Advanced Passive 1000 (AP1000)
Generic Technical Specification Traveler (GTST)

Title: Changes Related to LCO 3.3.1, Reactor Trip System (RTS) Instrumentation

I. Technical Specifications Task Force (TSTF) Travelers, Approved Since Revision 2 of STS NUREG-1431, and Used to Develop this GTST

TSTF Number and Title:

TSTF-347-A, Rev 1, P-7 Surveillance
TSTF-371-A, Rev 1, NIS Power Range Channel Daily SR TS Change to Address Low Power Decalibration
TSTF-418-A, Rev 2, RPS and ESFAS Test Times and Completion Times (WCAP-14333)
TSTF-425-A, Rev 3, Relocate Surveillance Frequencies to Licensee Control – RITSTF Initiative 5b
TSTF-453-T, Rev 2, Addition of New Tech Spec on RCS Boron Limits and Revisions to Tech Spec 3.3.1 to address RWFS
TSTF-483-T, Rev 1, Delete TS 3.3.1, Condition D, Power Range Neutron Flux – High Channel Inoperable
TSTF-519-T, Rev 0, Increase Standardization in Condition and Required Action Notes

STS NUREGs Affected:

TSTF-347-A, Rev 1: NUREG 1431
TSTF-371-A, Rev 1: NUREG 1431
TSTF-418-A, Rev 2: NUREG 1431
TSTF-425-A, Rev 3: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-453-T, Rev 2: NUREG 1431
TSTF-483-T, Rev 1: NUREG 1431
TSTF-519-T, Rev 0: NUREG 1430 and 1431

NRC Approval Date:

TSTF-347-A, Rev 1: 27-Mar-02
TSTF-371-A, Rev 1: 02-Apr-02
TSTF-418-A, Rev 2: 02-Apr-03
TSTF-425-A, Rev. 3: 06-Jul-09
TSTF-453-T, Rev 2: 18-Jan-05
TSTF-483-T, Rev 1: 19-Dec-05
TSTF-519-T, Rev 0: 16-Oct-09 (TSTF Review)

TSTF Classification:

TSTF-347-A, Rev 1: Technical Change
TSTF-371-A, Rev 1: Technical Change
TSTF-418-A, Rev 2: Technical Change
TSTF-425-A, Rev 3: Technical Change

TSTF-453-T, Rev 2: Technical Change
TSTF-483-T, Rev 1: Technical Change
TSTF-519-T, Rev 0: NUREG Only Change

II. Reference Combined License (RCOL) Standard Departures (Std. Dep.), RCOL COL Items, and RCOL Plant-Specific Technical Specifications (PTS) Changes Used to Develop this GTST

RCOL Std. Dep. Number and Title:

There are no Vogtle Electric Generating Plant Units 3 and 4 (Vogtle or VEGP) departures applicable to GTS 3.3.1.

RCOL COL Item Number and Title:

There are no Vogtle COL items applicable to GTS 3.3.1.

RCOL PTS Change Number and Title:

The VEGP License Amendment Request (LAR) proposed the following changes to the initial version of the PTS (referred to as the current TS by the VEGP LAR). These changes include Administrative Changes (A), Detail Removed Changes (D), Less Restrictive Changes (L), and More Restrictive Changes (M). These changes are discussed in Sections VI and VII of this GTST.

VEGP LAR DOC A024:	Reformat of GTS 3.3.1 into Seven Parts; 3.3.1 through 3.3.7; note that this maps GTS 3.3.1 requirements into interim A024-modified TS (MTS) Subsection 3.3.1, to which the other changes are applied.
VEGP LAR DOC A025:	SR text phrase change from “the prescribed values” to “within limits.”
VEGP LAR DOC A026:	SR Note Change
VEGP LAR DOC M01:	Deletion of Reactor Trip Channel Operational Test (RTCOT) Definition
VEGP LAR DOC M02:	Provision for Two or More Inoperable Divisions or Channels
VEGP LAR DOC L08:	Delete Required Action D
VEGP LAR DOC L10:	Delete Current TS 3.3.1 Function 16, Interlocks

III. Comments on Relations Among TSTFs, RCOL Std. Dep., RCOL COL Items, and RCOL PTS Changes

This section discusses the considered changes that are: (1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

TSTF-347-A is not applicable to the AP1000 design. AP1000 does not have a P-7 interlock.

TSTF-371-A is not applicable to the AP1000 design. The prescribed absolute differences in NIS channels that require a channel adjustment are different for AP1000. Also, the reactor thermal power thresholds for starting the time clocks on SRs are different for the AP1000. This change may ultimately be applicable to AP1000, but it should be implemented by a separate TSTF written specifically for the AP1000 design.

TSTF-418-A adjusts the WOG STS (NUREG-1431) required action completion times for the conventional Westinghouse Plant Protection System instrumentation design for which the WOG STS instrumentation requirements are applicable. The changes in TSTF-418 are based on the analysis in WCAP-14333-P, which did not consider the AP1000 protection and safety monitoring system (PMS) instrumentation design. The AP1000 GTS required action completion times (and surveillance frequencies) for the PMS were justified by APP-GW-GSC-020 (WCAP-16787), which is listed as Reference 6 in the GTS Subsection 3.3.2 Bases. APP-GW-GSC-020 does not reference WCAP-14333-P, but notes, “the AP1000 protection and safety monitoring system (PMS) redundancy is as good as or better than that of the conventional Westinghouse Plant Protection System. Although the PMS equipment reliability is considered to be equivalent to or better than that of the conventional Westinghouse Plant Protection System, a common basis for comparison to the digital portion of the PMS is not readily available.”

TSTF-425-A deferred for future consideration.

TSTF-453-T is not applicable to the AP1000 design. Based on Westinghouse NSAL-00-016 the proposed changes would revise the Applicability of Function 2. b., Power Range Neutron Flux-Low in Table 3.3.1-1 and add a new Applicability, new Conditions T and U, and the appropriate SRs required to demonstrate Operability of the Function. These changes are required to reflect the current safety analysis assumptions regarding the RCCA bank withdrawal from subcritical event. Westinghouse NSAL-00-016 did not consider the AP1000 design in the analysis.

TSTF-483-T is not applicable to the AP1000 GTS. TSTF-483-T is follow-on to TSTF-418-A, which relaxed TS completion times based on WCAP-14333-P. WCAP-14333-P did not consider the AP1000 design in the analysis. The AP1000 TS completion times and surveillance frequencies were justified by APP-GW-GSC-020 (WCAP-16787).

TSTF-519-T has already been incorporated into the AP1000 GTS regarding the Writer's Guide for Improved Standard Technical Specifications (Reference 4) placement of Notes in TS Actions tables.

IV. Additional Changes Proposed as Part of this GTST (modifications proposed by NRC staff and/or clear editorial changes or deviations identified by preparer of GTST)

In the Bases section for Applicable Safety Analyses, LCO, and Applicability, the statement just prior to the description of each Function in Table 3.3.1-1 (following the P-11 interlock discussion) states that "The LCO generally requires OPERABILITY of three channels in each instrumentation Function." This statement is in conflict with Table 3.3.1-1, which indicates that four channels in each instrumentation Function are generally required. If an instrumentation channel becomes inoperable, reactor operation at power can continue if the inoperable channel is placed in bypass or trip within the specified Completion Time. In addition, the current statement is logically more consistent with the lead-in discussion to this section of the bases regarding channels and functions than it is following a discussion of the P-11 interlock. Therefore, the statement is relocated to be the last paragraph before the discussion on interlocks and is modified to state:

> The LCO generally requires OPERABILITY of four channels in each instrumentation Function. If a required channel becomes inoperable, operation can continue provided the inoperable channel is placed in bypass or trip within the specified Completion Time.

Revise the fourth sentence under the heading "Reactor Trip System Interlocks" in the Bases section for "Applicable Safety Analyses, LCO, and Applicability" for consistency and clarity to state:

> Proper operation of these interlocks supports OPERABILITY of the associated **reactor trip** ~~TS~~ Functions and/or the requirement for actuation logic OPERABILITY. (NRC Staff Comment)

Uniformly use:

- Power Range Neutron Flux,
- Intermediate Range Neutron Flux, and
- Source Range Neutron Flux

in place of other phrases that refer to power, intermediate, and source range instrumentation channels or detectors. (NRC Staff Comment)

Remove "interlock" after P-6 and P-10, except when used to refer to the interlock and not the setpoint-and to be consistent with TS wording. (NRC Staff Comment)

Use the phrase "respective PMS division" in conjunction with instrumentation in the Bases to provide clarity and specificity to the signal discussion. (NRC Staff Comment)

NRC staff proposes to add "excore" and "nuclear instrument" and "Power Range Neutron Flux detectors" for consistency. Under SR 3.3.1.4, modify the last sentence of the first paragraph to state:

> SR 3.3.1.4 compares the AXIAL FLUX DIFFERENCE determined using the incore **neutron flux detector** system to the **excore** nuclear instrument channel AXIAL FLUX DIFFERENCE every 31 effective full power days (EFPD) and adjusts the excore nuclear instrument channel if the absolute difference between the incore and excore AFD is ≥ 3% AFD.

Under SR 3.3.1.4, modify the last sentence of the first paragraph to state:

> If the absolute difference is ≥ 3% AFD the **excore** nuclear instrument channel is still OPERABLE, but must be readjusted. If the **excore** nuclear instrument channel cannot be properly readjusted, the channel is declared inoperable. This surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip Function** ~~function~~.

Under SR 3.3.1.5, add "nuclear instrument" to the first paragraph, so that it states:

> SR 3.3.1.5 is a calibration of the excore **nuclear instrument** ~~channels~~ **(Power Range Neutron Flux) detectors** to the incore **neutron flux** ~~channels~~ **detectors**. If the measurements do not agree, the excore **nuclear instrument** channels are not declared inoperable but must be adjusted to agree with the incore **neutron flux** detector measurements. If the excore **nuclear instrument** channels cannot be adjusted, the **excore nuclear instrument** channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip** Function. (NRC Staff Comment)

In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.7," modify the first sentence of the third paragraph to state:

> The Frequency of prior to **reactor** startup ensures this surveillance is performed prior to critical operations and applies to the ~~source, intermediate and~~ **P**ower **R**ange **Neutron Flux – L**ow **Setpoint** instrument channels.

In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.9," modify the third paragraph to state:

> ~~The~~ **This Surveillance does not include the** CHANNEL CALIBRATION for the ~~power range neutron~~ **Power Range Neutron Flux** detectors**, which** consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore **Power Range Neutron Flux detectors** ~~channels~~. ~~This Surveillance is not required for the power range detectors for entry into MODES 2 and 1 because the plant must be in at least MODE 1 to perform the test.~~

Editorial changes are made throughout the Bases to provide consistent instrumentation terminology. Additional minor editorial changes are also implemented throughout the Bases to correct grammar, provide consistency between sections, and improve clarity.

Identify all acronyms at the first occurrence in the Bases discussion.

Added appropriate references. Adjusted the listed reference order to reflect the order of their initial appearance.

APOG Recommended Changes to Improve the Bases

The modifier “PMS” for “power range detectors,” “Intermediate Range Neutron Flux,” and “Source Range, Neutron Flux,” is unnecessary. Inclusion of “PMS” in the Bases is inconsistent with other PMS instruments, with the LCO requirement nomenclature, and the general AP1000 DCD presentation. Delete “PMS” as a modifier to “power range,” “Intermediate Range,” and “Source Range,” throughout the Bases. NRC staff notes that the initial use of Protection and Safety Monitoring System (PMS) in the Bases for an STS Subsection should be retained. In addition, NRC staff proposes to uniformly use

- Power Range Neutron Flux,
- Intermediate Range Neutron Flux, and
- Source Range Neutron Flux

in place of other phrases that refer to power, intermediate, and source range instrumentation channels or detectors.

The second paragraph of the discussion under Required Action A.1 is not relevant to the RTS Instrumentation Functions listed in STS Table 3.3.1-1. This discussion is captured in the STS LCO 3.3.3 Bases. This paragraph should be deleted.

The tense of the verb in the “Background” section of the Bases for STS Subsection 3.3.1, in the fourth paragraph, last sentence is incorrect. Change “assured” to “assures.”

In the “Background” section of the Bases, change “ESF” to “Engineered Safety Features (ESF)” in the first bullet under the heading “Protection and Safety Monitoring System Cabinets.” ESF – Engineered Safety Features – has not been previously defined.

In the “Background” section of the Bases, change “±” to “plus or minus” in the first paragraph, second sentence, and second paragraph, last sentence under the heading “Nominal Trip Setpoint (NTS).” APOG indicates that this change aligns with Writer's Guide convention. NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4.

In the “Background” section of the Bases under the heading “Reactor Trip Switchgear Interface,” include additional clarifying information for the reactor trip switchgear voting logic consistent with the design as described in AP1000 DCD section 7.2.1.1.7. Revise the first sentence to state:

> The final stage of the voting logic provides the signal to energize the undervoltage trip attachment on each **reactor trip breaker (**RTB**)** within the reactor trip switchgear**, which allows RTB closure**.

For added clarity, revise the opening sentence of the “ASA, LCO, and Applicability” section of the Bases for STS Subsections 3.3.1 through 3.3.7 to state:

> The RTS functions to maintain **compliance with** the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

In the “ASA, LCO, and Applicability” section of the Bases, change “±” to “plus or minus” in the fourth paragraph. APOG indicates that this change aligns with Writer's Guide convention. NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4.

In the “ASA, LCO, and Applicability” section of the Bases, change the first word “on” to “On” in paragraph (1) under the heading “Power Range Neutron Flux, P-10.” This is consistent with paragraph (2) through paragraph (6) and with Writers Guide 2.1.3.b.1. However, the NRC staff notes that the use of digits in parenthesis is contrary to the Writer's Guide for primary level ordered list enumeration, which uses lower case letters. Also, the Writer's Guide does not directly discuss ordered list enumeration convention for the “ASA, LCO, and Applicability” section of the Bases for Section 3.3.

In the “ASA, LCO, and Applicability” section of the Bases under the heading “Power Range Neutron Flux, P-10,” revise paragraph (5) and paragraph (6) to include the word “Setpoint” after the word “Low” for the listed Functions. As noted in the response to the APOG comment (internal reference #119), NRC staff proposes to add “respective division,” “respective,” and “channel” to emphasize the divisional implementation of the P-10 interlock.

In the “ASA, LCO, and Applicability” section of the Bases, change “>” to “greater than the” in the paragraph under the heading “Pressurizer Pressure, P-11.” Per APOG, this change aligns with Writer's Guide convention when no value follows the symbol. NRC staff recommends adding “Function” following “High 2 reactor trip.”

In the “ASA, LCO, and Applicability” section of the Bases under Function 11 “SG Narrow range Water Level – High 2,” capitalize the word “range” in the first paragraph, first sentence. The second paragraph is revised to state:

> The LCO requires four channels of **the** SG Narrow ~~r~~**R**ange Water Level – High 2 **trip Function** per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. (APOG Comment and NRC Staff Edit)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.1,” includes a paragraph that lists the channels that are to be checked by the SR. This information is already provided in the Function column of the TS Table 3.3.1-1 and does not need to be repeated in the Bases. Including these functions is not consistent with other SR Bases. Delete the Bases paragraph listing the channel titles.

In the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.4,” there is an extra period at end of last sentence in the first paragraph. Delete the extra period.

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.7,” states that the Frequency is “prior to startup.” The TS SR 3.3.1.7 Frequency is actually “prior to reactor startup.” Change “prior to startup” to “prior to reactor startup.”

