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UNIVERSITY

SCHOOL OF NUCLEAR ENGINEERING

4 Jan 2012

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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)

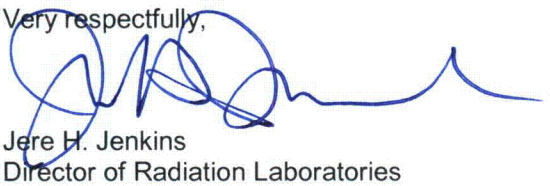
Dear Ms. Montgomery:

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 11, 12, 13, 15, 16, 18, 21, 23, 25, 27, 28, 30, 31, 33, 35, 36, and 37. Further responses will be forthcoming as previously arranged.

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

A020
NRR

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

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

11. NUREG-1537 states the content of the TSs follow ANSI/ANS 15.1 guidance. In TS 3.4, a specification states that the reactor room will be maintained at a negative pressure of 0.05 inches of water, but doesn't state what equipment maintains that negative pressure. ANSI/ANS-15.1-2007 states that equipment required to achieve confinement be specified. There is no specification(s) or surveillances for the ventilation system, which is used to maintain confinement during reactor operations. Please update Section 3 of the TS to identify equipment required to achieve confinement and to specify appropriate surveillances in Section 4 of the TSs for the equipment or provide an explanation describing your reason(s) for not incorporating the changes.

PUR-1 Response

TS 3.4.a.1 will be changed as follows:

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.

Justification: The ventilation system surveillances are described in TS 4.4, including the negative pressure (developed by the exhaust fan pulling through the HEPA filter) which is checked weekly (4.4.a), and the inlet and outlet dampers (TS 4.4.b) checked semi-annually. These surveillances are already covered, therefore no changes are needed

12. TS 3.4. TS 3.4(b) specifies requirements for HEPA filters or equivalent. However, there is no corresponding surveillance associated with the HEPA filters. Please update the TS to include a surveillance that indicates when such filters are checked and any criteria for requiring a filter change or justify why this surveillance is not required.

PUR-1 Response

The surveillance of the HEPA filter is done every time the room pressure is measured. If the negative room pressure requirement is not able to be met, the filter is changed. This pressure is checked weekly as per TS 4.4.a. Therefore, a surveillance requirement is not necessary in the TS.

13. TS 3.4. TS 3.4(d) specifies that the reactor operator can secure the air conditioner. The purpose of this TS or the established constraint on the system is not clear nor substantiated in the bases. Please consider if this TS is required and update the TS and/or bases as required.

PUR-1 Response

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The air conditioner is responsible for the air circulation within the room. Shutting down the air conditioner (which is done on the same switch as the room exhaust fan and damper) limits the spread of contamination from a failed experiment within confinement itself, and will limit the spread of contamination toward the egress doors and possible spread to the environment external to confinement. Therefore, as stated in the Bases, "the specifications stated above will further reduce the release to the environment".

15. ***TS 4.1: ANSI/ANS-15.1-2007 Section 4.1 provides guidance related to annual measurement of core parameters. TS 4.1(a) contains a requirement for shutdown margin calculations without referring to excess core reactivity measurements. Please update TS 4.1(a) to be in conformance with ANSI/ANS-15.1-2007 Section 4.1 or discuss how conformance is achieved.***

PUR-1 Response

The calculation of shutdown margin requires the value of core excess reactivity, so it must be determined prior to calculating shutdown margin. Excess reactivity is determined as part of the shim-safety rod worth measurements.

16. ***TS Section 4.0: NUREG-1537 states the content of the TSs follow ANSI/ANS 15.1 guidance. ANSI/ANS-15.1-2007 Section 4.5 provides surveillance requirements for the ventilation systems. There are no TS under Section 4, Surveillance Requirements, for Ventilation Systems as required by ANSI/ANS-15.1-2007. Please propose TS changes for surveillance of the ventilation system or provide an explanation describing your reason(s) for not incorporating the changes.***

PUR-1 Response

The ventilation system surveillances are described in TS 4.4, including the negative pressure (developed by the exhaust fan pulling through the HEPA filter) which is checked weekly (4.4.a), and the inlet and outlet dampers (TS 4.4.b) checked semi-annually. These surveillances are already covered, therefore no changes are needed.

