for events requiring the presence at the facility of the senior reactor operator. Please update PUR-1 TS 6.1.11 and 6.1.14 for compliance with the requirements in ANSI/ANS-15.1- 2007, Section 6.1.3(3) and 10 CFR 50.54(m)(1) or provide an explanation describing your reason(s) for not incorporating the changes.

TS 6.1.11 and 6.1.14 have been moved to the new 6.1.2 (Staffing). Item (3) reads as follows:

(3) Events requiring the presence at the facility of a senior reactor operator are

(a) Initial startup and approach to power following a core change. The presence of an SRO at the reactor facility is unnecessary for the initial daily start up, provided the core remains unchanged from the previous run;

(b) All fuel or control-rod relocations within the core region;

(c) Recovery from an unplanned or unscheduled shutdown except in instances which resulting from the following

(i) A verified electrical power failure or interruption exclusive of internal power supply failures or interruption of the reactor instrumentation, control, and safety systems;

(ii) Accidental manipulation of equipment in a manner which does not affect the safety of the reactor;

(iii) A verified practice of the evacuation of the building initiated by persons exclusive of reactor operations personnel.

The SRO shall be notified of the shutdown and shall determine its cause. If due to one of the enumerated reasons above, he shall decide if his presence is necessary for a subsequent start up.

34 Section 5.1 Site and Facility Description. ANSI/ANS-15.1-2007, Section 5.1 provides guidance to provide a general description of the site and facility including location and exclusion areas. Please update TS 5.1 to describe in detail which areas are under the jurisdiction of the reactor license (licensed area) and include a description of the facility location, as well as, the location of exclusion and restricted areas, as appropriate.

Section 5.1 of ANSI 15.1-2007 reads as follows:

5.1 Site Description

5.1.1 The reactor is located on the ground floor of the Duncan Annex of the Electrical Engineering Building, Purdue University, West Lafayette, Indiana.

5.1.2 The School of Nuclear Engineering controls approximately 5000 square feet of the Duncan Annex ground floor, which includes the reactor room. Access to the Nuclear Engineering controlled area is restricted except when classes are held there.

5.1.3 The licensed areas include the reactor room, and a fuel storage room. Both of these areas are restricted to authorized personnel, or those escorted by authorized personnel.

5.1.4 The reactor room remains locked at all times except for the entry or exit of authorized personnel or those escorted by authorized personnel, equipment, or materials.

5.1.5 The PUR-1 reactor room is a closed room designed to restrict leakage.

5.1.6 The minimum free volume of the reactor room is approximately 15,000 cubic feet.

5.1.7 The ventilation system is designed to exhaust air or other gases from the reactor room through an exhaust vent at a minimum of 50 feet above the ground.

5.1.8 Openings into the reactor room consist of the following:

a. Three personnel doors

b. One door to a storage room with no outside access.

c. Air intake

d. Air exhaust

e. Sewer vent

The information requested in this question is already provided in 5.1.3.

40 TS 4.2(a) and Table III. The Reactor Safety System channels required to be tested before each reactor startup following a shutdown in excess of 8 hours are provided in Table III as referenced by TS 4.2(a). The 8 hour requirement for this specification has no basis. Please provide adequate justification for the 8 hour requirement or revise the TS to be consistent with NUREG-1537, Appendix 14.1, which requires surveillance only if the reactor is secured (assuming the updated definitions for reactor shutdown and reactor secured as tailored by NUREG-1537 (see RAI 3)). The following is an example revision based on NUREG 1537, Appendix 14.1 previously found acceptable to the NRC: a. A channel test of each of the reactor safety system channels listed in Table III shall be performed prior to reactor operation: i. anytime the reactor has been placed in a secure condition, and ii. monthly, not to exceed 6 weeks, since last channel test < LIST TABLE III SURVEILLANCES>

We disagree with the definitions suggested in Q3, and have modified our existing definitions slightly to be more consistent with ANSI 15.1. However, they were already similar to the ANSI 15.1 recommended definitions for "reactor shutdown" and "reactor secure".

The reactor can be placed in a secure shutdown condition by the removal of the key from the console key switch (which opens the circuit for the control rod electromagnets) without de-energizing any of the other instrumentation and control systems. This would allow for an operator to leave the room with other non-operating personnel present, then he can return and resume operations without performing a new start-up with channel tests. This is of particular importance with a small operations staff such as the one at PUR-1.