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.9,” includes a closing sentence that states an exception for entering Modes 1 and 2, and that the plant must be in Mode 1 to perform the test. This provision is not in accordance with the actual SR. Delete the SR 3.3.1.9 Bases, third paragraph, final sentence.

In the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.11,” the first two sentences of the last paragraph state the same thing. Combine them into a single sentence for clarity as follows:

> SR 3.3.1.11 is modified by a Note indicating that neutron detectors <u>may be</u> excluded from RTS RESPONSE TIME testing.

NRC staff notes that “may be” should be “are.”

Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” clarifier. Since these Section and Chapter references are to an external document, it is appropriate to include the “FSAR” modifier. (DOC A003)

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.3.1, Reactor Trip System (RTS) Instrumentation

Changes to the Generic Technical Specifications and Bases:

GTS 3.3.1, "Reactor Trip System (RTS) Instrumentation," is reformatted by DOC A024 into multiple Specifications including interim A024-modified TS (MTS) 3.3.1, "Reactor Trip System (RTS) Instrumentation." The reformatting relocates GTS 3.3.1 Functions 2.a, 2.b, 3, 6, 7, 8.a, 8.b, 9, 10, 11, 12, 13, 14, 16.a, 16.b, 16.c, and 22 into MTS Table 3.3.1-1 as Functions 1.a, 1.b, 2, 3, 4, 5.a, 5.b, 6, 7, 8, 9, 10, 11, 12.a, 12.b, 12.c, and 13. The MTS format is depicted in Section XI of this GTST as the reference case in the markup of the GTS instrumentation requirements for RTS instrumentation.

MTS 3.3.1 Function No. & STS Title	GTS 3.3.1 Function(s)
1. Power Range Neutron Flux a. High Setpoint b. Low Setpoint	2. Power Range Neutron Flux a. High Setpoint b. Low Setpoint
2. Power Range Neutron Flux High Positive Rate	3. Power Range Neutron Flux High Positive Rate
3. Overtemperature ΔT	6. Overtemperature ΔT
4. Overpower ΔT	7. Overpower ΔT
5. Pressurizer Pressure a. Low Setpoint b. High Setpoint	8. Pressurizer Pressure a. Low Setpoint b. High Setpoint
6. Pressurizer Water Level – High 3	9. Pressurizer Water Level – High 3
7. Reactor Coolant Flow – Low	10. Reactor Coolant Flow – Low
8. Reactor Coolant Pump (RCP) Bearing Water Temperature – High	11. Reactor Coolant Pump (RCP) Bearing Water Temperature – High
9. RCP Speed – Low	12. RCP Speed – Low
10. Steam Generator (SG) Narrow Range Water Level – Low	13. Steam Generator (SG) Narrow Range Water Level – Low
11. Steam Generator (SG) Narrow Range Water Level – High 2	14. Steam Generator (SG) Narrow Range Water Level – High 2

MTS 3.3.1 Function No. & STS Title	GTS 3.3.1 Function(s)
12. Reactor Trip System Interlocks a. Intermediate Range Neutron Flux, P-6 b. Power Range Neutron Flux, P-10 c. Pressurizer Pressure, P-11	16. Reactor Trip System Interlocks a. Intermediate Range Neutron Flux, P-6 b. Power Range Neutron Flux, P-10 c. Pressurizer Pressure, P-11
13 Passive Residual Heat Removal Actuation	22 Passive Residual Heat Removal Actuation

References 2, 3, and 6 provide details showing the correspondence of GTS 3.3.1 Functions and STS 3.3.1 through 3.3.7 Functions.

GTS 3.3.1 Conditions A, D, E, K and M are reordered and relabeled as AP1000 MTS 3.3.1 Conditions A, B, C, D, E, F, and G. (DOC A024)

GTS Table 3.3.1-1 footnote (b), “Below the P-10 (Power Range Neutron Flux) interlocks” applies to operation in MODE 1 for RTS instrumentation. GTS Table 3.3.1-1 footnote (b) is incorporated into the MTS Table 3.3.1-1 as footnote (a). GTS Table 3.3.1-1 footnote (f), “Above the P-10 (Power Range Neutron Flux) interlock” applies to operation in MODE 1 for RTS instrumentation. GTS Table 3.3.1-1 footnote (f) is incorporated into the MTS Table 3.3.1-1 as footnote (b). GTS Table 3.3.1-1 footnote (g), “Above the P-11 (Pressurizer Pressure) interlock” applies to operation in MODE 2 for RTS instrumentation. GTS Table 3.3.1-1 footnote (g) is incorporated into the MTS Table 3.3.1-1 as footnote (c). (DOC A024)

Proposed MTS 3.3.1 Condition C is revised to add a second part for inoperability of more than two inoperable automatic initiation channels. Otherwise, LCO 3.0.3 would apply when the LCO is not met and the associated Actions are not met or an associated Action is not provided. (DOC M02)

MTS 3.3.1 Condition F is deleted. SRs associated with TS 3.2.4 provide appropriate restrictions. (DOC L08)

MTS 3.3.1 Condition G is deleted and MTS 3.3.1 Function 12 is removed from MTS 3.3.1 Table 3.3.1-1. The interlock operability is adequately addressed by each related Function’s requirement to be Operable and the requirement for actuation logic operability. (DOC L10)

GTS SR 3.3.1.6 and SR 3.3.1.7 are moved to another LCO subsection and the remaining SRs are renumbered accordingly. (DOC A024)

MTS SR 3.3.1.6 (GTS SR 3.3.1.8) is revised from “Perform RTCOT...” to “Perform COT...” The definition of RTCOT does not explicitly require adjustments of required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. NUREG-1431 specifies the COT for similar Functions. (DOC M01)

MTS SR 3.3.1.7 (GTS SR 3.3.1.9) is revised from “Perform RTCOT...” to “Perform COT...” and Frequency Note is repositioned as a Surveillance Note, replacing GTS Surveillance Note 1. The definition of RTCOT does not explicitly require adjustments of required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. NUREG-1431 specifies the COT for similar Functions. Note relocation is per the Writer's Guide (Reference 4). (DOC M01 and DOC A026)

MTS SR 3.3.1.8 (GTS SR 3.3.1.10) Note is revised per the Writer's Guide (Reference 4). (DOC A025)

The Bases are revised to reflect these changes.

The following tables are provided as an aid to tracking the various changes to GTS 3.3.1 Conditions, Required Actions, Functions, Applicability Footnotes, and Surveillance Requirements that result in interim A024-modified TS (MTS) 3.3.1 and as further changed, STS 3.3.1.

Changes to Conditions

GTS 3.3.1 Condition	MTS 3.3.1 Condition	STS 3.3.1 Condition	Other STS Subsections Addressing the Listed Condition	Additional DOC Changes
A	C	C	---	M02
B	→	→	3.3.5	---
C	→	→	3.3.5	---
D	F	---	Deleted	L08
E	A	A	GTS Condition E split into 3 Conditions	---
E	B	B	---	---
E	D	D	---	---
F	→	→	3.3.3	---
G	→	→	3.3.3	---
H	→	→	3.3.3	---
I	→	→	3.3.2	---
J	→	→	3.3.2	---
K	E	E	---	---
L	→	→	3.3.4, 3.3.6	---
M	G	---	Deleted	L10
N	→	→	3.3.7	---
O	→	→	3.3.7	---
P	→	→	3.3.4, 3.3.6	---
Q	→	→	3.3.2	---
R	→	→	3.3.2	---

Changes to Functions

--------------------	Function [Modes(footnote)]	-----------	STS 3.3.1	Other STS Subsections	Additional
GTS 3.3.1	MTS 3.3.1	STS 3.3.1	Conditions	and Additional Changes	DOC Changes
2.a [1,2]	1.a [1,2]	1.a [1,2]	D	---	---
2.b [1(b),2]	1.b [1(a),2]	1.b [1(a),2]	D	---	---
3. [1,2]	2. [1,2]	2. [1,2]	D	---	---
6. [1,2]	3. [1,2]	3. [1,2]	D	---	---
7. [1,2]	4. [1,2]	4. [1,2]	D	---	---
8.a [1(f)]	5.a [1(b)]	5.a [1(b)]	E	---	---
8.b [1,2]	5.b [1,2]	5.b [1,2]	D	---	---
9. [1(f)]	6. [1(b)]	6. [1(b)]	E	---	---
10. [1(f)]	7. [1(b)]	7. [1(b)]	E	---	---
11. [1,2]	8. [1,2]	8. [1,2]	D	---	---
12. [1(f)]	9. [1(b)]	9. [1(b)]	E	---	---
13. [1,2]	10. [1,2]	10. [1,2]	D	---	---
14. [1,2(g)]	11. [1,2(c)]	11. [1,2(c)]	D	---	---
16.a [2]	12.a [2]	---	---	---	L10
16.b [1,2]	12.b [1,2]	---	---	---	L10
16.c [1,2]	12.c [1,2]	---	---	---	L10
22. [1,2]	13. [1,2]	12. [1,2]	D	---	---

Changes to Applicability Footnotes

GTS 3.3.1 Footnote	MTS 3.3.1 Footnote	STS 3.3.1 Footnote	STS 3.3.1 Function	STS Subsections Also Addressing Listed footnote	Additional Changes DOC Number
b	a	a	1.b	---	---
f	b	b	5.a, 6, 7, 9	---	---
g	c	c	11	---	---

Changes to Surveillance Requirements

GTS 3.3.1 SR	MTS 3.3.1 SR	STS 3.3.1 SR	STS Subsections Also Addressing the Listed SR	Example Surveillance No. Surveillance Description
3.3.1.1	3.3.1.1	3.3.1.1	3.3.2, 3.3.3	3.3.1.1 CHANNEL CHECK
3.3.1.2	3.3.1.2	3.3.1.2	---	3.3.1.2 Compare calorimetric heat balance to NI channel output
3.3.1.3	3.3.1.3	3.3.1.3	---	3.3.1.3 Compare calorimetric heat balance to delta-T power calculation
3.3.1.4	3.3.1.4	3.3.1.4	---	3.3.1.4 Compare incore detector measurement to NI AXIAL FLUX DIFFERENCE
3.3.1.5	3.3.1.5	3.3.1.5	---	3.3.1.5 Calibrate excore channels
3.3.1.6	→	→	3.3.7	3.3.7.1 Perform TADOT
3.3.1.7	→	→	3.3.4, 3.3.6	3.3.4.1 ACTUATION LOGIC TEST
3.3.1.8	3.3.1.6	3.3.1.6	3.3.2	3.3.1.6 Perform COT
3.3.1.9	3.3.1.7	3.3.1.7	3.3.2, 3.3.3	3.3.1.7 Perform COT
3.3.1.10	3.3.1.8	3.3.1.8	---	3.3.1.8 CHANNEL CALIBRATION
3.3.1.11	3.3.1.9	3.3.1.9	3.3.2, 3.3.3	3.3.1.9 CHANNEL CALIBRATION
3.3.1.12	3.3.1.10	3.3.1.10	3.3.5	3.3.1.10 Perform TADOT
3.3.1.13	3.3.1.11	3.3.1.11	3.3.2, 3.3.3	3.3.1.11 Verify RTS RESPONSE TIME within limits

The nomenclature for “power range,” “Intermediate Range,” and “Source Range,” neutron flux detectors is revised for consistency throughout the Bases. (APOG Comment and NRC Staff Edit)

The word “interlock” is removed after P-6 and P-10, except when used to refer to the interlock and not the setpoint-and to be consistent with TS wording. (NRC Staff Comment)

Better clarity and specificity is added to the instrumentation signal discussion throughout the Bases. (NRC Staff Comment)

The second paragraph of the discussion under Required Action A.1 is deleted because it is not relevant to the RTS Instrumentation Functions listed in STS Table 3.3.1-1. (APOG Comment)

Table 3.3.1-1, Item 3, REQUIRED CHANNELS is corrected to match the GTS. (APOG Comment)

The “Background” section of the Bases for STS Subsection 3.3.1, fourth paragraph, last sentence is revised to correct the verb tense. (APOG Comment)

The “Background” section of the Bases is revised to define “Engineered Safety Features (ESF).” (APOG Comment)

The “Background” section of the Bases is revised to replace “±” with “plus or minus.” (APOG Comment)

The “Background” section of the Bases under the heading “Reactor Trip Switchgear Interface,” is revised to include additional clarifying information for the reactor trip switchgear voting logic. (APOG Comment)

The opening sentence of the “ASA, LCO, and Applicability” section of the Bases for STS Subsections 3.3.1 through 3.3.7 is revised to provide additional clarity. (APOG Comment)

The “ASA, LCO, and Applicability” section of the Bases is revised to replace “±” with “plus or minus.” (APOG Comment)

The fourth sentence under the heading “Reactor Trip System Interlocks” in the Bases section for “ASA, LCO, and Applicability” is revised for consistency and clarity. (NRC Staff Comment)

The “ASA, LCO, and Applicability” section of the Bases is revised under the heading “Power Range Neutron Flux, P-10” for consistency (APOG Comment and NRC Staff Edit)

The “ASA, LCO, and Applicability” section of the Bases under the heading “Pressurizer Pressure, P-11.” is revised to replace “>” with “greater than the” and add “Function” following “High 2 reactor trip.” (APOG Comment and NRC Staff Edit)

The “ASA, LCO, and Applicability” section of the Bases under Function 11 “SG Narrow range Water Level – High 2,” is revised to improve clarity, consistency, and operator usability. (APOG Comment)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.1,” is revised to provide consistency. (APOG Comment)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.4,” is revised to provide consistency. (APOG Comment and NRC Staff Edit)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.5,” is revised to provide consistency. (NRC Comment)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.7,” is revised to provide consistency and clarity. (APOG Comment and NRC Staff Edit)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.9,” is revised to provide consistency and clarity. (APOG Comment and NRC Staff Edit)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.11,” is revised to provide clarity. (APOG Comment and NRC Staff Edit)

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

VI. Traveler Information

Description of TSTF changes:

Not Applicable

Rationale for TSTF changes:

Not Applicable

Description of changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

The Vogtle Electric Generating Plant Units 3 and 4 (VEGP) technical specifications upgrade (TSU) License Amendment Request (VEGP TSU LAR) (Reference 2) proposed changes to the initial version of the VEGP PTS (referred to as the current TS by the VEGP TSU LAR). As detailed in VEGP TSU LAR Enclosure 1, administrative change number 24 (DOC A024) reformats PTS 3.3.1 into multiple Specifications as follows:

- 3.3.1, “Reactor Trip System (RTS) Instrumentation”;
- 3.3.2, “Reactor Trip System (RTS) Source Range Instrumentation”;
- 3.3.3, “Reactor Trip System (RTS) Intermediate Range Instrumentation”;
- 3.3.4, “Reactor Trip System (RTS) Engineered Safety Feature Actuation
- 3.3.5, “Reactor Trip System (RTS) Manual Actuation”;
- 3.3.6, “Reactor Trip System (RTS) Automatic Trip Logic”; and
- 3.3.7, “Reactor Trip System (RTS) Trip Actuation Devices.”