18. ***TS 4.3: TS 4.3(c) should reference the minimum 13 foot depth as specified in the LCO (TS 3.3(c)) for primary coolant and provided in the bases for TS 4.3. Please update the TS to include the numerical minimum depth and surveillance interval for this surveillance or justify why an alternative measure related to the height of the skimmer trough in TS 4.3(c) is more appropriate for specifying the minimum performance level of TS 3.3(c). Additionally, prescribe the frequency, scope and minimum water level of this surveillance when the reactor is secured or shutdown or justify why a minimum level is not required.***

PUR-1 Response

The surveillance interval is already included, it is whenever the reactor is operated, as it is also a LCO.

The text will be changed as follows:

c. The reactor pool water will be at a height of the 13 feet over the top of the core whenever the reactor is operated.

Bases When the reactor pool water is at a height of 13 feet above the core, adequate shielding during operations is assured.

The 13 feet of water requirement is for shielding during operations. No minimum level is necessary for safety during shutdown.

21. TS 4.5: ANSI/ANS-15.1-2007, Section 6.5. provides the review and approval process to comply with the guidance provided in Section 6.2.3, unless it is a "tried experiment". PUR-1 TS 4.5 does defer the proper review and approval of the experiment to Section 6 of the TSs. However, PUR-1 TS 6.2.4(a) and 6.2.4(c) do not provide any of the formal review requirements or established and approved procedures for experiments. Please update the formal review and approval requirements for experiments in PUR-1 TS 6.2.4 to include the requirements of ANSI/ANS-15.1-2007, Section 6.5, identify where the provisions are contained in the PUR-1 TS, or justify why they are not required.

PUR-1 Response

Please see the response to Q27.

23. TS 5.0: NUREG-1537 states the content of the TSs follow ANSI/ANS 15.1 guidance. ANSI/ANS-15.1-2007 Section 5.0 provides the requirements for Design Features. There are no PUR-1 TSs under Section 5, Design Features, for the following systems:

- ***a. Control Elements, as required by ANSI/ANS-15.1-2007 TS 5.2,***
- ***b. Reactor Coolant System, as required by ANSI/ANS-15.1-2007 TS 5.2,***
- ***c. Ventilation Systems, as required by ANSI/ANS-15.1-2007 TS 5.1 Please propose changes to TS for the aforementioned systems or provide an explanation describing your reason(s) for not incorporating the changes.***

PUR-1 Response

The TS have been changed to reflect the questions in parts a and b as follows:

5.2 Reactor Coolant System

5.2.1 Primary Cooling System – The PUR-1 primary cooling system is a pool containing approximately 6,400 gallons of water.

5.2.2 Process Water System – The process water system is assembled in one unit and contains a pump, filter, demineralizer, valves, flow meters, and a heat exchanger (see 5.2.4). The demineralizer contains a removable cartridge that is monitored continuously for radioactivity buildup. This system limits, by the use of filters and ion-exchange resin, the aluminum corrosion rate, corrosion product buildup, and neutron activation of impurities in the coolant.

5.2.3 Primary Coolant Makeup Water System – Makeup water for the pool is taken batchwise from the Purdue University water line and is passed through the demineralizer enroute to

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the pool. A vacuum breaker excludes any possibility of siphoning pool water into the supply line. The pool makeup water system, in addition to the demineralizer, also includes a normally closed manual shutoff and throttle valve and a check valve.

5.2.4 Primary Coolant Chiller System – The chiller is designed with three loops. Pool water passes through the primary loop, a Freon refrigerant is in the secondary loop, and water from the building water supply is used to remove heat, which is then discharged to the building sewer system. The heat-removal capacity of the heat exchanger is 10.5 kW. It was designed to maintain the reactor pool temperature at 75°F during continuous operation at 10 kW.

5.3 Reactor Core and Fuel

5.3.1 The fuel assemblies shall be MTR type consisting of aluminum clad plates enriched up to 20% in the U-235 isotope.

5.3.2 A standard fuel assembly shall consist of up to 14 fuel plates containing a maximum of 180 grams of U-235.

5.3.3 A control fuel assembly shall consist of up to 8 fuel plates containing a maximum of 103 grams of U-235.

5.3.4 Partially loaded fuel assemblies in which some of the fuel plates are replaced by aluminum plates containing no uranium may be used.