Furthermore, item (5) of NUREG 1537 Appendix 14.1 (see page 32 of Appendix 14.1) reads as follows:

> *"(5) Scram and Power Measuring Channels*
>
> *Channel tests of all scram and power measuring channels required by technical specifications, including scram actions with safety rod release and interlocks, should be performed before each reactor startup following a shutdown of more than **24 hours** or following each secured shutdown. If the reactor operating schedule calls for no secured shutdowns, the channel tests should be performed at least quarterly."*

There appears to be some disparity between NUREG 1537 and ANSI 15.1 over what secured shutdown entails. Utilizing the present definition of "reactor secured" from ANSI 15.1 (see the answer to Q3), and the reasoning described above which describes a condition where an operator may need to leave the reactor room temporarily with non-operations personnel present, we do not agree that a channel test is necessary after every such secured shutdown, and the 8 hour requirement is sufficient. Moreover, we feel the 8 hour requirement is justified because: (1) the 8 hour requirement in the PUR-1 TS is more conservative than the 24 suggested by NUREG 1537, (2) the reactor can be placed in a "secured shutdown" condition without de-energizing the I&C systems, (3) based on the operational experience at PUR-1 which indicates that the electronics are stable for periods of days. Therefore, we see no reason to make any changes.

REQUESTED ADDITIONAL INFORMATION IN RESPONSE TO RAIs DATED 6 JULY 2011 (ML101460429)

REGARDING THE PURDUE UNIVERSITY REACTOR LICENSE RENEWAL (TAC NO. ME 1594)

3. TS 1.32 and TS1.33: The Reactor secured and Reactor shutdown definitions provided in TS 1.32 and TS 1.33 differ from the definitions the NRC has previously found acceptable. The definitions for Reactor Secured and Reactor Shutdown are provided in ANSI/ANS- 15.1-2007, Section 1 as tailored by NUREG-1537. The following are definitions, from guidance provided in NUREG 1537, Appendix 14.1, deemed acceptable:

Reactor secured: A reactor is secured when:

1. Either there is insufficient moderator available in the reactor to attain criticality or there is insufficient fissile material present in the reactor to attain criticality under optimum available conditions of moderation and reflection;

2. Or the following conditions exist:

a. The reactor is shutdown, as required by TS 1.33, and;

b. The requirements of the reactor secure procedure are met.

Reactor shutdown: A reactor is shutdown when the following conditions exist:

a. The minimum number of neutron absorbing control devices is fully inserted or other safety devices are in shutdown position, as required by TS;

b. The console key switch is in the off position, and the key is removed from the lock;

c. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods;

d. No experiments are being moved or serviced that have, on movement, reactivity worth exceeding the maximum value allowed for a single experiment, or one dollar, whichever is smaller.

Note: For subparagraph d., a single value should be chosen to specify the smaller value of either "one dollar" or "the maximum value allowed for a single experiment." Do not specify both options in the definition.

Please evaluate PUR-1 TS 1.33 against the suggested definitions for Reactor secured and Reactor shutdown and propose TS changes or justify your current definitions.

The definitions for Reactor Secured and Reactor Shutdown are to be changed as follows (as suggested in ANSI 15.1-2007 with some minor modifications for operations at PUR-1, none of which change the intent):

1.32 Reactor secured: A reactor is secured when:

a. Either there is insufficient moderator available in the reactor to attain criticality or there is insufficient fissile material present in the reactor to attain criticality under optimum available conditions of moderation and reflection;

b. Or the following conditions exist:

i. The minimum number of neutron absorbing control devices is fully inserted or other safety devices are in shutdown position, as required by technical specifications;

ii. Electrical power to the control rod circuits is switched off via the console key switch, and the switch key is in proper custody.

iii. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods;

iv. No experiments are being moved or serviced that have, on movement, reactivity worth exceeding the maximum value allowed for a single experiment.

1.33 Reactor shutdown: The reactor is shut down if it is subcritical by at least one dollar in the reference core condition with the reactivity worth of all installed experiments included.

Justification: To bring TS into alignment with ANSI/ANS-15.1-2007 and NUREG 1537.

4. TS 1.36 and TS 6.6.2: ANSI/ANS-15.1-2007, Section 6.7.2 provides a schedule of events that require special reports. The Reportable Occurrence definition in PUR-1 TS 1.36 that addresses these special reports does not appear to be consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.7.2. Additionally, per NUREG-1537, Appendix 14.1, TS 6.6.2 should state that special written reports should be sent to the NRC document control desk and special telephone reports of events should be made to the NRC Operations Center. Please propose changes to the TS or provide an explanation describing your reason(s) for not incorporating the changes.

The definition of Reportable Occurrence is removed from the Technical Specifications, and left to T.S. 6.6.2, which brings the TS into closer alignment with ANSI/ANS 15.1 and NUREG 1537.