Since PTS 3.3.1, “Reactor Trip System (RTS) Instrumentation,” is identical to GTS 3.3.1, it is appropriate for this GTST to consider the proposed changes to PTS 3.3.1 as changes to GTS 3.3.1 for incorporation in AP1000 STS 3.3.1. DOC A024 is extensive, but retains the intention of PTS 3.3.1 while improving operational use of the TS. The numerous Functions, Conditions and extensive bases discussion associated with PTS 3.3.1 are repackaged into seven smaller parts. Therefore, the changes implemented by DOC A024 are presented in the attached Subsection 3.3.1 markup, in Section XI of this GTST, as the “clean” starting point for this GTST and are identified as interim A024-modified TS (MTS) 3.3.1. The specific details of the reformatting for MTS 3.3.1 can be found in VEGP TSU LAR (Reference 2), in Enclosure 2 (markup) and Enclosure 4 (clean). The NRC staff safety evaluation regarding DOC A024 can be found in Reference 3, VEGP LAR SER. The VEGP TSU LAR was modified in response to NRC staff RAIs in Reference 5 and the Southern Nuclear Operating Company RAI Response in Reference 6.

DOC A025 revises proposed MTS 3.3.1 SR 3.3.1.8 Note to change the phrase “the prescribed values” to “within limits.”

DOC A026 moves the proposed MTS 3.3.1 SR 3.3.1.7 Frequency Note “Only required when not performed within previous 92 days” to replace the PTS Surveillance Note. The new Surveillance Note states “Only required to be performed when not performed within previous 92 days.”

DOC M01 revises proposed MTS 3.3.1 SR 3.3.1.6 and SR 3.3.1.7 requirements from "Perform RTCOT in accordance with Setpoint Program," to "Perform COT in accordance with Setpoint Program."

DOC M02 addresses the fact that MTS 3.3.1, "Reactor Trip System (RTS) Instrumentation," does not specify Actions for inoperability of more than two inoperable instrumentation channels. This results in entry into LCO 3.0.3 when three or more channels are inoperable.

DOC L08 deletes proposed MTS 3.3.1 Action F.

DOC L10 removes proposed MTS 3.3.1 Table 3.3.1-1, Function 12, Reactor Trip System Interlocks from the list of Functions. As a result, proposed MTS 3.3.1 Action G is deleted.

A more detailed description of the changes by each of the above DOCs can be found in Reference 2, VEGP TSU LAR in Enclosure 1; the NRC staff safety evaluation can be found in Reference 3, VEGP LAR SER. The VEGP TSU LAR was modified in response to NRC staff RAIs (Reference 5) by Southern Nuclear Operating Company's RAI Response in Reference 6.

Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

The reformatting per DOC A024, except where addressed in other DOCs, addresses inconsistencies in formatting and approach between PTS 3.3.1 and PTS 3.3.2, respectively. Simplification and clarification are proposed for each Specification. In breaking down each PTS Specification into specific subsets of the Protection and Safety Monitoring System (PMS) function, improved human factored operator usability results.

These improvements also reflect the general approach currently in use in the Improved Standard Technical Specifications (STS) for Babcock and Wilcox Plants, NUREG-1430, Rev. 4. That is to separate the functions for [sensor] instrumentation, Manual Actuation, Trip/Actuation Logic, and Trip Actuation Devices (e.g., Reactor Trip Breakers (RTBs)) into separate Specification subsections. Furthermore, the Actions for some ESFAS Functions generally involve a more complex presentation than needed for other Functions, such that simple common Actions are not reasonable. Such Functions are also provided with separate Specification subsections.

When TS instrument function tables are utilized to reference Actions, the generally preferred format of the Actions for an instrumentation Specification in NUREG-1430 is to provide the initial Actions that would be common to all of the specified functions (typically for bypassing and/or tripping one or two inoperable channels), then the "default" Action would direct consulting the function table for follow-on Actions applicable to the specific affected function. These follow-up Actions generally reflect the actions to exit the Applicability for that function.

This format also allows splitting the default Actions from the initial preferred actions. This general approach is the standard format for other Specifications and for Instrumentation Specifications for other vendors' Improved STS.

DOC A025 is consistent with similar requirements elsewhere in the AP1000 GTS and STS (NUREG-1431).

DOC A026 is consistent with the TS Writer's Guide found in reference 4. DOC L10 notes that the GTS SR 3.3.1.9 Surveillance Note provides details of performing a Channel Operational Test (COT) and is deleted. GTS SR 3.3.1.9 is proposed as MTS SR 3.3.1.7. The requirement

for verification that interlocks P-6 and P-10 are in their required state for existing unit condition is unchanged and is appropriately summarized in the Bases.

DOC M01 notes that the definition of RTCOT does not explicitly require “adjustments of required alarm, interlock, and trip setpoints” that are “required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy.” The PTS Bases associated with the RTCOT describe these adjustments, but the bases are intended to clarify, not provide additional requirements. The COT definition explicitly requires these adjustments. Therefore, because the definition of COT more closely aligns with the RTCOT test description provided in the bases, the COT is specified instead of an RTCOT. The RTCOT definition is deleted from TS Section 1.1. A COT may be performed by means of any series of sequential, overlapping, or total channel steps. The changes are consistent with the intent of the required TS testing, and are consistent with NUREG-1431.

DOC M02 directly provides for the default Actions of LCO 3.0.3 without allowing for the additional hour that LCO 3.0.3 permits prior to initiating shutdown. This provides clarity for the operator and is more restrictive than LCO 3.0.3.

DOC L08 indicates that the actions provided in PTS 3.3.1 Required Action D.1.1 and D.2.2 [F.1.1 and F.2.2] are related to TS 3.2.4, Quadrant Power Tilt Ratio (QPTR), radial power distribution monitoring. The two Surveillances of TS 3.2.4 are provided with Notes defining the appropriate Surveillance when Power Range Neutron Flux channels may not be available for monitoring. These Surveillances and their Notes provide the appropriate restrictions in the event of inoperable Power Range Neutron Flux channels without reliance on duplicating those restrictions in the Actions of TS 3.3.1.

DOC L10 notes that Interlock Operability is adequately addressed by each related Function’s requirement to be Operable and the requirement for actuation logic operability. Interlock functions do not directly trip the reactor or initiate an ESFAS function, and as such are removed from the actuation instrumentation listing in TS.

Description of additional changes proposed by NRC staff/preparer of GTST:

All acronyms are identified at the first occurrence in the Bases discussion.

In the Bases section for Applicable Safety Analyses, LCO, and Applicability, the statement just prior to the description of each Function in Table 3.3.1-1 (following the P-11 interlock discussion) is relocated to be the last paragraph before the discussion on interlocks and is revised from “The LCO generally requires OPERABILITY of three channels in each instrumentation Function” to “The LCO generally requires OPERABILITY of four channels in each instrumentation Function. If a required channel becomes inoperable, operation can continue provided the inoperable channel is placed in bypass or trip within the specified Completion Time.” (NRC Staff Comment)

The modifier “PMS” is deleted for “Power Range,” “Intermediate Range,” and “Source Range,” detectors throughout the Bases. In addition, references to these three detector types are uniformly changed to:

- Power Range Neutron Flux,
- Intermediate Range Neutron Flux, and
- Source Range Neutron Flux

in place of other phrases that refer to power, intermediate, and source range instrumentation channels or detectors. (APOG Comment and NRC Staff Edit)

The first paragraph of the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Intermediate Range Neutron Flux, P-6," is revised to state:

> The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective PMS **division** Intermediate Range Neutron Flux channel increases to approximately one decade above the channel lower range limit. The P-6 interlock ensures that the following are performed:
>
> (1) On increasing power, the P-6 interlock allows the manual block of the respective PMS **division** Source Range Neutron Flux **– High Setpoint** reactor **Function** trip **channel**. This prevents a premature block of the ~~source range~~ **Source Range Neutron Flux – High reactor** trip **Function channel** and allows the operator to ensure that the ~~intermediate range~~ **Intermediate Range Neutron Flux – High reactor trip Function channels are** ~~is~~ OPERABLE prior to leaving the source range. When ~~the~~ **a** ~~source range~~ **Source Range Neutron Flux – High reactor** trip **Function channel** is blocked, the high voltage to the **detector of the Source Range Neutron Flux channel** ~~detectors~~ is also removed.
>
> (2) On decreasing power, the P-6 interlock automatically energizes the **respective** PMS ~~source range~~ **division Source Range Neutron Flux** detector~~s~~ and enables the **respective** PMS **division** Source Range Neutron Flux **– High** reactor trip **Function channel**.
>
> (3) On increasing power, the P-6 interlock provides a backup ~~block~~ signal to **automatically block** the **respective PMS division** ~~source range neutron flux doubling~~ **Source Range Neutron Flux Doubling Engineered Safety Feature Actuation System (ESFAS) Function channel** ~~circuit~~. Normally, this **Boron Dilution Block ESFAS** Function is manually blocked by the main control room operator during the reactor startup.

Revise the fourth sentence under the heading "Reactor Trip System Interlocks" in the Bases section for "Applicable Safety Analyses, LCO, and Applicability" to state:

> Proper operation of these interlocks supports OPERABILITY of the associated **reactor trip** ~~TS~~ Functions and/or the requirement for actuation logic OPERABILITY. (NRC Staff Comment)

The first sentence of the first paragraph in the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Power Range Neutron Flux, P-10," is revised to state:

> The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the **respective division** ~~power- range~~ **Power Range Neutron Flux channel** ~~detector~~ **detectors**.

Paragraph (4) in the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Power Range Neutron Flux, P-10" is revised to state:

> (4) On increasing power, the **respective division** P-10 interlock **channel** automatically provides a backup ~~block~~ signal to **block** the **respective**

> **division** Source Range Neutron Flux reactor trip **channel** and also to de-energize the **respective division** ~~source range~~ **Source Range Neutron Flux** ~~detectors~~ **detector**.

Paragraph (6) in the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “Power Range Neutron Flux, P-10” is revised to state:

> (6) On decreasing power, the **respective division** P-10 interlock **channel** automatically enables the **respective** Power Range Neutron Flux - Low **Setpoint** reactor trip **channel** and the **respective** Intermediate Range Neutron Flux **– High** reactor trip (and rod stop) **channel**.

The first paragraph of the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “1. Power Range Neutron Flux,” is revised to state:

> The ~~PMS power range~~ **Power Range Neutron Flux** detectors are located external to the reactor vessel and measure neutrons leaking from the core. The ~~PMS power range~~ **Power Range Neutron Flux** detectors provide input to the PLS. Minimum requirements for protection and control ~~is~~ **are** achieved with three channels OPERABLE. . . .

In the same subsection under the heading “a. Power Range Neutron Flux – High **Setpoint**” the heading and last sentence of the last paragraph are revised to state:

> . . . In addition, the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect neutron **flux** levels in this range.

In the same subsection under the heading “b. Power Range Neutron Flux – Low **Setpoint**” the heading and second and third sentences of the third paragraph are revised to state:

> . . . ~~This~~ **Each channel of this** Function may be manually blocked by the operator when the respective ~~power range~~ **division Power Range Neutron Flux** channel is greater than approximately 10% of RTP (P-10 setpoint). ~~This~~ **Each channel of this** Function is automatically unblocked when the respective ~~power range~~ **division Power Range Neutron Flux** channel is below the P-10 setpoint. . . .

In the same subsection under the heading “b. Power Range Neutron Flux – Low **Setpoint**” the heading and first sentence of the fourth paragraph are revised to state:

> . . . because the reactor is shutdown and the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect **the** neutron **flux** levels generated in MODES 3, 4, 5, and 6. . .

The third sentence of the first paragraph in the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “2. Power Range Neutron Flux – High Positive Rate,” is revised to state:

> . . . The Power Range Neutron Flux **– High Positive** Rate trip uses the same **Power Range Neutron Flux** channels as discussed for Function 1 above.

In the same subsection, the second paragraph, last sentence is revised to state:

> . . . In addition, the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect neutron **flux** levels present in ~~this~~ MODE **6**.

The last sentence of the first paragraph and the third bullet in the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “3. Overtemperature ΔT,” are revised to state:

> . . . The ~~overtemperature~~ **Overtemperature** ΔT ~~setpoint~~ **Trip Setpoint** is automatically varied for changes in the parameters that affect DNB as follows: ...
>
> - Axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower ~~power range~~ **Power Range Neutron Flux** detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower ~~PMS power range~~ **Power Range Neutron Flux** detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

In the same subsection, the last paragraph, first sentence is revised to state:

> In MODE 1 or 2, the Overtemperature ΔT trip **Function** must be OPERABLE to prevent DNB.

The first paragraph, second and fourth sentences, and bulleted paragraph in the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “4. Overpower ΔT,” are revised to state:

> . . . This trip Function also limits the required range of the Overtemperature ΔT trip ~~function~~ **Function** and provides a backup to the Power Range Neutron Flux – High Setpoint trip **Function**.
>
> . . . It uses the same ΔT power signal generated for the Overtemperature ΔT **trip Function**. The ~~setpoint~~ **Trip Setpoint** is automatically varied with the following parameter:
>
> - Axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower ~~power range~~ **Power Range Neutron Flux** detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower ~~PMS power range~~ **Power Range Neutron Flux** detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

In the same subsection, the third paragraph, third sentence is revised to state:

> . . . The Overpower ΔT **trip** Function receives input from channels shared with other RTS Functions.

The first sentence of the first and third paragraphs in the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “12. Passive Residual Heat Removal Actuation,” are revised to state:

> The Passive Residual Heat Removal (PRHR) Actuation reactor trip **Function** ensures that a reactivity excursion due to cold water injection will be minimized upon an inadvertent operation of the PRHR discharge valves. . . .
>
> In MODES 1 and 2, the ~~Passive Heat Removal~~ **PRHR** Actuation reactor trip **Function** must be OPERABLE. In MODES 3, 4, 5, and 6, the **PRHR Actuation** ~~Passive Heat Removal Initiation~~ reactor trip Function does not have to be OPERABLE because the reactor is not operating or critical.

The second sentence of the paragraph in the "Actions" section of the Bases for STS Subsection 3.3.1, under the heading "E.1," is revised to state:

> . . . If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, ~~thermal power~~ **THERMAL POWER** must be reduced to below the P-10 **setpoint,**~~interlock;~~ a condition in which the LCO does not apply.

The paragraphs beginning with following sentences in the "SRs" section of the Bases for STS Subsection 3.3.1, under the heading "SR 3.3.1.6," are revised to state:

> A test subsystem is provided with the Protection and Safety Monitoring System **(PMS)** to aid the plant staff in performing the COT.
>
> To the extent possible, ~~Protection and Safety Monitoring System~~ **PMS** functional testing is accomplished with continuous system self-checking features and the continuous functional testing features.

In the same subsection, the last two paragraphs are revised to state:

> ~~This~~ **The** ~~test frequency~~ **COT Surveillance Frequency** of 92 days is justified based on Reference 6 **(which refers to this test as "RTCOT")** and the use of continuous diagnostic test features, such as deadman timers, cross-check of redundant channels, memory checks, numeric coprocessor checks, and tests of timers, counters and crystal time bases, which will report a failure within the ~~Protection and Safety Monitoring System~~ **PMS** cabinets to the operator within 10 minutes of a detectable failure.
>
> During the ~~RT~~COT, the ~~protection and safety monitoring system~~ **PMS** cabinets in the division under test may be placed in bypass.

The fifth sentence of the first paragraph in the "SRs" section of the Bases for STS Subsection 3.3.1, under the heading "SR 3.3.1.7," is revised to state:

> This evaluation will consist of resetting the ~~channels~~ **channel** ~~setpoint~~**Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the ~~channels~~ **channel** response.