5.3.5 The core configuration shall consist of 13 standard fuel assemblies as described in 5.3.2, and 3 control fuel assemblies as described in 5.3.3, and two shim-safety rods and one regulating rod.

5.3.6 Representative fuel assemblies shall be inspected annually, with no interval to exceed 15 months.

The ventilation system is described in TS 5.1.7.

25. TS 6.2.4, TS 6.2.5: Guidance in ANSI/ANS-15.1-2007 states there should be an individual or group responsible for implementing the radiation protection program at PUR-1 and an individual or group that performs periodic audits of the program. In TS 6.2.4 and TS 6.2.5 there is no mention of who is responsible for the radiation protection program at PUR-1 or who performs the periodic audits. Please propose changes to TS or provide an explanation describing your reason(s) for not incorporating the changes

PUR-1 Response

PUR-1 has operated under the Purdue University Radiation Safety Program since its early development, which is under the responsibility of the University Radiation Safety Officer and the Institution Radiation Safety Committee. This was mentioned in 6.1.5 of the submitted TS, and 6.1.1.d of the revision submitted with these answers. It was also described in 6.1.7 of the original submission, which is now 6.1.4 of the revision. Audits of the Radiation Safety Program are carried out annually by the Radiation Safety Officer.

27. ***TS 6.2.4(c): ANSI/ANS-15.1-2007, Section 6.2.3 provides guidance for the review function for experiments as well as other activities. PUR-1 TS 6.2.4(c) indicates that the Committee on Reactor Operations (CORO) shall review and approve "proposed tests or experiments which are significantly different from previous approved tests or experiments." Please explain what is meant by "significantly different" and propose a quantitative, less subjective, revision to PUR-1 TS 6.2.4.c. that incorporates CORO review for all of the items outlined in ANSI/ANS-15.1-2007, Section 6.2.3 or provide an explanation describing your reason(s) for not incorporating the changes.***

PUR-1 Response

6.2.4(c) as written is very similar to ANSI 15.1-2007 6.5(2), which reads:

> **6.5 Experiments review and approval**
>
> Approved experiments shall be carried out in accordance with established and approved procedures. The following provisions shall be stated:
>
> (1) All new experiments or class of experiments shall be reviewed by the review group (see Sec. 6.2.3) and approved in writing by Level 2 or designated alternates prior to initiation;
>
> (2) Substantive changes to previously approved experiments shall be made only after review by the review group and approved in writing by Level 2 or designated alternates. Minor changes that do not significantly alter the experiment may be approved by Level 3 or higher.

The details to be reviewed as discussed in TS 6.2.4 a-c are similar to the requirements of ANSI 15.1-2007 Sec. 6.2.3(1-3), and the use of "substantive changes" in to ANSI 15.1-2007 6.5(2) is similar to the use of "significantly different" in TS 6.2.4c. The critical concept required to be reviewed is the safety significance of the changes.

28. ***The regulations in 10 CFR 20.1101 require that each licensee develop, document, and implement a radiation protection program. NUREG-1537, Chapter 12.1 states that the organization should meet the non-power reactor standard ANSI/ANS-15.1-2007. ANSI/ANS-15.1, Section 6.3 states that the facility shall implement a radiation protection program in accordance with the guidelines in ANSI/ANS-15.1. However the radiation protection program is not presented or discussed in the PUR-1 TS 6.0. Please provide a TS to meet the criteria in 10 CFR 20.1101 and ANSI/ANS-15.1, Section 6.3 or provide an explanation describing your reason for not incorporating the change.***

PUR-1 Response

PUR-1 has operated under the Purdue University Radiation Safety Program since its early development, which is under the responsibility of the University Radiation Safety Officer and the Institution Radiation Safety Committee. This was mentioned in 6.1.5 of the submitted TS, and 6.1.1.d of the revision submitted with these answers. It was also described in 6.1.7 of the original submission, which is now 6.1.4 of the revision.