The following section will be added to the technical specifications:

6.6.2 Non-Routine Reports

a. Special Reports

Special reports are used to report unplanned events as well as planned major facility and administrative changes. The following schedule shall be incorporated in the specifications:

(1) There shall be a report not later than the following working day by telephone and confirmed in writing by facsimile or similar conveyance to licensing authorities, to be followed by a written report to NRC Document Control that describes the circumstances of the event within 14 days of any of the following:

(a) operation with actual safety system settings for required systems less conservative than the limiting safety system settings specified in the technical specifications,

(b) operation in violation of limiting conditions for operation established in the technical specifications unless prompt remedial action is taken as permitted in Sec. 3,

(c) a reactor safety system component malfunction that renders or could render the reactor safety system incapable of performing its intended safety function. If the malfunction or condition is caused by maintenance, then no report is required.

(d) an unanticipated or uncontrolled change in reactivity greater than 0.6% Δk/k,

(e) abnormal and significant degradation in reactor fuel or cladding, or both, coolant boundary,

(f) an observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to reactor safety;

Justification: To bring TS into alignment with ANSI/ANS-15.1-2007 and NUREG 1537.

7. ***TS Section 3.0: NUREG-1537 states the content of the TSs follow ANSI/ANS 15.1 guidance. ANSI/ANS-15.1-2007 Section 3.5 provides specifications for the ventilation systems. Section 3 of the PUR-1 TSs does not contain Limiting Conditions for Operation of the Ventilation Systems as referenced by ANSI/ANS-15.1-2007. Please propose TS changes for the ventilation system limiting conditions for operations (LCOs) or provide an explanation describing your reason(s) for not incorporating the changes.***

The ventilation system for the reactor room is always on, except during maintenance and testing. Maintenance and testing do not generally occur during operations.

The PUR-1 TS do contain an LCO for operation of the ventilation system, TS 3.4. The TS 3.4.a.1 was changed in response to Q11, and is shown here.

3.4 Confinement

Applicability - This specification applies to the integrity of the reactor room.

Objective - The objective is to limit and control the release of airborne radioactive material from the reactor room.

Specification -

a. During reactor operation the following conditions will be met:

1. The reactor room will be maintained at a negative pressure of at least 0.05 inches of water with the operation of the room exhaust fan.

10. ***TS 3.3: ANSI/ANS-15.1-2007, Section 3.3 provides a list of minimum operating equipment or operating limits, or both, for the limiting conditions for operations for the coolant systems. PUR-1 TS 3.3 specifies the limiting conditions for operations for the water chemistry and coolant level specifications. PUR-1 TS 3.3 does not contain specifications for the reactor pool coolant system parameters listed in ANSI/ANS 15.1, Section 3.3, such as pool temperature (core cooling) or leak or loss-of-coolant detection. Please propose TS changes to meet the specification operating limits for the coolant system by ANSI/ANS 15.1, Section 3.3 or provide an explanation describing your reason(s) for not incorporating the changes.***

The appropriate items from ANSI 15.1-2007, Sec. 3.3 are included in the TS 3.3, namely pH and resistivity (as suggested in 3.3(9) of ANSI 15.1), and coolant level limits (as suggested in 3.3(3) of ANSI 15.1). None of the other systems mentioned in ANSI 15.1-2007, Sec. 3.3 are applicable to PUR-1.

As determined in NUREG-1283, the Safety Evaluation Report for PUR-1, Section 14.4,

> "The reactor pool is designed to prevent unintentional drainage. The pool is constructed of a stainless steel liner and set in a second steel tank with the interstitial region filled with sand. The tank rests on a concrete pad about 4.6 m below the floor of the reactor room, which is in the basement of the building. The pool has no drains or coolant pipes that could open or break. Therefore, a sudden loss of coolant is considered to be extremely unlikely. Furthermore, if the pool drained instantaneously, while the reactor was operating, the loss of water (moderator) would shut down the reactor."

The pool water level is checked at least weekly, and before every startup. And historical records of makeup water use are maintained. Substantive changes in makeup water volumes would be identified each time makeup water is added, and compared to historical data. Therefore, a leak or loss-of-coolant detection system is not required.

No changes will be made to TS 3.3.

17. TS Section 4.0: ANSI/ANS-15.1-2007, Section 4 states that for each surveillance requirement (SR), it should be specified if the surveillance activity can or cannot be deferred during reactor shutdown, as well as, guidance pertaining to deferred SR that must be performed prior to reactor operations.