In the same subsection, the third, fourth, and last sentences of the third paragraph are revised to state:

> . . . The Frequency of ~~every~~ 92 days thereafter applies **to the performance of this COT** if the plant remains in the MODE of Applicability after the initial performances of prior to reactor startup and ~~four~~ **4** hours after reducing power

> below P-10. The MODE of Applicability for this surveillance is < P-10 for the ~~power range low~~ **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** channels. . . . ~~This test~~ **The Surveillance Frequencies for this COT** ~~ensures~~ **ensure** that the ~~NIS power range low~~ **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** channels are OPERABLE prior to taking the reactor critical and after reducing power into the applicable MODE (< P-10) for periods **greater than four** ~~> 4~~ hours.

The second paragraph in the "SRs" section of the Bases for STS Subsection 3.3.1, under the heading "SR 3.3.1.8," is revised to state:

> The ~~test~~ **CHANNEL CALIBRATION** is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response. . . .

The first three paragraphs in the "SRs" section of the Bases for STS Subsection 3.3.1, under the heading "SR 3.3.1.9," are revised to state (see APOG comment #136):

> ~~SR 3.3.1.9 is the performance of a~~ **A** CHANNEL CALIBRATION **is performed** every 24 months**, or approximately at every refueling**. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. ~~The test is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable.~~
>
> The ~~test~~ **CHANNEL CALIBRATION** is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response. . . .
>
> ~~The~~ **This Surveillance does not include the** CHANNEL CALIBRATION for the ~~power range neutron~~ **Power Range Neutron Flux** detectors**, which** consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore **Power Range Neutron Flux detectors**~~channels~~. ~~This Surveillance is not required for the power range detectors for entry into MODES 2 and 1 because the plant must be in at least MODE 1 to perform the test.~~

In the same subsection, the last paragraph is revised to state:

> The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed ~~on~~ **at** the 24 month Frequency.

The first and third paragraphs in the “SRs” section of the Bases for STS Subsection 3.3.1, under the heading “SR 3.3.1.10,” are revised to state:

> SR 3.3.1.10 is the performance of a TADOT of the Passive Residual Heat Removal **(PRHR)** Actuation **reactor trip Function**. This TADOT is performed every 24 months.
>
> The SR is modified by a Note that excludes verification of setpoints from the TADOT. The ~~Functions~~ **Function (reactor trip on PRHR Actuation)** affected ~~have~~ **by this** SR **has** no setpoints associated with ~~them~~ **it.**

The first sentence of the second paragraph in the “SRs” section of the Bases for STS Subsection 3.3.1, under the heading “SR 3.3.1.11,” is revised to state (see APOG comment #3 and #138):

> For channels that include dynamic transfer Functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer Function set to one, with the resulting measured response time compared to the appropriate ~~DCD~~ **FSAR** Chapter 7 response time.

In the same subsection, the first and second sentences of the fifth paragraph are revised to state (see APOG comment #137):

> ~~The~~ SR 3.3.1.11 is modified by a ~~note~~ **Note** ~~exempting neutron detectors from response time testing. A Note to the Surveillance indicates~~ **indicating** that neutron detectors ~~may be~~ **are** excluded from RTS RESPONSE TIME testing.

The second paragraph of the discussion under Required Action A.1 is deleted. (APOG Comment)

Table 3.3.1-1, Item 3, REQUIRED CHANNELS is revised to state “4 (2/loop)” instead of “4.” (APOG Comment)

In the “Background” section of the Bases, the word “assured” is changed to “assures” in the fourth paragraph, last sentence. (APOG Comment)

In the “Background” section of the Bases, “ESF” is revised to “Engineered Safety Features (ESF)” in the first bullet under the heading “Protection and safety Monitoring Cabinets.” (APOG Comment)

In the “Background” section of the Bases, “±” is revised to “plus or minus” in the first paragraph, second sentence, and second paragraph, last sentence under the heading “Nominal Trip Setpoint (NTS).” (APOG Comment)

The first sentence of the first paragraph in the “Background” section of the Bases for STS Subsection 3.3.1, under the heading “Reactor Trip Switchgear Interface,” is revised to state:

> The final stage of the voting logic provides the signal to energize the undervoltage trip attachment on each **reactor trip breaker (**RTB**)** within the reactor trip switchgear**, which allows RTB closure**. (APOG Comment)

The opening sentence of the “ASA, LCO, and Applicability” section of the Bases for STS Subsections 3.3.1 through 3.3.7 is revised to state:

> The RTS functions to maintain **compliance with** the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed. (APOG Comment)

In the “ASA, LCO, and Applicability” section of the Bases, “±” is revised to “plus or minus” in the fourth paragraph. (APOG Comment)

In the “ASA, LCO, and Applicability” section of the Bases, the first word “on” is revised to “On” in paragraph (1) under the heading “Power Range Neutron Flux, P-10.” (APOG Comment)

Paragraph (5) in the “ASA, LCO, and Applicability” section of the Bases under the heading “Power Range Neutron Flux, P-10,” is revised to state (APOG Comment):

> (5) On decreasing power, the P-10 interlock automatically blocks reactor trips on the following Functions:
> - Pressurizer Pressure – Low **Setpoint**,
> - Pressurizer Water Level – High 3,
> - Reactor Coolant Flow – Low, and
> - RCP Speed – Low.

In the “ASA, LCO, and Applicability” section of the Bases, “>” is revised to “greater than the” in the paragraph under the heading “Pressurizer Pressure, P-11.” In addition, “Function” is added following “High 2 reactor trip.” (APOG Comment and NRC Staff Edit)

In the “ASA, LCO, and Applicability” section of the Bases under Function 11 “SG Narrow range Water Level – High 2,” the word “range” is capitalized in the first paragraph, first sentence. The second paragraphis revised to state:

> The LCO requires four channels of **the** SG Narrow Range Water Level – High 2 **trip Function** per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. (APOG Comment and NRC Staff Edit)

The paragraph that lists the channels that are to be checked by the SR in the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.1,” is deleted. (APOG Comment)

The “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.4,” is revised to remove an extra period at end of last sentence in the first paragraph. (APOG Comment)

In the same subsection, the last sentence of first paragraph is revised to state:

> SR 3.3.1.4 compares the AXIAL FLUX DIFFERENCE determined using the incore **neutron flux detector** system to the **excore** nuclear instrument channel AXIAL FLUX DIFFERENCE every 31 effective full power days (EFPD) **and adjusts the excore nuclear instrument channel if the absolute difference between the incore and excore AFD is ≥ 3% AFD**. (NRC Staff Comment)

In the same subsection, the last sentence of first paragraph is revised to state:

> If the absolute difference is ≥ 3% AFD the **excore** nuclear instrument channel is still OPERABLE, but must be readjusted. If the **excore** nuclear instrument

> channel cannot be properly readjusted, the channel is declared inoperable. This surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip Function** ~~function~~. (NRC Staff Comment)

In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.5," the first paragraph is revised to state:

> SR 3.3.1.5 is a calibration of the excore **nuclear instrument** ~~channels~~ **(Power Range Neutron Flux) detectors** to the incore **neutron flux** ~~channels~~ **detectors**. If the measurements do not agree, the excore **nuclear instrument** channels are not declared inoperable but must be adjusted to agree with the incore **neutron flux** detector measurements. If the excore **nuclear instrument** channels cannot be adjusted, the **excore nuclear instrument** channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip** Function. (NRC Staff Comment)

In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.7," the first sentence of the third paragraph is revised to state:

> The Frequency of prior to **reactor** startup ensures this surveillance is performed prior to critical operations and applies to the ~~source, intermediate and~~ **P**ower **R**ange **Neutron Flux – L**ow **Setpoint** instrument channels. (APOG Comment and NRC Staff Edit)

In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.11," the first two sentences of the last paragraph are deleted and replaced with the following:

> **SR 3.3.1.11 is modified by a Note indicating that neutron detectors are excluded from RTS RESPONSE TIME testing.**

Adjusted the reference order to reflect the order of their first appearance.

The acronym "FSAR" is added to modify "Section" and "Chapter" in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

Rationale for additional changes proposed by NRC staff/preparer of GTST:

The lead-in statement is in conflict with Table 3.3.1-1, which indicates that four channels in each instrumentation Function are generally required. If an instrumentation channel becomes inoperable, reactor operation at power can continue if the inoperable channel is placed in bypass or trip within the specified Completion Time. In addition, the PTS statement is logically more consistent with the lead-in discussion to this section of the bases regarding channels and functions than it is following a discussion of the P-11 interlock. Therefore, the statement is relocated to be the last paragraph before the discussion on interlocks and is modified to be consistent with Table 3.3.1-1.

The Bases modifier "PMS" for "Power Range," "Intermediate Range," and "Source Range" detectors is unnecessary and inconsistent with other PMS instruments. The Bases references to all these detector types are standardized for consistency.

The Bases material deleted under Required Action A.1 is not relevant to the RTS Instrumentation Functions listed in STS Table 3.3.1-1.

The change to Table 3.3.1-1, Item 3, REQUIRED CHANNELS is necessary such that the GTST revision matches the GTS. No change was specified for the Table item.

The tense of the verb in the “Background” section of the Bases is incorrect.

In the first bullet in the “Background” section of the Bases under the heading “Protection and safety Monitoring Cabinets,” ESF – Engineered Safety Features – has not been previously defined.

In the “Background” section of the Bases, “±” is revised to “plus or minus” based on APOG evaluation of Writer's Guide convention. NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4. However, the expression of the symbol in word form is acceptable.

The non-technical change to the “Background” section of the Bases for STS Subsection 3.3.1, under the heading “Reactor Trip Switchgear Interface,” provides additional clarity.

The non-technical change to the opening sentence of the “ASA, LCO, and Applicability” section of the Bases for STS Subsections 3.3.1 through 3.3.7 provides additional clarity.

In the “ASA, LCO, and Applicability” section of the Bases, “±” is revised to “plus or minus” based on APOG evaluation of Writer's Guide convention. NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4. However, the expression of the symbol in word form is acceptable.

The primary level ordered list enumeration in the “ASA, LCO, and Applicability” section of the Bases under subsection heading of “Power Range Neutron Flux, P-10”, is revised to be consistent with paragraph (2) through paragraph (6) and with Writers Guide 2.1.3.b.1. However, the use of digits in parenthesis is contrary to the Writer's Guide for primary level ordered list enumeration, which uses lower case letters. Also, the Writer's Guide does not directly discuss ordered list enumeration convention for the “ASA, LCO, and Applicability” section of the Bases for Section 3.3. Nevertheless, this change makes the Bases discussion of P-10 consistent with that of P-6, and with NUREG-1431, Rev. 4, and so is acceptable.

The non-technical change to the fourth sentence in the “ASA, LCO, and Applicability” section of the Bases under the heading “Reactor Trip System Interlocks,” provides clarity and consistency.

The non-technical change to paragraph (5) in the “ASA, LCO, and Applicability” section of the Bases under the heading “Power Range Neutron Flux, P-10,” provides consistency.

The non-technical change to the “ASA, LCO, and Applicability” section of the Bases under the heading “Pressurizer Pressure, P-11” is consistent with other Bases changes when no value follows the symbol.

The non-technical changes to the “ASA, LCO, and Applicability” section of the Bases under Function 11 “SG Narrow range Water Level – High 2,” provide improved clarity, consistency, and operator usability.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.1” provides consistency.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.4” provides consistency.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.5” provides consistency.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.7” provides clarity.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.9” provides clarity.

The non-technical change to the “Surveillance Requirements” section of the Bases under the heading “SR 3.3.1.11” provides clarity.

Since Bases references to FSAR Sections and Chapters are to an external document, it is appropriate to include the “FSAR” modifier.

VII. GTST Safety Evaluation

Technical Analysis:

DOC M01 revises MTS 3.3.1 SR 3.3.1.6 and SR 3.3.1.7 (GTS 3.3.1 SR 3.3.1.8 and SR 3.3.1.9) requirements to state "Perform COT in accordance with Setpoint Program," in place of "Perform RTCOT in accordance with Setpoint Program." PTS Section 1.1 defines a Reactor Trip Channel Operational Test (RTCOT) as "A RTCOT shall be the injection of a simulated or actual signal into the reactor trip channel as close to the sensor as practicable to verify OPERABILITY of the required interlock and/or trip functions. The RTCOT may be performed by means of a series of sequential, overlapping, or total channel steps so that the entire channel is tested from the signal conditioner through the trip logic."

The proposed AP1000 STS Section 1.1 definition for Channel Operational Test (COT) per reference 2, DOC A001, states "A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps."

MTS SR 3.3.1.6 and SR 3.3.1.7 require an RTCOT, in accordance with the Setpoint Program, to be performed on each TS required automatic protection instrumentation Function. Each Function requiring performance of an RTCOT by either MTS 3.3.1 SR 3.3.1.6 or SR 3.3.1.7 also requires performance of a Channel Calibration by either MTS 3.3.1 SR 3.3.1.8 or SR 3.3.1.9. Therefore, the Functions referencing MTS 3.3.1 SR 3.3.1.6 and SR 3.3.1.7 contain adjustable devices.

The definition of RTCOT does not explicitly require adjustments of required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The Bases associated with the RTCOT describe these adjustments, but the Bases are intended to clarify, not provide additional requirements. A COT explicitly requires these adjustments. Therefore, the definition of a COT more closely aligns with the description of the testing provided in the Bases for MTS SR 3.3.1.6 and SR 3.3.1.7. Use of COT for these SRs is consistent with similar testing specified in NUREG-1431, TS 3.3.1. Use of COT for this SR is consistent with similar testing specified in NUREG-1431, TS 3.3.1. Use of COT is also consistent with testing performed on other instrumentation specified in the PTS.

The GTS/PTS Section 1.1 definition of RTCOT is deleted for a series of reasons as described in DOC M01. Changes made by DOC M01 result in consistency with the use of Actuation Logic Test and COT in other TS requirements, are consistent with the intent of the required TS testing, and are consistent with NUREG-1431, Rev.4.

DOC M02 addresses the fact that PTS 3.3.1, "Reactor Trip System (RTS) Instrumentation," does not specify Actions for inoperability of more than two inoperable automatic initiation channels. This results in entry into LCO 3.0.3 when three or more channels are inoperable. GTS LCO 3.0.3 is only applicable in MODES 1, 2, 3, and 4, and states:

> When an LCO is not met and the associated ACTIONS are not met, an associated ACTION is not provided, or if directed by the associated ACTIONS, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable,

a. MODE 3 within 7 hours; and
b. MODE 4 within 13 hours; and
c. MODE 5 within 37 hours.

GTS 3.3.1 and 3.3.2 Functions with applicability statements that include MODE 1, 2, 3, or 4, generally have no Actions specified for addressing a loss of function condition, such as when all required channels are inoperable. Upon discovery of such a condition, LCO 3.0.3 would apply. The intent of LCO 3.0.3 (as stated in the TS Bases) is to "impose time limits for placing the unit in a safe MODE or other specified condition when operation cannot be maintained within the limits for safe operation as defined by the LCO and its ACTIONS."

The Actions for inoperable RTS and ESFAS instrumentation provide restoration time and/or compensatory action allowances (e.g., place the inoperable channel in trip); but only for inoperability of some of the channels (e.g., 1 or 2 out of 4 required channels, typically). If these restoration and/or compensatory actions cannot be met in the required time, "default" actions are provided, which are designed to place the unit in a safe MODE or other specified condition – typically, actions that result in exiting the Applicability for that Function.

The shutdown actions of LCO 3.0.3 are typical of "default" actions throughout the TS that direct plant shutdown to exit the Applicability, with the exception that LCO 3.0.3 includes an additional 1 hour before the shutdown is required to be initiated.