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30. TS 6.6.2: ANSI/ANS-15.1-2007, Section 6.6.2 and 6.7.2(1) provide guidance on licensee actions following a reportable occurrence. It is not specified in the PUR-1 TS 6.6.2 who can authorize restart of the reactor after a reportable occurrence where the reactor was shut down. Please clarify this authority.

PUR-1 Response

The following changes have been made to the TS:

TS 6.3 was moved to TS 6.6 as 6.6.1 to more closely align with ANSI 15.1-2007, and the suggested text from ANSI 15.1-2007 Sec 6.6.2 was added to clarify the authority to restart, as shown below:

6.5 Required Actions

The following actions shall be taken relating to the types of events listed in Secs. 6.6.1 and 6.6.2

6.5.1 The following actions shall be taken in the event the Safety Limit is violated:

(1) The reactor will be shut down immediately and reactor operation will not be resumed without authorization by the Commission.

(2) The Safety Limit Violation shall be reported to the Director of the appropriate NRC Office of Inspection and Enforcement (or designee), the Laboratory Director and to the CORO not later than the next work day.

(3) A Safety Limit Violation Report shall be prepared. The report shall be reviewed by the CORO. This report shall describe (1) applicable circumstances preceding the violation, (2) effects of the violation upon facility components, systems or structures, and (3) corrective action taken to prevent recurrence.

(4) The Safety Limit Violation Report shall be submitted to the Commission, the CORO and the Reactor Supervisor within 14 days of the violation, in support of a request to the Commission for authorization to resume operations.

6.5.2 The following actions are to be taken in the event of reportable occurrence as defined in 1.36 .

(1) Reactor conditions shall be returned to normal, or the reactor shall be shut down. If it is necessary to shut down the reactor to correct the occurrence, operations shall not be resumed unless authorized by Level 2 or designated alternates;

(2) Occurrence shall be reported to Level 2 or designated alternates and to chartering or licensing authorities as required;

(3) Occurrence shall be reviewed by the review group at its next scheduled meeting.

31. ANSI/ANS-15.1-2007, Section 6.7.2(2) provides guidance for a TS requirement to provide a written report to the NRC within 30 days of permanent changes in the PUR-1 organization involving Level 1 or 2 personnel and significant changes in transient or accident analyses as described in the SAR. This requirement does not seem to appear in TS 6.6. Please amend PUR-1 TS 6.6 to include these requirements, provide reference to where these requirements

exist in the TS, or provide an explanation describing your reason(s) for not incorporating the changes.

PUR-1 Response

The following was added as TS 6.6.2(2)

(2) There shall be a written report within 30 days to the chartering or licensing authorities of the following:

(a) Permanent changes in the facility organization involving Level 1 or 2 personnel

(b) significant changes in the transient or accident analysis as described in the Safety Analysis Report.

33. Section 5.0 Design Features - This section of the TS requires applicability, objective and bases statements per 10 CFR 50.36. Please update the PUR-1 TS to satisfy this regulatory requirement.

PUR-1 Response

PUR-1 does not agree with this question, since the words "applicability" and "objective" do not appear in 10 CFR 50.36. Furthermore, ANSI 15.1 does not suggest the necessity of Applicability or Objective statements or bases for Sec. 5 (see ANSI 15.1, Sec. 1.2.2), they are only required for Secs. 2, 3, and 4.

Furthermore, 10 CFR 50.36 (a)(1) states:

> "Each applicant for a license authorizing operation of a production or utilization facility shall include in his application proposed technical specifications in accordance with the requirements of this section. 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 technical specifications."

Since PUR-1 has a long operating history of safe operation, in addition to the fact that the facility has been licensed previously with these technical specifications approved, no further bases are required.

35. TS 6.1.8 states that a qualified operator is required at the operating console unless the reactor is shutdown. ANSI/ANS-15.1-2007, Section 6.1.3 (1) requires a licensed operator at the controls unless the reactor is secured. Please update the PUR-1 TS to be consistent with ANSI/ANS-15.1-2007 or justify why a qualified operator is not required at the controls when the reactor is shutdown per PUR-1 TS 1.33.

PUR-1 Response

ANSI 15.1-2007, Section 6.1.3(1) requires "a licensed reactor operator in the control room", not a licensed operator "at the controls" as suggested by Question 35. Since the controls for the reactor sit adjacent to the reactor pool, there is no "control room" per se. The intent of ANSI 15.1-2007, Section 6.1.3(1) is met in TS 6.1.8, as written.