(a) a. Please identify those surveillances that may be deferred during reactor shutdown, and;

(b) b. Identify systems and/or components that require surveillance after any addition, modification, or maintenance before declaring that system operational in accordance with the original specifications to which the systems were designed and fabricated.

This is already done in TS 4.1 and 4.2. For 4.3, the following changes are made:

a. The pH of the primary coolant shall be recorded monthly, not to exceed six weeks. This cannot be deferred during reactor shutdown.

b. The conductivity of the primary coolant shall be recorded monthly, not to exceed six weeks. This cannot be deferred during reactor shutdown.

c. The reactor pool water will be at or above the height of the skimmer trough whenever the reactor is operated.

d. The primary coolant shall be sampled monthly, not to exceed six weeks, and analyzed for gross alpha and beta activity. This cannot be deferred during reactor shutdown.

19. TS 4.3. TS 4.3(d) specifies a monthly primary coolant sampling requirement for gross alpha and beta activity. Please update the TS to indicate under which modes of reactor operation monthly sampling is required. Also, consider whether a corresponding LCO for this surveillance is required in TS 3.3

This was already answered in the response to Q17. An LCO is not necessary.

20. TS 4.4(d): TS 4.4(d) specifies inspection requirements for the fuel cladding. Per the guidance of ANSI/ANS-15.1-2007, fuel inspections, if appropriate, are normally included as part of reactor core parameters (Section 3.1 / Section 4.1). Please consider moving TS 4.4(d) for inspecting fuel assemblies into a separate TS from confinement surveillance. Additionally, please identify the Section 3 LCO that establishes the minimum performance level for this surveillance or add an LCO, if needed.

TS 4.4.d has been moved to TS 5.2.5, as recommended in ANSI 15.1 Sec 5.3.

5.2 Fuel Assemblies

5.2.5 Representative fuel assemblies shall be inspected annually for channel blockage or plate deformation, with no interval to exceed 15 months.

22. ANSI/ANS-15.1-2007, Section 4.7.2 provides for dosimetry monitoring of effluents at the boundary of the facility and for environmental monitoring, e.g., sampling of soil, vegetation, or water in the vicinity of the facility. TS 6.6.1.a.4. discusses results of surveillances required by these TSs, but the PUR-1 TS do not appear to contain any such surveillance requirements. Please propose TSs to address these requirements, reference where the requirements exist, or provide an explanation describing your reason(s) for not incorporating the changes.

PUR-1 is a small training reactor, and generates no effluents. The TS 6.6.1 discusses the annual report requirements, which is similar to the requirements outlined in ANSI 15.1-2007 6.7.2. The annual reports have summarized that PUR-1 releases no effluents.

24. TS 5.3. Guidance in ANSI/ANS-15.1-2007, Section 5.3 states there should be requirements for periodic fuel inspection and conditions for operation, as appropriate for operation of the reactor with damaged fuel. Please update the TS to establish surveillance for fuel condition and limiting conditions for operation when and if the reactor can operate with damaged fuel (LCO) or justify why these are not required.

A description for surveillance of the fuel condition is already provided for in 4.4.d (now 5.3.6) and 4.3.d.

Based on the long successful history of fuel integrity at PUR-1, the excellent control of water chemistry with no evidence of fuel degredation, and the fact that coolant water is tested monthly to verify fuel integrity, PUR-1 does not see an LCO for operation with damaged fuel as necessary.

29. TS 6.1.11, TS 6.1.14: ANSI/ANS-15.1-2007, Section 6.1.3(3) provides guidance for events requiring the presence at the facility of the senior reactor operator. Please update PUR-1 TS 6.1.11 and 6.1.14 for compliance with the requirements in ANSI/ANS-15.1- 2007, Section 6.1.3(3) and 10 CFR 50.54(m)(1) or provide an explanation describing your reason(s) for not incorporating the changes.

TS 6.1.11 and 6.1.14 have been moved to the new 6.1.2 (Staffing). Item (3) reads as follows:

(3) Events requiring the presence at the facility of a senior reactor operator are

(a) Initial startup and approach to power following a core change. The presence of an SRO at the reactor facility is unnecessary for the initial daily start up, provided the core remains unchanged from the previous run;

(b) All fuel or control-rod relocations within the core region;

(c) Recovery from an unplanned or unscheduled shutdown except in instances which resulting from the following

(i) A verified electrical power failure or interruption exclusive of internal power supply failures or interruption of the reactor instrumentation, control, and safety systems;

(ii) Accidental manipulation of equipment in a manner which does not affect the safety of the reactor;

(iii) A verified practice of the evacuation of the building initiated by persons exclusive of reactor operations personnel.