The revisions described in DOC M02 address multiple-channel inoperability. The revisions will immediately impose the "default" Actions for that Function – without allowance for the 1 hour delay that is provided in LCO 3.0.3. Furthermore, the Function-specific "default" actions (currently, or proposed to be, specified for some Functions) impose requirements intended to establish safe operation that are not necessarily required by LCO 3.0.3. Since each Function-specific default action is specifically considering that Function's safety-basis, such default actions necessarily result in more appropriate actions than the general default actions of LCO 3.0.3. Specifically, the Actions for each new Condition associated with DOC M02 for RTS and ESFAS Functions applicable in MODES1, 2, 3, or 4, are compared to LCO 3.0.3, and in each case, the new Actions are equivalent to or more restrictive than the actions of LCO 3.0.3.

STS 3.3.1, revision of Condition C leads to new default Action D or Action E. Action D to be in Mode 3 in 6 hours, which is more restrictive than LCO 3.0.3, and Action E to be below P-10 (approximately 10% RTP) in 6 hours, which is also more restrictive than LCO 3.0.3.

GTS 3.3.1 and 3.3.2 actions do not specify conditions that explicitly address multiple inoperable channels (that is, more than two inoperable channels or divisions, in most cases), and therefore default to LCO 3.0.3. In each instance, the proposed actions to address these conditions are more restrictive than the LCO 3.0.3 actions because completion times for reaching lower operational modes are shorter by 1 hour. In addition, Function-specific actions, where specified, are more appropriate for the affected Function than the unit-shutdown actions of LCO 3.0.3 alone. Therefore, the changes specified by DOC M02 do not introduce any adverse impact on public health and safety.

DOC L08 deletes MTS 3.3.1 Action F. The actions provided in MTS 3.3.1 Required Action F.1.1 and F.2.2 are related to GTS 3.2.4, Quadrant Power Tilt Ratio (QPTR), radial power distribution monitoring. The two SRs of GTS 3.2.4 are provided with Notes defining the appropriate SR when Power Range Neutron Flux channels may not be available for monitoring. These SRs and their Notes provide the appropriate restrictions in the event of inoperable Power Range Neutron Flux channels without reliance on duplicating those restrictions in the actions of MTS 3.3.1.

As stated in the bases for MTS 3.3.1 Action F, the requirement to reduce power to ≤ 75% is an alternate to monitoring QPTR every 12 hours in accordance with SR 3.2.4.2 (i.e., Required Action F.2.2 and as stated in SR 3.2.4.2). The MTS 3.3.1, Required Action F.2.2 Note and the GTS 3.2.4 Applicability both state that this would only be required in the event the On-line Power Distribution Monitoring System (OPDMS) is not monitoring parameters.

Furthermore, Power Range Neutron Flux channels could be inoperable for the RTS function yet continue to provide usable input for QPTR monitoring, in which case neither the power reduction nor performance of SR 3.2.4.2 would be necessary to provide adequate protection and monitoring.

Finally, if there were two inoperable Power Range Neutron Flux channels, Required Action F.2.1 would require both inoperable channels to be placed in bypass. The AP1000 design does not permit bypassing more than one channel. As such, this required action is inappropriate and could not be completed. The remaining components of STS 3.3.1 Action F match Action A.

As such, the overly restrictive and inappropriate required actions are being deleted in STS 3.3.1 because adequate compensatory measures already address the potential impact on radial power monitoring and the remaining actions are appropriate for compensatory and mitigative actions in the event the RTS function is degraded for the Power Range Neutron Flux function. Therefore, this change has no significant adverse impact on the public health and safety.

DOC L10 removes Function 12, Reactor Trip System Interlocks (P-6, P-10, and P-11), from MTS 3.3.1, Table 3.3.1-1. RTS interlocks are provided to ensure reactor trip system instrumentation and actuation Functions are in the correct configuration for the current plant status. They back up operator actions to ensure protection system Functions are not blocked during plant conditions in which the safety analysis assumes the Functions are Operable.

Additionally, several interlocks are included as part of the ESFAS (GTS 3.3.2, Function 18). These ESFAS interlocks (P-3, P-4, P-6, P-11, P-12, and P-19) are provided to permit the operator to block some signals, automatically enable other signals, prevent some actions from occurring, and cause other actions to occur. The interlock Functions backup manual actions to ensure ESF instrumentation and actuation Functions that can be bypassed are in operation under the conditions assumed in the safety analyses.

The interlocks, as separate RTS and ESFAS Functions are removed from the GTS and the associated action requirements are deleted. Interlock Operability is adequately addressed by each related Function's requirement to be Operable and the requirement for reactor trip logic and ESF actuation logic operability.

For these related RTS and ESFAS instrumentation and actuation Functions to be Operable, the associated RTS and ESFAS interlock functions would have to be in the required state as a support feature for Operability. For these RTS trip and ESFAS actuation Functions to be Operable, the associated RTS and ESFAS interlock Functions would have to be in the required state as a support feature for operability. These RTS and ESFAS interlock functions do not directly trip the reactor or actuate ESFAS, and as such are removed from the actuation instrumentation listing in TS. The role of the interlocks, and their support for the operability of RTS trip and ESFAS actuation Functions, are described in the TS Bases, as well as in Final Safety Analysis Report (FSAR) Chapter 7, Instrumentation and Controls.

Furthermore, each RTS trip and ESFAS actuation Function is required operable during the stated TS Applicability. The Applicability for certain trip or actuation Functions is based on transitioning above or below an interlock; while other Functions are not directly supported by an

interlock. For Functions supported by an interlock, while operating within the TS required Applicability for that Function, its associated supporting interlock is not required to automatically change state. The interlock status must be established in conjunction with assuring supported Function's operability prior to entering the required Applicability. In addition, LCO 3.0.4 requires the operators to ensure RTS trip and ESFAS operability prior to entering their Applicability. These TS requirements remain in effect and impose the necessary operability requirements related to the removed interlock Functions. As such, interlocks are adequately addressed by each related Function's requirement to be operable and the requirement for actuation logic operability.

MTS SR 3.3.1.7 Surveillance Note provides details of performing a Channel Operational Test (COT) and is deleted. The requirement for verification that interlocks P-6 and P-10 are in their required state for existing unit conditions is unchanged and is appropriately summarized in the Bases.

If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate operability evaluations performed for the affected Function(s), which would evaluate potential operability impact on individual instrument Function channels and/or the coincident logic subsystem channel. Adverse impacts to operability could be evaluated to affect individual instrumentation channels, or may be evaluated to impact the divisional coincident logic. In either outcome, the appropriate actions are provided by the affected supported feature(s).

Certain Actions being deleted for inoperable interlock functions (GTS 3.3.1 Required Action M.1 for RTS interlocks [MTS 3.3.1 Action G.1]) provide an optional allowance: "Verify the interlocks are in the required state for the existing plant conditions" within "1 hour." This verification is essentially the operability evaluation for the supported functions. If interlocks are not in the required state for the existing plant conditions, then the affected supported Functions would be inoperable and their Actions would apply. The PTS 1 hour allowance provides time for the operator to manually place the interlock in the state that accomplishes the interlock function necessary to support RTS actuation Function operability. Once this required action is completed, operation is allowed to continue indefinitely without limit. As such, this optional action provides an acceptable alternative to reliance on the automatic interlock function to enable the supported Function, and allows the operator to manually establish the required interlock state. With this optional action deleted, the determination of supported function operability is immediate and the actions for any inoperable supported Functions are immediately entered; thereby making this portion of the change more restrictive.

Instrument channel Functions with interlocks implicitly required to support the Function's operability, are also addressed by the COT and Channel Calibration Surveillance Requirements. Actuation logic with interlocks implicitly required to support operability of the logic is also addressed by the Actuation Logic Test Surveillance Requirements. The applicable COT, Channel Calibration, and Actuation Logic Test Bases will include the following discussion supporting this change ("CHANNEL CALIBRATION" is replaced with "COT" or "ACTUATION LOGIC TEST" as appropriate):

> Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this CHANNEL CALIBRATION. This portion of the CHANNEL CALIBRATION ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an

interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

Related actions being deleted (GTS 3.3.1 Action M.2.1, M.2.2, and M.3 for RTS interlocks [MTS 3.3.1 Action G.2.1, G.2.2, and G.3 following revision provided by DOC A024]; which are to trip and/or bypass inoperable channels) also have the additional 1-hour greater allowance than specified for associated inoperable actuation Functions. Therefore, removal of these actions is also a more restrictive portion of the change.

The remaining changes, including those made by DOC A024, are editorial, clarifying, grammatical, or otherwise considered administrative. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

Having found that this GTST's proposed changes to the GTS and Bases are acceptable, the NRC staff concludes that AP1000 STS Subsection 3.3.1 is an acceptable model Specification for the AP1000 standard reactor design.

References to Previous NRC Safety Evaluation Reports (SERs):

None

VIII. Review Information

Evaluator Comments:

None

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/29/2014.

APOG Comments (Ref. 7) and Resolutions:

1. (Internal # 3 and 138) Throughout the Bases, references to Sections and Chapters of the FSAR do not include the "FSAR" clarifier. Since these Section and Chapter references are to an external document, it is appropriate (DOC A003) to include the "FSAR" modifier. This is resolved by adding the FSAR modifier as appropriate.

2. (Internal # 6) The GTST sections often repeat VEGP LAR DOCs, which reference "existing" and "current" requirements. The inclusion in the GTST of references to "existing" and "current," are not always valid in the context of the GTS. Each occurrence of "existing" and "current" should be revised to be clear and specific to GTS, MTS, or VEGP COL TS (or other), as appropriate. Noted ambiguities are corrected in the GTST body.

3. (Internal # 7) Section VII, GTST Safety Evaluation, inconsistently completes the subsection "References to Previous NRC Safety Evaluation Reports (SERs)" by citing the associated SE for VEGP 3&4 COL Amendment 13. It is not clear whether there is a substantive intended difference when omitting the SE citation. This is resolved by removing the SE citation in Section VII of the GTST and ensuring that appropriate references to the consistent citation of this reference in Section X of the GTST are made.

4. (Internal #13) Many GTSTs evaluated TSTF-425 with the following note: Risk-informed TS changes will be considered at a later time for application to the AP1000 STS.

   The NRC approval of TSTF-425, and model safety evaluation provided in the CLIIP for TSTF-425, are generically applicable to any design's Technical Specifications. As such, the replacement of certain Frequencies with a Surveillance Frequency Control Program should be included in the GTST for AP1000 STS NUREG.

   However, implementation in the AP1000 STS should not reflect optional (i.e., bracketed) material showing retention of fixed Surveillance Frequencies where relocation to a Surveillance Frequency Control Program is acceptable. Since each represented AP1000 Utility is committed to maintaining standardization, there is no rationale for an AP1000 STS that includes bracketed options.

Consistent with TSTF-425 criteria, replace applicable Surveillance Frequencies with “In accordance with the Surveillance Frequency control Program” and add that Program as new AP1000 STS Specification 5.5.15.

NRC Staff disagreed with implementing TSTF-425 in the initial version of the STS. Although the APOG thinks the analysis supporting this traveler is general enough to be applicable to AP1000, staff thinks an AP1000-specific proposal from APOG is needed to identify any GTS SRs that should be excluded. Also, with the adoption of a Surveillance Frequency Control Program (SFCP) in the AP1000 STS, bracketed Frequencies, which provide a choice between the GTS Frequency and the SFCP Frequency, are needed because the NRC will use the AP1000 STS as a reference, and to be consistent with NUREG-1431, Rev. 4. APOG was requested to consider proposing an AP1000 version of TSTF-425 for a subsequent revision of the STS.

5. (Internal # 116) In GTST for Subsection 3.3.1 (and Subsections 3.3.2 through 3.3.7), Section VI, under the heading “Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes,” the first paragraph mentions DOC A028. This DOC is for changes to ESFAS TS and does not affect Subsection 3.3.1. Note that it is not mentioned anywhere else in this Subsection. This is also stated in Subsections 3.3.2 through 3.3.7. Change “DOCs A024 and A028” to “DOC A024” in GTST 3.3.1 through GTST 3.3.7. This is resolved by making the recommended change.

6. (Internal # 117 and 118) In GTST for Subsection 3.3.1, Section VII, under the heading “GTST Safety Evaluation,” the fifth paragraph states, “With the DOC L01 changes, an RTCOT is not required by the TS. Therefore, the Section 1.1 RTCOT definition is deleted.” The definition of RTCOT is deleted for a series of reasons as described in DOC M01. Replace the fifth paragraph, with:

   > The GTS/PTS Section 1.1 definition of RTCOT is deleted for a series of reasons as described in DOC M01. Changes made by DOC M01 result in consistency with the use of Actuation Logic Test and COT in other TS requirements, are consistent with the intent of the required TS testing, and are consistent with NUREG-1431, Rev.4.

   This is resolved by making the recommended change.

7. (Internal # 119) The modifier “PMS” for “power range detectors,” “Intermediate Range Neutron Flux,” and “Source Range, Neutron Flux,” is unnecessary. Inclusion of “PMS” in the Bases is inconsistent with other PMS instruments, with the LCO requirement nomenclature, and the general AP1000 DCD presentation. Delete “PMS” as a modifier to “power range,” “Intermediate Range,” and “Source Range,” throughout the Bases. NRC Staff notes that this comment also applies to STS Subsections 3.3.2, 3.3.3, 3.3.8, and 3.9.3. This is resolved by making the recommended change with additional edits. NRC staff notes that the initial use of Protection and Safety Monitoring System (PMS) in the Bases for an STS Subsection should be retained. In addition, NRC staff proposes to uniformly use

   - Power Range Neutron Flux,
   - Intermediate Range Neutron Flux, and
   - Source Range Neutron Flux

   in place of other phrases that refer to power, intermediate, and source range instrumentation channels or detectors. NRC staff further proposes to remove “interlock”

after P-6 and P-10, except when used to refer to the interlock and not the setpoint-and to be consistent with TS wording.

In the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Intermediate Range Neutron Flux, P-6," revise the first paragraph as indicated:

> The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective PMS **division** Intermediate Range Neutron Flux channel increases to approximately one decade above the channel lower range limit. The P-6 interlock ensures that the following are performed:
>
> (1) On increasing power, the P-6 interlock allows the manual block of the respective PMS **division** Source Range Neutron Flux **– High Setpoint** reactor **Function** trip **channel**. This prevents a premature block of the ~~source range~~ **Source Range Neutron Flux – High reactor** trip **Function channel** and allows the operator to ensure that the ~~intermediate range~~ **Intermediate Range Neutron Flux – High reactor trip Function channels are** ~~is~~ OPERABLE prior to leaving the source range. When ~~the~~ **a** ~~source range~~ **Source Range Neutron Flux – High reactor** trip **Function channel** is blocked, the high voltage to the **detector of the Source Range Neutron Flux channel** ~~detectors~~ is also removed.
>
> (2) On decreasing power, the P-6 interlock automatically energizes the **respective** PMS ~~source range~~ **division Source Range Neutron Flux** detector~~s~~ and enables the **respective** PMS **division** Source Range Neutron Flux **– High** reactor trip **Function channel**.
>
> (3) On increasing power, the P-6 interlock provides a backup ~~block~~ signal to **automatically block** the **respective PMS division** ~~source range neutron flux doubling~~ **Source Range Neutron Flux Doubling Engineered Safety Feature Actuation System (ESFAS) Function channel** ~~circuit~~. Normally, this **Boron Dilution Block ESFAS** Function is manually blocked by the main control room operator during the reactor startup.