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36. ***Staffing - The minimum requirements for staffing the reactor in Section 6 of the PUR-1 TSs and not readily clear. ANSI/ANS-15.1-2007, Section 6.1.3 provides guidance for minimum staffing as tailored by NUREG-1537. The following wording for minimum staffing as provided in NUREG 1537, Appendix 14.1 was previously deemed acceptable by the NRC: Staffing requirements 1. The minimum staffing when the reactor is operating shall be: a. A licensed reactor operator or senior reactor operator in the control room, b. A second designated person present at the facility complex able to carry out prescribed written instructions. The instructions may, for more complex and higher-power reactors, require initiating the first stages of the emergency plan including evacuation and initial notification procedures. Unexpected absence for as long as 2 hours to accommodate a personal emergency may be acceptable provided immediate action is taken to obtain a replacement, c. A designated senior reactor operator shall be present at the facility or readily available on call. "Readily Available on Call" means an individual who: i. has been specifically designated and the designation known to the operator on duty, ii. can be rapidly contacted by phone, by the operator on duty, iii. is capable of getting to the reactor facility within a reasonable time under normal conditions (e.g., 30 minutes or within a 15-mile radius); 2. The minimum staffing when the reactor is shutdown shall be a licensed reactor operator or senior reactor operator in the licensed facility. 3. No licensed reactor operator or senior reactor operator shall be required within the licensed facility if the reactor is secure.***

PUR-1 Response

Many of these requirements already existed in the PUR-1 TS, but they were not organized as recommended by ANSI 15.1, since they were written before ANSI 15.1 existed. The technical specifications have been reorganized and modified slightly as shown below, to more closely match the ANSI 15.1 format.

6.1.2 Staffing

(1) The minimum staffing when the reactor is not secured shall be

(a) A licensed reactor operator in the reactor room,

(b) The minimum crew for operating the reactor shall consist of 2 (two) persons, one of whom must be an NRC licensed member of the PUR-1 operations staff, the second crew member must be instructed as to how to shut down the reactor in the event of an emergency.

(c) A designated senior reactor operator (unless the operations staff consists of only one senior reactor operator, and that individual is operating the reactor) shall be present or readily available on call at any time that the reactor is operating. "Readily Available on Call means an individual who

(i) Has been specifically designates and the designation is known to the operator on duty,

(ii) Can be rapidly contacted by phone or other method by the operator on duty,

(iii) Is capable of getting to the reactor facility within a reasonable time under normal conditions

(2) No licensed reactor operator or senior reactor operator shall be required within the licensed facility if the reactor is secure.

(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.

37. PUR-1 Organization: Neither Figure 6.1 nor TS 6.1.5 clearly indicate the organizational level of the Head of Nuclear Engineering. Please update the figure and/or TS to reflect the level of authority for the Head of the school of Nuclear Engineering or justify why it is not required.

PUR-1 Response

The NE department head was in the original organization chart from the 1988 license, which predated the licensee levels specified in ANSI 15.1. Since the organization has been changed to reflect the ANSI 15.1 style license levels, we have removed the NE department head from the organization chart, and TS 6.1.5 has been modified as follows:

In all matters pertaining to the operation of the reactor and the administrative aspects of these technical specifications, the Laboratory Director (Level 2) [or the Reactor Supervisor (Level 3) in the absence of the Laboratory Director] shall report to and be directly responsible to the Level 1 Licensee, the Dean of the College of Engineering. In all matters pertaining to radiation safety they shall be responsible to the Radiation Safety Committee.

Figure 6.1 has been modified to reflect that change.