The SRO shall be notified of the shutdown and shall determine its cause. If due to one of the enumerated reasons above, he shall decide if his presence is necessary for a subsequent start up.

34. Section 5.1 Site and Facility Description. ANSI/ANS-15.1-2007, Section 5.1 provides guidance to provide a general description of the site and facility including location and exclusion areas. Please update TS 5.1 to describe in detail which areas are under the jurisdiction of the reactor license (licensed area) and include a description of the facility location, as well as, the location of exclusion and restricted areas, as appropriate.

Section 5.1 of ANSI 15.1-2007 reads as follows:

5.1 Site Description

5.1.1 The reactor is located on the ground floor of the Duncan Annex of the Electrical Engineering Building, Purdue University, West Lafayette, Indiana.

5.1.2 The School of Nuclear Engineering controls approximately 5000 square feet of the Duncan Annex ground floor, which includes the reactor room. Access to the Nuclear Engineering controlled area is restricted except when classes are held there.

5.1.3 The licensed areas include the reactor room, and a fuel storage room. Both of these areas are restricted to authorized personnel, or those escorted by authorized personnel.

5.1.4 The reactor room remains locked at all times except for the entry or exit of authorized personnel or those escorted by authorized personnel, equipment, or materials.

5.1.5 The PUR-1 reactor room is a closed room designed to restrict leakage.

5.1.6 The minimum free volume of the reactor room is approximately 15,000 cubic feet.

5.1.7 The ventilation system is designed to exhaust air or other gases from the reactor room through an exhaust vent at a minimum of 50 feet above the ground.

5.1.8 Openings into the reactor room consist of the following:

a. Three personnel doors

b. One door to a storage room with no outside access.

c. Air intake

d. Air exhaust

e. Sewer vent

The information requested in this question is already provided in 5.1.3.

40. TS 4.2(a) and Table III. The Reactor Safety System channels required to be tested before each reactor startup following a shutdown in excess of 8 hours are provided in Table III as referenced by TS 4.2(a). The 8 hour requirement for this specification has no basis. Please provide adequate justification for the 8 hour requirement or revise the TS to be consistent with NUREG-1537, Appendix 14.1, which requires surveillance only if the reactor is secured (assuming the updated definitions for reactor shutdown and reactor secured as tailored by NUREG-1537 (see RAI 3)). The following is an example revision based on NUREG 1537, Appendix 14.1 previously found acceptable to the NRC: a. A channel test of each of the reactor safety system channels listed in Table III shall be performed prior to reactor operation: i. anytime the reactor has been placed in a secure condition, and ii. monthly, not to exceed 6 weeks, since last channel test < LIST TABLE III SURVEILLANCES>

We disagree with the definitions suggested in Q3, and have modified our existing definitions slightly to be more consistent with ANSI 15.1. However, they were already similar to the ANSI 15.1 recommended definitions for "reactor shutdown" and "reactor secure".

The reactor can be placed in a secure shutdown condition by the removal of the key from the console key switch (which opens the circuit for the control rod electromagnets) without de-energizing any of the other instrumentation and control systems. This would allow for an operator to leave the room with other non-operating personnel present, then he can return and resume operations without performing a new start-up with channel tests. This is of particular importance with a small operations staff such as the one at PUR-1.

Furthermore, item (5) of NUREG 1537 Appendix 14.1 (see page 32 of Appendix 14.1) reads as follows:

> *"(5) Scram and Power Measuring Channels*
>
> *Channel tests of all scram and power measuring channels required by technical specifications, including scram actions with safety rod release and interlocks, should be performed before each reactor startup following a shutdown of more than **24 hours** or following each secured shutdown. If the reactor operating schedule calls for no secured shutdowns, the channel tests should be performed at least quarterly."*

There appears to be some disparity between NUREG 1537 and ANSI 15.1 over what secured shutdown entails. Utilizing the present definition of "reactor secured" from ANSI 15.1 (see the answer to Q3), and the reasoning described above which describes a condition where an operator may need to leave the reactor room temporarily with non-operations personnel present, we do not agree that a channel test is necessary after every such secured shutdown, and the 8 hour requirement is sufficient. Moreover, we feel the 8 hour requirement is justified because: (1) the 8 hour requirement in the PUR-1 TS is more conservative than the 24 suggested by NUREG 1537, (2) the reactor can be placed in a "secured shutdown" condition without de-energizing the I&C systems, (3) based on the operational experience at PUR-1 which indicates that the electronics are stable for periods of days. Therefore, we see no reason to make any changes.