In the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Power Range Neutron Flux, P-10," revise the first sentence of the first paragraph as indicated:

> The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the **respective PMS division** ~~power- range~~ **Power Range Neutron Flux channel** ~~detector~~ **detectors**.

In the "ASA, LCO, and Applicability" section of the Bases for STS Subsection 3.3.1, under the heading "Power Range Neutron Flux, P-10" revise paragraph (4) as indicated:

> (4) On increasing power, the **respective PMS division** P-10 interlock **channel** automatically provides a backup ~~block~~ signal to **block** the **respective PMS division** Source Range Neutron Flux reactor trip **channel** and also to de-energize the **respective PMS division** ~~source range~~ **Source Range Neutron Flux** ~~detectors~~ **detector**.

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “Power Range Neutron Flux, P-10” revise paragraph (6) as indicated:

> (6) On decreasing power, the **respective PMS division** P-10 interlock **channel** automatically enables the **respective** Power Range Neutron Flux – Low **Setpoint** reactor trip **channel** and the **respective** Intermediate Range Neutron Flux **– High** reactor trip (and rod stop) **channel**.

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “1. Power Range Neutron Flux,” revise the first paragraph as indicated:

> The ~~PMS power range~~ **Power Range Neutron Flux** detectors are located external to the reactor vessel and measure neutrons leaking from the core. The ~~PMS power range~~ **Power Range Neutron Flux** detectors provide input to the PLS. Minimum requirements for protection and control ~~is~~ **are** achieved with three channels OPERABLE. . . .

Revise the heading and last sentence of last paragraph under the heading “a. Power Range Neutron Flux – High Setpoint” as indicated:

> . . . In addition, the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect neutron **flux** levels in this range.

Revise the heading and second and third sentences of the third paragraph under the heading “b. Power Range Neutron Flux – Low Setpoint” as indicated:

> . . . ~~This~~ **Each channel of this** Function may be manually blocked by the operator when the respective ~~power range~~ **division Power Range Neutron Flux** channel is greater than approximately 10% of RTP (P-10 setpoint). ~~This~~ **Each channel of this** Function is automatically unblocked when the respective ~~power~~ range **division Power Range Neutron Flux** channel is below the P-10 setpoint. . . .

Revise the heading and first sentence of the fourth paragraph under the heading “b. Power Range Neutron Flux – Low Setpoint” as indicated:

> . . . because the reactor is shutdown and the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect **the** neutron **flux** levels generated in MODES 3, 4, 5, and 6. . .

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “2. Power Range Neutron Flux – High Positive Rate,” revise the third sentence of the first paragraph as indicated:

> . . . The Power Range Neutron Flux **– High Positive** Rate trip uses the same **Power Range Neutron Flux** channels as discussed for Function 1 above.

Revise the second paragraph, last sentence, as indicated:

> . . . In addition, the ~~PMS power range~~ **Power Range Neutron Flux** detectors cannot detect neutron **flux** levels present in ~~this~~ MODE **6**.

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “3. Overtemperature ΔT,” revise the last sentence of the first paragraph and the third bullet as indicated:

> . . . The ~~overtemperature~~ **Overtemperature** ΔT ~~setpoint~~ **Trip Setpoint** is automatically varied for changes in the parameters that affect DNB as follows: . . .
>
> - axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower ~~power range~~ **Power Range Neutron Flux** detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower ~~PMS power range~~ **Power Range Neutron Flux** detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

Revise the last paragraph, first sentence, as indicated:

> In MODE 1 or 2, the Overtemperature ΔT trip **Function** must be OPERABLE to prevent DNB.

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “4. Overpower ΔT,” revise the first paragraph, second and fourth sentences, and bulleted paragraph as indicated:

> . . . This trip Function also limits the required range of the Overtemperature ΔT trip ~~function~~ **Function** and provides a backup to the Power Range Neutron Flux – High Setpoint trip **Function**.
>
> . . . It uses the same ΔT power signal generated for the Overtemperature ΔT **trip Function**. The ~~setpoint~~ **Trip Setpoint** is automatically varied with the following parameter:
>
> - Axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower ~~power range~~ **Power Range Neutron Flux** detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower ~~PMS power range~~ **Power Range Neutron Flux** detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

Revise the third paragraph, third sentence, as indicated:

> . . . The Overpower ΔT **trip** Function receives input from channels shared with other RTS Functions.

In the “ASA, LCO, and Applicability” section of the Bases for STS Subsection 3.3.1, under the heading “12. Passive Residual Heat Removal Actuation,” revise the first sentence of the first and third paragraphs as indicated:

> The Passive Residual Heat Removal (PRHR) Actuation reactor trip **Function** ensures that a reactivity excursion due to cold water injection will be minimized upon an inadvertent operation of the PRHR discharge valves. . . .

In MODES 1 and 2, the ~~Passive Heat Removal~~ **PRHR** Actuation reactor trip **Function** must be OPERABLE. In MODES 3, 4, 5, and 6, the **PRHR Actuation** ~~Passive Heat Removal Initiation~~ reactor trip Function does not have to be OPERATIONAL because the reactor is not operating or critical.

In the "Actions" section of the Bases for STS Subsection 3.3.1, under the heading "E.1," revise the second sentence of the paragraph as indicated:

. . . If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, ~~thermal power~~ **THERMAL POWER** must be reduced to below the P-10 **setpoint,**~~interlock;~~ a condition in which the LCO does not apply.

In the "SRs" section of the Bases for STS Subsection 3.3.1, under the heading "SR 3.3.1.6," in paragraphs beginning with following sentences, revise those sentences as indicated:

A test subsystem is provided with the Protection and Safety Monitoring System **(PMS)** to aid the plant staff in performing the COT.

To the extent possible, ~~Protection and Safety Monitoring System~~ **PMS** functional testing is accomplished with continuous system self-checking features and the continuous functional testing features.

Under heading of "SR 3.3.1.6," revise last two paragraphs as indicated:

~~This~~ **The** ~~test frequency~~ **COT Surveillance Frequency** of 92 days is justified based on Reference ~~6~~ **7 (which refers to this test as "RTCOT")** and the use of continuous diagnostic test features, such as deadman timers, cross-check of redundant channels, memory checks, numeric coprocessor checks, and tests of timers, counters and crystal time bases, which will report a failure within the ~~Protection and Safety Monitoring System~~ **PMS** cabinets to the operator within 10 minutes of a detectable failure.

During the ~~RT~~COT, the ~~protection and safety monitoring system~~ **PMS** cabinets in the division under test may be placed in bypass.

Under heading of "SR 3.3.1.7," revise the fifth sentence of the first paragraph as indicated:

This evaluation will consist of resetting the ~~channels~~ **channel** ~~setpoint~~ **Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the ~~channels~~ **channel** response.

Under heading of "SR 3.3.1.7," revise the third, fourth, and last sentences of the third paragraph as indicated:

. . . The Frequency of ~~every~~ 92 days thereafter applies **to the performance of this COT** if the plant remains in the MODE of Applicability after the initial performances of prior to reactor startup and ~~four~~ **4** hours after reducing power below P-10. The MODE of Applicability for this surveillance is < P-10 for the ~~power range low~~ **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** channels. . . . ~~This test~~ **The Surveillance**

> **Frequencies for this COT** ~~ensures~~ **ensure** that the ~~NIS power range low~~ **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** channels are OPERABLE prior to taking the reactor critical and after reducing power into the applicable MODE (< P-10) for periods **greater than four** ~~> 4~~ hours.

Under heading of "SR 3.3.1.8," revise the second paragraph as indicated:

> The ~~test~~ **CHANNEL CALIBRATION** is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response.
> . . .

Under heading of "SR 3.3.1.9," revise the first three paragraphs as indicated (see comment # 136):

> ~~SR 3.3.1.9 is the performance of a~~ **A** CHANNEL CALIBRATION **is performed** every 24 months**, or approximately at every refueling**. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. ~~The test is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable.~~
>
> The ~~test~~ **CHANNEL CALIBRATION** is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response.
> . . .
>
> ~~The~~ **This Surveillance does not include the** CHANNEL CALIBRATION for the ~~power range neutron~~ **Power Range Neutron Flux** detectors**, which** consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore **Power Range Neutron Flux detectors**~~channels~~. ~~This Surveillance is not required for the power range detectors for entry into MODES 2 and 1 because the plant must be in at least MODE 1 to perform the test.~~

Under heading of "SR 3.3.1.9," revise the last paragraph as indicated:

> The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed ~~on~~ **at** the 24 month Frequency.

Under heading of "SR 3.3.1.10," revise the first and third paragraphs as indicated:

SR 3.3.1.10 is the performance of a TADOT of the Passive Residual Heat Removal **(PRHR)** Actuation **reactor trip Function**. This TADOT is performed every 24 months.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The ~~Functions~~ **Function (reactor trip on PRHR Actuation)** affected ~~have~~ **by this** SR **has** no setpoints associated with ~~them~~ **it.**

Under heading of "SR 3.3.1.11," revise the first sentence of the second paragraph as indicated (see comment # 138):

For channels that include dynamic transfer Functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer Function set to one, with the resulting measured response time compared to the appropriate ~~DCD~~ **FSAR** Chapter 7 response time.

Under heading of "SR 3.3.1.11," revise the first and second sentences of the fifth paragraph as indicated (see comment # 137):

~~The~~ SR 3.3.1.11 is modified by a ~~note~~ **Note** ~~exempting neutron detectors from response time testing. A Note to the Surveillance indicates~~ **indicating** that neutron detectors ~~may be~~ **are** excluded from RTS RESPONSE TIME testing.

8. (Internal # 120 and 132) The second paragraph of the discussion under Required Action A.1 is not relevant to the RTS Instrumentation Functions listed in STS Table 3.3.1-1. This discussion is captured in the STS LCO 3.3.3 Bases. This paragraph should be deleted. This is resolved by making the recommended change.

9. (Internal # 121) Table 3.3.1-1, Item 3, REQUIRED CHANNELS states "4", whereas the GTS states "4 (2/loop)". There is no discussion of change. This appears to be a typographical oversight. Replace "4" with "4 (2/loop)" in Table 3.3.1-1, Item 3 Required Channels. This is resolved by making the recommended change.

10. (Internal # 122) The tense of the verb in the "Background" section of the Bases for STS Subsection 3.3.1, in the fourth paragraph, last sentence is incorrect. Change "assured" to "assures." This is resolved by making the recommended change.

11. (Internal # 123) In the "Background" section of the Bases, change "ESF" to "Engineered Safety Features (ESF)" in the first bullet under the heading "Protection and Safety Monitoring Cabinets." ESF – Engineered Safety Features – has not been previously defined. This is resolved by making the recommended change.

12. (Internal # 124) In the "Background" section of the Bases, change "±" to "plus or minus" in the first paragraph, second sentence, and second paragraph, last sentence under the heading "Nominal Trip Setpoint (NTS)." Per APOG, this change aligns with Writer's Guide convention when no value follows the symbol. This is resolved by making the recommended change. However, NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4.

13. (Internal # 125) In the "Background" section of the Bases under the heading "Reactor Trip Switchgear Interface," include additional clarifying information for the reactor trip switchgear

voting logic consistent with the design as described in AP1000 DCD section 7.2.1.1.7. Add the phrase ", which allows RTB closure" to the end of the first sentence of the section. This is resolved by making the recommended change. NRC staff noted that the abbreviation RTB should be spelled out in the first occurence in this sentence.

14. (Internal # 126) In the "ASA, LCO, and Applicability" section of the Bases for STS Subsections 3.3.1 through 3.3.7, revise the opening sentence to state:

    The RTS functions to maintain **compliance with** the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed

    This provides additional clarity. This is resolved by making the recommended change.

15. (Internal # 127) In the "ASA, LCO, and Applicability" section of the Bases, change "±" to "plus or minus" in the fourth paragraph. Per APOG, this change aligns with Writer's Guide convention when no value follows the symbol. This is resolved by making the recommended change. However, NRC staff notes that the Writer's Guide is actually silent regarding this convention and this change does not conform to the convention of NUREG-1431, Rev. 4.

16. (Internal # 128) In the "ASA, LCO, and Applicability" section of the Bases, change the first word "on" to "On" in paragraph (1) under the heading "Power Range Neutron Flux, P-10." This is consistent with paragraph (2) through paragraph (6). This is resolved by making the recommended change. The change is consistent with Writers Guide 2.1.3.b.1; however, the use of digits in parenthesis is contrary to the Writer's Guide for primary level ordered list enumeration, which uses lower case letters. Also, the Writer's Guide does not directly discuss ordered list enumeration convention for the "ASA, LCO, and Applicability" section of the Bases for Section 3.3. Nevertheless, this change makes the Bases discussion of P-10 consistent with that of P-6, and with NUREG-1431, Rev. 4, and so is acceptable.

17. (Internal # 129) In the "ASA, LCO, and Applicability" section of the Bases, change ">" to "greater than the" in the paragraph under the heading "Pressurizer Pressure, P-11." Per APOG, this change aligns with Writer's Guide convention when no value follows the symbol. This is resolved by making the recommended change with an additional edit. Add "Function" following "High 2 reactor trip."

18. (Internal # 130) In the "ASA, LCO, and Applicability" section of the Bases under the heading "Power Range Neutron Flux, P-10," revise paragraph (5) and paragraph (6) to include the word "Setpoint" after the word "Low" for the listed Functions. This non-technical change provides consistency. This is resolved by making the recommended change with additional edits. As noted in the response to comment # 119, NRC staff proposes to add "respective division," "respective," and "channel" to emphasize the divisional implementation of the P-10 interlock.

19. (Internal # 131) In the "ASA, LCO, and Applicability" section of the Bases under Function 11 "SG Narrow range Water Level – High 2," capitalize the word "range" in the first paragraph, first sentence. In the second paragraph, the phrase "2 per SG" should be "(2 per SG)."

    The second change, "(2 per SG)" is incorrect. The "2" is part of the Function title, "SG Narrow range Water Level – High 2." NRC staff recommends the following correction to improve clarity:

> The LCO requires four channels of **the** SG Narrow Range Water Level – High 2 **trip Function** per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

20. (Internal # 133) The "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.1," includes a paragraph that lists the channels that are to be checked by the SR. This information is already provided in the Function column of the TS Table 3.3.1-1 and does not need to be repeated in the Bases. Including these functions is not consistent with other SR Bases. Delete the Bases paragraph listing the channel titles. This non-technical change provides consistency. This is resolved by making the recommended change.

21. (Internal # 134) In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.4," there is an extra period at end of last sentence in the first paragraph. Delete the extra period. This is resolved by making the recommended change with additional edits. NRC staff proposes to add "excore" and "nuclear instrument" and "Power Range Neutron Flux detectors" for consistency. Under SR 3.3.1.4, modify the last sentence of the first paragraph to state:

> SR 3.3.1.4 compares the AXIAL FLUX DIFFERENCE determined using the incore **neutron flux detector** system to the **excore** nuclear instrument channel AXIAL FLUX DIFFERENCE every 31 effective full power days (EFPD) **and adjusts the excore nuclear instrument channel if the absolute difference between the incore and excore AFD is ≥ 3% AFD**.~~.~~

Under SR 3.3.1.4, modify the last sentence of the first paragraph to state:

> If the absolute difference is ≥ 3% AFD the **excore** nuclear instrument channel is still OPERABLE, but must be readjusted. If the **excore** nuclear instrument channel cannot be properly readjusted, the channel is declared inoperable. This surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip Function** ~~function~~.