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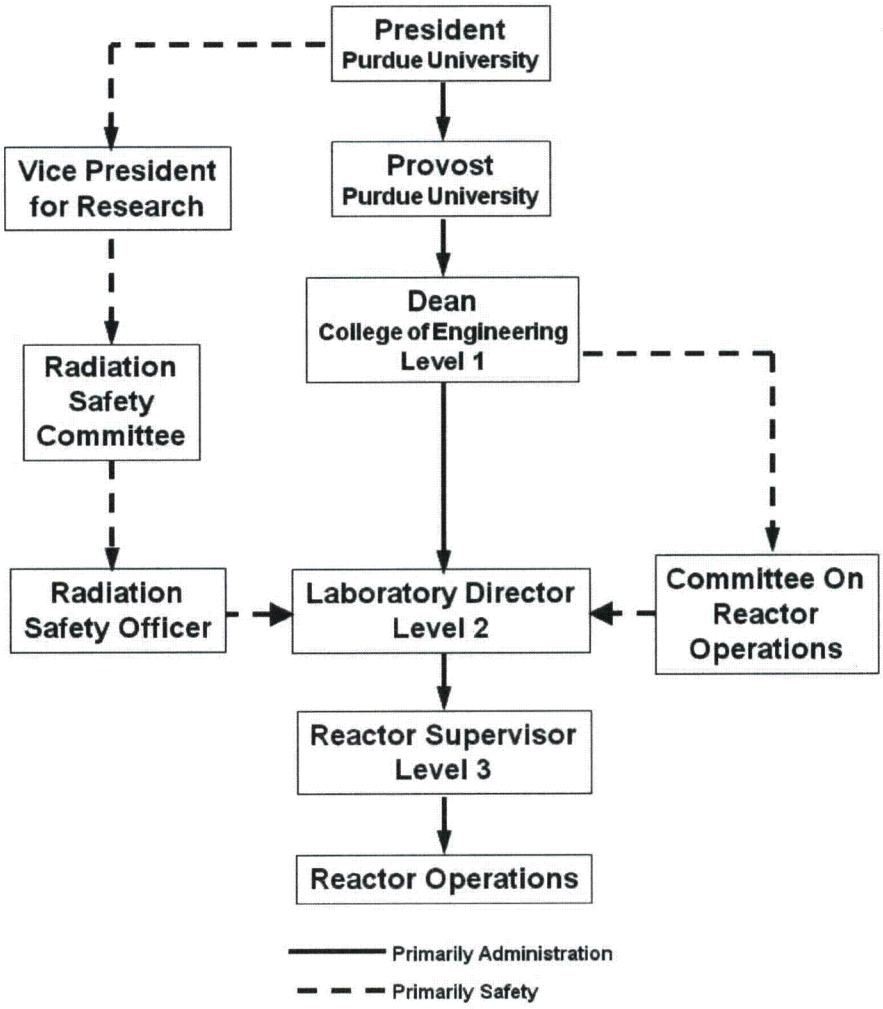

FIGURE 6.1: PUR-1 Organization

38. TS 6.1.6. Please review TS 6.1.6 and correct the typographical error associated with reference to ANSI/ANS-15.4.

PUR-1 Response

Minimum Qualifications of Reactor Personnel - The minimum qualifications should be consistent with the American National Standard for the Selection and Training of Personnel for Research Reactors, ANSI/ANS 15.4, and include the following:

Justification of the change is to correct a typo.

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39. TS 6.5 Operating Records to be retained for the Lifetime of the Reactor Facility. The regulations in 10 CFR 50.36 require that reviews of exceeding the safety limit (10 CFR 50.36(c)(1)(i)(A)), reviews of the failure of the automatic safety system that protects the limiting safety system settings (LSSSs) (10 CFR 50.36(c)(1)(ii)(A)) and reviews of not meeting limiting conditions for operation (10 CFR 50.36(c)(2)(i)) be retained until the Commission terminates the license. Please add these items to section 6.5 of the TSs.

PUR-1 Response

The technical specifications have been changed as shown:

6.5.2 The following records and logs shall be prepared and retained for the life of the facility:

a. Gaseous and liquid waste released to the environs.

b. Offsite environmental monitoring surveys.

c. Radiation exposures for all PUR-1 personnel.

d. Updated, corrected, and as-built facility drawings.

e. Annual operating reports.

f. Reviews of instances where the safety limit was exceeded.

g. Reviews of failure of the automatic safety system that protects the limiting safety system settings (LSSSs).

h. Reviews of instances where limiting conditions of operation were not met.

Justification of the change is to bring the Technical Specifications into compliance with 10 CFR 50.36.

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