Under SR 3.3.1.5, add "nuclear instrument" to the first paragraph, so that it states:

> SR 3.3.1.5 is a calibration of the excore **nuclear instrument** ~~channels~~ **(Power Range Neutron Flux) detectors** to the incore **neutron flux** ~~channels~~ **detectors**. If the measurements do not agree, the excore **nuclear instrument** channels are not declared inoperable but must be adjusted to agree with the incore **neutron flux** detector measurements. If the excore **nuclear instrument** channels cannot be adjusted, the **excore nuclear instrument** channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip** Function.

22. (Internal # 135) The "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.7," states that the Frequency is "prior to startup." The TS SR 3.3.1.7 Frequency is actually "prior to reactor startup." Change "prior to startup" to "prior to reactor startup" This is resolved by making the recommended change with additional edits. NRC staff proposes additional clarifying edits. Under SR 3.3.1.7, modify the first sentence of the third paragraph to state:

The Frequency of prior to **reactor** startup ensures this surveillance is performed prior to critical operations and applies to the ~~source, intermediate and~~ **P**ower **R**ange **Neutron Flux – L**ow **Setpoint** instrument channels.

23. (Internal # 136) The "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.9," includes a closing sentence that states an exception for entering MODES 1 and 2, and that the plant must be in MODE 1 to perform the test. This provision is not in accordance with the actual SR. Delete the SR 3.3.1.9 Bases, third paragraph, final sentence. This is resolved by making the recommended change with additional edits. As noted in the response to another comment (internal# 119), NRC staff proposes additional clarifying edits. Under SR 3.3.1.9, modify the third paragraph to state:

    ~~The~~ **This Surveillance does not include the** CHANNEL CALIBRATION for the ~~power range neutron~~ **Power Range Neutron Flux** detectors**, which** consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore **Power Range Neutron Flux detectors** ~~channels~~. ~~This Surveillance is not required for the power range detectors for entry into MODES 2 and 1 because the plant must be in at least MODE 1 to perform the test.~~

24. (Internal # 137) In the "Surveillance Requirements" section of the Bases under the heading "SR 3.3.1.11," the first two sentences of the last paragraph state the same thing. Combine them into a single sentence for clarity. Delete first two sentences and replace with:

    SR 3.3.1.11 is modified by a Note indicating that neutron detectors may be excluded from RTS RESPONSE TIME testing.

    This is resolved by making the recommended change with an additional edit. NRC staff notes that "may be" should be "are."

NRC Final Approval Date: 12/14/2015

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IX. Evaluator Comments for Consideration in Finalizing Technical Specifications and Bases

Final production of files for Subsections 3.3.1, 3.3.8, and 3.3.9 will require reformatting of footnotes for Table 3.3.1-1, Table 3.3.8-1, and Table 3.3.9-1 to conform to Writer's Guide (Ref. 4) Sections 2.1.2 and 2.1.9; in particular [with clarification]:

2.1.2 Page Format

d. The suggested font is Arial 11 point for all type. … Reduced footnote, table, or figure font sizes may occasionally be required, but to ensure readability, these fonts should be no smaller than [Arial] 8 point …

2.1.9 Figure and Table Footnote Format

Footnotes are restricted for use in figures and tables. Footnotes are not used in Specifications or Bases except in figures and tables.

a. Use superscript, lower-case letters enclosed within parentheses as footnote designators where it modifies an item. Order them alphabetically.

b. If the same footnote is repeated in a figure or table, use the same footnote designator for each repeated reference. Do so even if the continued figure and table span several pages.

c. Place the footnote key on each page the footnote appears. Include in the key only those footnotes appearing on that page. For tables, the key is placed two blank lines below the table. … For figures, the key is two blank lines below the figure and one blank line above the title.

d. Footnote designators in the key should not be superscript. Text in the key should be indented two [en] spaces from the footnote designator.

e. On occasion, table width may preclude the use of the normal size font. When this occurs, regardless of the font [size] used, use the same font [size] for all facets of the figure or table: [except title], column headings, body text, and footnotes.

The above corrections will require moving Table entries from page to page to make room for the necessary footnotes. Note that these changes are necessary on the LCO mark-up and on the LCO clean version.

X. References Used in GTST

1. AP1000 DCD, Revision 19, Section 16, “Technical Specifications,” June 2011 (ML11171A500).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. NRC Safety Evaluation (SE) for Amendment No. 13 to Combined License (COL) No. NPF-91 for Vogtle Electric Generating Plant (VEGP) Unit 3, and Amendment No. 13 to COL No. NPF-92 for VEGP Unit 4, September 9, 2013, ADAMS Package Accession No. ML13238A337, which contains:

ML13238A355	Cover Letter - Issuance of License Amendment No. 13 for Vogtle Units 3 and 4 (LAR 12-002).
ML13238A359	Enclosure 1 - Amendment No. 13 to COL No. NPF-91
ML13239A256	Enclosure 2 - Amendment No. 13 to COL No. NPF-92
ML13239A284	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13)
ML13239A287	Enclosure 4 - Safety Evaluation (SE), and Attachment 1 - Acronyms
ML13239A288	SE Attachment 2 - Table A - Administrative Changes
ML13239A319	SE Attachment 3 - Table M - More Restrictive Changes
ML13239A333	SE Attachment 4 - Table R - Relocated Specifications
ML13239A331	SE Attachment 5 - Table D - Detail Removed Changes
ML13239A316	SE Attachment 6 - Table L - Less Restrictive Changes

The following documents were subsequently issued to correct an administrative error in Enclosure 3:

ML13277A616	Letter - Correction To The Attachment (Replacement Pages) - Vogtle Electric Generating Plant Units 3 and 4-Issuance of Amendment Re: Technical Specifications Upgrade (LAR 12-002) (TAC No. RP9402)
ML13277A637	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13) (corrected)

4. TSTF-GG-05-01, “Writer's Guide for Plant-Specific Improved Technical Specifications,” June 2005.

5. RAI Letter No. 01 Related to License Amendment Request (LAR) 12-002 for the Vogtle Electric Generating Plant Units 3 and 4 Combined Licenses, September 7, 2012 (ML12251A355).

6. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Response to Request for Additional Information Letter No. 01 Related to License Amendment Request LAR-12-002, ND-12-2015, October 04, 2012 (ML12286A363 and ML12286A360)

7. APOG-2014-008, APOG (AP1000 Utilities) Comments on AP1000 Standardized Technical Specifications (STS) Generic Technical Specification Travelers (GTSTs), Docket ID NRC-2014-0147, September 22, 2014 (ML14265A493).

XI. MARKUP of the Applicable GTS Subsection for Preparation of the STS NUREG

The entire section of the Specifications and the Bases associated with this GTST is presented next.

Changes to the Specifications and Bases are denoted as follows: Deleted portions are marked in strikethrough red font, and inserted portions in bold blue font.

3.3 INSTRUMENTATION

3.3.1 Reactor Trip System (RTS) Instrumentation

LCO 3.3.1 The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

---NOTE---

Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel inoperable.	A.1 Place inoperable channel in bypass or trip.	6 hours
B. One or more Functions with two channels inoperable.	B.1 Place one inoperable channel in bypass.	6 hours
	AND	
	B. 2 Place one inoperable channel in trip.	6 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met. OR **One or more Functions with three or more channels inoperable.**	C.1	Enter the Condition referenced in Table 3.3.1-1 for the channel(s).	Immediately
D. As required by Required Action C.1 and referenced in Table 3.3.1-1.	D.1	Be in MODE 3.	6 hours
E. As required by Required Action C.1 and referenced in Table 3.3.1-1.	E.1	Reduce THERMAL POWER to < P-10.	6 hours
~~F. One or two Power Range Neutron Flux - High channels inoperable.~~	~~F.1.1~~	~~Reduce THERMAL POWER to ≤ 75% RTP.~~	~~12 hours~~
	~~AND~~		
	~~F.1.2~~	~~Place one inoperable channel in bypass or trip.~~	~~6 hours~~
	~~AND~~		
	~~F.1.3~~	~~With two inoperable channels, place one channel in bypass and one channel in trip.~~	~~6 hours~~
	~~OR~~		

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~F. (continued)~~	~~F.2.1 Place inoperable channel(s) in bypass.~~	~~6 hours~~
	~~AND~~	
	~~F.2.2 --------------NOTE------------ Only required to be performed when OPDMS is inoperable and the Power Range Neutron Flux input to QPTR is inoperable. ---------------------------------~~	
	~~Perform SR 3.2.4.2.~~	~~Once per 12 hours~~
	~~OR~~	
	~~F.3 Be in MODE 3.~~	~~12 hours~~
~~G. One or two interlock channels inoperable.~~	~~G.1 Verify the interlocks are in required state for existing plant conditions.~~	~~1 hour~~
	~~OR~~	
	~~G.2.1 Place the Functions associated with one inoperable interlock channel in bypass or trip.~~	~~7 hours~~
	~~AND~~	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~G. (continued)~~	~~G.2.2 With two interlock channels inoperable, place the Functions associated with one inoperable interlock channel in bypass and with one inoperable interlock channel in trip.~~	~~7 hours~~
	~~OR~~	
	~~G.3 Be in MODE 3.~~	~~13 hours~~

SURVEILLANCE REQUIREMENTS

---NOTE---
Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2	-------------------------------NOTES------------------------------ 1. Adjust nuclear instrument channel in the Protection and Safety Monitoring System (PMS) if absolute difference is > 1% RTP. 2. Required to be met within 12 hours after reaching 15% RTP. 3. If the calorimetric heat balance is < 70% RTP, and if the nuclear instrumentation channel indicated power is: a. lower than the calorimetric measurement by > 1%, then adjust the nuclear instrumentation channel upward to match the calorimetric measurement. b. higher than the calorimetric measurement, then no adjustment is required. --- Compare results of calorimetric heat balance to nuclear instrument channel output.	24 hours

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.3	-------------------------------NOTES------------------------------ 1. Adjust the conversion factor, ΔT°, in the ΔT power calculation ($q_{\Delta T}$) if absolute difference between $q_{\Delta T}$ and the calorimetric measurement is > 1% RTP. 2. Required to be met within 12 hours after reaching 50% RTP. 3. If the calorimetric heat balance is < 70% RTP, and if $q_{\Delta T}$ is: a. lower than the calorimetric measurement by > 5%, then adjust ΔT° to match the calorimetric measurement. b. higher than the calorimetric measurement, then no adjustment is required. --- Compare results of calorimetric heat balance to the ΔT power calculation ($q_{\Delta T}$) output.	24 hours
SR 3.3.1.4	-------------------------------NOTES------------------------------ 1. Adjust nuclear instrument channel in PMS if absolute difference is ≥ 3% AFD. 2. Required to be met within 24 hours after reaching 20% RTP. --- Compare results of the incore detector measurements to nuclear instrument channel AXIAL FLUX DIFFERENCE.	31 effective full power days (EFPD)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.5	--------------------------------NOTE------------------------------- Required to be met within 24 hours after reaching 50% RTP. --- Calibrate excore channels to agree with incore detector measurements.	 92 EFPD
SR 3.3.1.6	Perform RTCOT in accordance with Setpoint Program.	92 days
SR 3.3.1.7	--------------------------------NOTE------------------------------- This Surveillance shall include verification that interlock P-10 is in its required state for existing unit conditions. **Only required to be performed when not performed within previous 92 days.** --- Perform RTCOT in accordance with Setpoint Program.	-------NOTE------- Only required when not performed within previous 92 days --------------------- Prior to reactor startup AND 4 hours after reducing power below P-10 AND 92 days thereafter

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.8	-------------------------------NOTE------------------------------ This Surveillance shall include verification that the time constants are adjusted to **within limits** ~~the prescribed values~~. --- Perform CHANNEL CALIBRATION in accordance with Setpoint Program.	24 months
SR 3.3.1.9	-------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION in accordance with Setpoint Program.	24 months
SR 3.3.1.10	-------------------------------NOTE------------------------------ Verification of setpoint is not required. --- Perform TADOT.	24 months
SR 3.3.1.11	-------------------------------NOTE------------------------------ Neutron detectors are excluded from response time testing. --- Verify RTS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

Table 3.3.1-1 (page 1 of 2)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
1. Power Range Neutron Flux				
a. High Setpoint	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.6 SR 3.3.1.9 SR 3.3.1.11
b. Low Setpoint	1[(a)],2	4	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.11
2. Power Range Neutron Flux High Positive Rate	1,2	4	D	SR 3.3.1.6 SR 3.3.1.9 SR 3.3.1.11
3. Overtemperature ΔT	1,2	4 (2/loop)	D	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
4. Overpower ΔT	1,2	4 (2/loop)	D	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
5. Pressurizer Pressure				
a. Low Setpoint	1[(b)]	4	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
b. High Setpoint	1,2	4	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
6. Pressurizer Water Level – High 3	1[(b)]	4	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11

Table 3.3.1-1 (page 2 of 2)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
7. Reactor Coolant Flow – Low	1(b)	4 per hot leg	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
8. Reactor Coolant Pump (RCP) Bearing Water Temperature – High	1,2	4 per RCP	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
9. RCP Speed – Low	1(b)	4 (1/pump)	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
10. Steam Generator (SG) Narrow Range Water Level – Low	1,2	4 per SG	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
11. Steam Generator (SG) Narrow Range Water Level – High 2	1,2(c)	4 per SG	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
~~12. Reactor Trip System Interlocks~~				
~~a. Intermediate Range Neutron Flux, P-6~~	~~2~~	~~4~~	~~G~~	~~SR 3.3.1.6~~ ~~SR 3.3.1.9~~
~~b. Power Range Neutron Flux, P-10~~	~~1,2~~	~~4~~	~~G~~	~~SR 3.3.1.6~~ ~~SR 3.3.1.9~~
~~c. Pressurizer Pressure, P-11~~	~~1,2~~	~~4~~	~~G~~	~~SR 3.3.1.6~~ ~~SR 3.3.1.9~~
12~~13~~. Passive Residual Heat Removal Actuation	1,2	4 per valve	D	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11

(a) Below the P-10 (Power Range Neutron Flux) interlocks.

(b) Above the P-10 (Power Range Neutron Flux) interlock.

(c) Above the P-11 (Pressurizer Pressure) interlock.

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

BASES

BACKGROUND

The RTS initiates a unit shutdown, based upon the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Feature Actuation System (ESFAS) in mitigating accidents.

The Protection and Safety Monitoring System (PMS) has been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

Technical Specifications are required by 10 CFR 50.36 to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as "Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Safety Analysis Limit (SAL) is the limit of the process variable at which a protective action is initiated, as established by the safety analysis, to assure that a SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Safety Analysis Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The LSSS values are identified and maintained in the Setpoint Program (SP) and are controlled by 10 CFR 50.59.

The Nominal Trip Setpoint (NTS) specified in the SP is a predetermined field setting for a protection channel chosen to initiate automatic actuation prior to the process variable reaching the Safety Analysis Limit and, thus, assures that the SL is not exceeded. As such, the NTS accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the NTS **assures** ~~assured~~ that the SLs are not exceeded. Therefore, the NTS meets the 10 CFR 50.36 definition of an LSSS.

BASES

BACKGROUND (continued)

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of performing its safety functions(s)." Relying solely on the NTS to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as-found" value of a protection channel setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the NTS due to some drift of the setting may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the NTS, and thus, the automatic protective action would still have assured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE since it would have performed its safety function. If the as-found condition of the channel is near the as-found tolerance, recalibration is considered appropriate to allow for drift during the next surveillance interval.

During AOOs, which are those events expected to occur one or more times during the unit life, the acceptable limits are:

1. The Departure from Nucleate Boiling Ratio (DNBR) shall be maintained above the Safety Limit (SL) value to prevent departure from nucleate boiling (DNB);

2. Fuel centerline melt shall not occur; and

3. The RCS pressure SL of 2750 psia shall not be exceeded.

Operation within the SLs of Specification 2.0, "Safety Limits (SLs)," also maintains the above values and assures that offsite doses are within the acceptance criteria during AOOs.

Design Basis Accidents (DBA) are events that are analyzed even though they are not expected to occur during the unit life. The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of the limits. Different accident categories are allowed a different fraction of these limits, based on the probability of

BACKGROUND (continued)

occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RTS maintains surveillance on key process variables which are directly related to equipment mechanical limitations, such as pressure, and on variables which directly affect the heat transfer capability of the reactor, such as flow and temperature. Some limits, such as Overtemperature ΔT, are calculated in the Protection and Safety Monitoring System cabinets from other parameters when direct measurement of the variable is not possible.

The RTS instrumentation is segmented into four distinct but interconnected modules as identified below:

- Field inputs from process sensors, nuclear instrumentation;
- Protection and Safety Monitoring System Cabinets;
- Voting Logic; and
- Reactor Trip Switchgear Interface.

<u>Field Transmitters and Sensors</u>

Normally, four redundant measurements using four separate sensors are made for each variable used for reactor trip. The use of four channels for protection functions is based on a minimum of two channels being required for a trip or actuation, one channel in test or bypass, and a single failure on the remaining channel. The signal selector algorithm in the Plant Control System (PLS) will function with only three channels. This includes two channels properly functioning and one channel having a single failure. For protection channels providing data to the control system, the fourth channel permits one channel to be in test or bypass. Minimum requirements for protection and control are achieved with only three channels OPERABLE. The fourth channel is provided to increase plant availability, and permits the plant to run for an indefinite time with a single channel out of service. The circuit design is able to withstand both an input failure to the control system, which may then require the protection Function actuation, and a single failure in the other channels providing the protection Function actuation. Again, a single failure will neither cause nor prevent the protection Function actuation. These

BASES

BACKGROUND (continued)

requirements are described in IEEE-603 (Ref. **1**~~4~~). The actual number of channels required for each plant parameter is specified in Reference **2**~~1~~.

Selected analog measurements are converted to digital form by digital converters within the Protection and Safety Monitoring System cabinets. Signal conditioning may be applied to selected inputs following the conversion to digital form. Following necessary calculations and processing, the measurements are compared against the applicable setpoint for that variable. A partial trip signal for the given parameter is generated if one channel measurement exceeds its predetermined or calculation limit. Processing on all variables for reactor trip is duplicated in each of the four redundant divisions of the protection system. Each division sends its partial trip status to each of the other three divisions over isolated multiplexed links. Each division is capable of generating a reactor trip signal if two or more of the redundant channels of a single variable are in the partial trip state.

The reactor trip signal from each division is sent to the corresponding reactor trip actuation division. Each of the four reactor trip actuation divisions consists of two reactor trip circuit breakers. The reactor is tripped when two or more actuation divisions receive a reactor trip signal. This automatic trip demand initiates the following two actions:

1. It de-energizes the undervoltage trip attachment on each reactor trip breaker, and

2. It energizes the shunt trip device on each reactor trip breaker.

Either action causes the breakers to trip. Opening of the appropriate trip breakers removes power to the control rod drive mechanism (CRDM) coils, allowing the rods to fall into the core. This rapid negative reactivity insertion shuts down the reactor.

BASES

BACKGROUND (continued)

Protection and Safety Monitoring System Cabinets

The **PMS** ~~Protection and Safety Monitoring System~~ cabinets contain the necessary equipment to:

- Permit acquisition and analysis of the sensor inputs, including plant process sensors and nuclear instrumentation, required for reactor trip and **Engineered Safety Features (**ESF**)** calculations;
- Perform computation or logic operations on variables based on these inputs;
- Provide trip signals to the reactor trip switchgear and ESF actuation data to the ESF coincidence logic as required;
- Permit manual trip or bypass of each individual reactor trip Function and permit manual actuation or bypass of each individual voted ESF Function;
- Provide data to other systems in the Instrumentation and Control (I&C) architecture;
- Provide separate input circuitry for control Functions that require input from sensors that are also required for protection Functions.

Each of the four divisions provides signal conditioning, comparable output signals for indications in the main control room, and comparison of measured input signals with established setpoints. The bases of the setpoints are described in References **3**~~2~~ and **4**~~3~~. If the measured value of a unit parameter exceeds the predetermined setpoint, an output is generated which is transmitted to the ESF coincidence logic for logic evaluation.

Within the PMS, redundancy is generally provided for active equipment such as processors and communication hardware. This redundancy is provided to increase plant availability and facilitate surveillance testing. A division or channel is OPERABLE if it is capable of performing its specified safety function(s) and all the required supporting functions or systems are also capable of performing their related support functions. Thus, a division or channel is OPERABLE as long as one set of redundant components within the division or channel is capable of performing its specified safety function(s).

BASES

BACKGROUND (continued)

Voting Logic

The voting logic provides a reliable means of opening the reactor trip switchgear in its own division as demanded by the individual protection functions.

Reactor Trip Switchgear Interface

The final stage of the voting logic provides the signal to energize the undervoltage trip attachment on each **reactor trip breaker (**RTB**)** within the reactor trip switchgear**, which allows RTB closure**. Loss of the signal deenergizes the undervoltage trip attachments and results in the opening of those reactor trip switchgear. An additional external relay is deenergized with loss of the signal. The normally closed contacts of the relay energize the shunt trip attachments on each switchgear at the same time that the undervoltage trip attachment is deenergized. This diverse trip actuation is performed external to the PMS cabinets. The switchgear interface including the trip attachments and the external relay are within the scope of the PMS. Separate outputs are provided for each switchgear. Testing of the interface allows trip actuation of the breakers by either the undervoltage trip attachment or the shunt trip attachment.

Nominal Trip Setpoint (NTS)

The NTS is the nominal value at which the trip output is set. Any trip output is considered to be properly adjusted when the "as-left" value is within the band for CHANNEL CALIBRATION (i.e., **plus or minus** ~~±~~ rack calibration accuracy).

The trip setpoints used in the trip output are based on the Safety Analysis Limits stated in Reference **3**~~2~~. The determination of these NTSs is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the NTSs specified in the SP are conservative with respect to the Safety Analysis Limits. A detailed description of the methodology used to calculate the NTSs, including their explicit uncertainties, is provided in the "Westinghouse Setpoint Methodology for Protection Systems" (Ref. **4**~~3~~). The as-left tolerance and as-found tolerance band methodology is provided in the SP. The as-found OPERABILITY limit for the purpose of the ~~REACTOR TRIP~~ CHANNEL OPERATIONAL TEST

BACKGROUND (continued)

(RTCOT) is defined as the as-left limit about the NTS (i.e., **plus or minus** ± rack calibration accuracy).

The NTSs listed in the SP are based on the methodology described in Reference **4**3, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each NTS. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes. Transmitter and signal processing equipment calibration tolerances and drift allowances must be specified in plant calibration procedures, and must be consistent with the values used in the setpoint methodology.

The OPERABILITY of each transmitter or sensor can be evaluated when its "as-found" calibration data are compared against the "as-left" data and are shown to be within the setpoint methodology assumptions. The basis of the setpoints is described in References **3**2 and **4**3. Trending of calibration results is required by the program description in Technical Specifications 5.5.14.d.

Note that the as-left and as-found tolerances listed in the SP define the OPERABILITY limits for a channel during a periodic CHANNEL CALIBRATION or RTCOT that requires trip setpoint verification.

The **PMS** Protection and Safety Monitoring System testing features are designed to allow for complete functional testing by using a combination of system self-checking features, functional testing features, and other testing features. Successful functional testing consists of verifying that the capability of the system to perform the safety function has not failed or degraded. For hardware functions this would involve verifying that the hardware components and connections have not failed or degraded. Since software does not degrade, software functional testing involves verifying that the software code has not changed and that the software code is executing. To the extent possible, **PMS** Protection and Safety Monitoring System functional testing will be accomplished with continuous system self-checking features and the continuous functional testing features.

The **PMS** Protection and Safety Monitoring System incorporates continuous system self-checking features wherever practical. Self-checking features include on-line diagnostics for the computer system

BASES

BACKGROUND (continued)

and the hardware and communications tests. These self-checking tests do not interfere with normal system operation.

In addition to the self-checking features, the system includes functional testing features. Functional testing features include continuous functional testing features and manually initiated functional testing features. To the extent practical, functional testing features are designed not to interfere with normal system operation.

In addition to the system self-checking features and functional testing features, other test features are included for those parts of the system which are not tested with self-checking features or functional testing features. These test features allow for instruments/sensor checks, calibration verification, response time testing, setpoint verification and component testing. The test features again include a combination of continuous testing features and manual testing features.

All of the testing features are designed so that the duration of the testing is as short as possible. Testing features are designed so that the actual logic is not modified. To prevent unwanted actuation, the testing features are designed with either the capability to bypass a Function during testing and/or limit the number of signals allowed to be placed in test at one time.

Reactor Trip (RT) Channel

An RT Channel extends from the sensor to the output of the associated reactor trip subsystem in the Protection and Safety Monitoring System cabinets, and includes the sensor (or sensors), the signal conditioning, any associated datalinks, and the associated reactor trip subsystem. For RT Channels containing nuclear instrumentation, the RT Channel also includes the nuclear instrument signal conditioning and the associated Nuclear Instrumentation Signal Processing and Control (NISPAC) subsystem.

BASES

BACKGROUND (continued)

Automatic Trip Logic

The Automatic Trip Logic extends from, but does not include, the outputs of the various RT Channels to, but does not include, the reactor trip breakers. Operator bypass of a reactor trip function is performed within the Automatic Trip Logic.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The RTS functions to maintain **compliance with** the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

Each of the analyzed accidents and transients which require reactor trip can be detected by one of more RTS Functions. The accident analysis described in Reference **3**~~2~~ takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the plant. These RTS trip Functions may provide protection for conditions which do not require dynamic transient analysis to demonstrate function performance. These RTS trip Functions may also serve as backups to RTS trip Functions that were credited in the accident analysis.

Permissive and interlock functions are based upon the associated protection function instrumentation. Because they do not have to operate in adverse environmental conditions, the trip settings of the permissive and interlock functions use the normal environment, steady-state instrument uncertainties of the associated protection function instrumentation. This results in OPERABILITY criteria (i.e., as-found tolerance and as-left tolerance) that are the same as the associated protection function sensor and process rack modules. The NTSs for permissives and interlocks are based on the associated protection function OPERABILITY requirements; i.e., permissives and interlocks performing enabling functions must be set to occur prior to the specified trip setting of the associated protection function.

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 in the accompanying LCO, to be OPERABLE. The as-left and as-found tolerances specified in the SP define the OPERABILITY limits for a channel during a CHANNEL CALIBRATION or ~~RT~~COT. As such, the as-left and as-found tolerances differ from the NTS by **plus or minus** ~~±~~ the PMS rack calibration accuracy and envelope the expected

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

calibration~~ accuracy and drift~~.~~ In this manner, the actual setting of the channel (NTS) prevents exceeding an SL at any given point in time as long as the channel has not drifted beyond the expected tolerances during the surveillance interval. Note that the as-left and as-found recorded values must be confirmed to be operating within the assumptions of the statistical uncertainty calculations.~~

If the actual setting of the channel is found outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTS (within the allowed tolerance), and evaluating the channel's response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

A trip setpoint may be set more conservative than the NTS as necessary in response to plant conditions. However, in this case, the OPERABILITY of this instrument must be verified based on the actual field setting and not the NTS. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of four channels in each instrumentation Function. If a required channel becomes inoperable, operation can continue provided the inoperable channel is placed in bypass or trip within the specified Completion Time.

Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure reactor trips are in the correct configuration for the current plant status. They back up operator actions to ensure protection system Functions are not blocked during plant conditions under which the safety analysis assumes the Functions are OPERABLE. Therefore, the interlock Functions do not need to be OPERABLE when the associated reactor trip Functions are outside the applicable MODES. Proper operation of these interlocks supports OPERABILITY of the associated **reactor trip** ~~TS~~ Functions and/or the requirement for actuation logic OPERABILITY. Interlocks must

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

be in the required state, as appropriate, to support OPERABILITY of the associated Functions. The interlocks are:

Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective **PMS division** ~~PMS~~ Intermediate Range Neutron Flux channel increases to approximately one decade above the channel lower range limit. The P-6 interlock ensures that the following are performed:

(1) On increasing power, the P-6 interlock allows the manual block of the respective PMS **division** Source Range Neutron Flux – High Setpoint reactor trip **Function channel**. This prevents a premature block of the **Source Range Neutron Flux – High reactor** ~~source range~~ trip **Function channel** and allows the operator to ensure that the **Intermediate Range Neutron Flux – High reactor trip Function channels are** ~~intermediate range is~~ OPERABLE prior to leaving the source range. When **a Source Range Neutron Flux – High reactor** ~~the source range~~ trip **Function channel** is blocked, the high voltage to the **detector of the Source Range Neutron Flux channel** ~~detectors~~ is also removed.

(2) On decreasing power, the P-6 interlock automatically energizes the **respective PMS division Source Range Neutron Flux** ~~source range~~ detector~~s~~ and enables the **respective** PMS **division** Source Range Neutron Flux **– High** reactor trip **Function channel**.

(3) On increasing power, the P-6 interlock provides a backup ~~block~~ signal to **automatically block** the **respective PMS division Source Range Neutron Flux Doubling Engineered Safety Feature Actuation System (ESFAS) Function channel** ~~source range neutron flux doubling circuit~~. Normally, this **Boron Dilution Block ESFAS** Function is manually blocked by the main control room operator during the reactor startup.

~~The LCO requires four channels of Intermediate Range Neutron Flux, P-6 interlock to be OPERABLE in MODE 2 when below the P-6 interlock setpoint.~~

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~In MODE 2, when below the P-6 interlock setpoint, the P-6 interlock must be OPERABLE. Above the P-6 interlock setpoint, the PMS Source Range Neutron Flux reactor trip will be blocked; and this Function will no longer be necessary. In MODES 3, 4, 5, and 6, the P-6 interlock does not have to be OPERABLE because the PMS Source Range is providing core protection.~~

Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the respective PMS **division Power Range Neutron Flux channel** ~~power-range~~ detector**s**. The P-10 interlock ensures that the following are performed:

(1) **On** ~~on~~ increasing power, the P-10 interlock automatically enables reactor trips on the following Functions:

- Pressurizer Pressure – Low Setpoint,
- Pressurizer Water Level – High 3,
- Reactor Coolant Flow – Low, and
- RCP Speed – Low.

These reactor trips are only required when operating above the P-10 setpoint (approximately 10% power). These reactor trips provide protection against violating the DNBR limit. Below the P-10 setpoint, the RCS is capable of providing sufficient natural circulation without any RCP running.

(2) On increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip.

(3) On increasing power, the P-10 interlock allows the operator to manually block the Power Range Neutron Flux – Low Setpoint reactor trip.

(4) On increasing power, the **respective PMS division** P-10 interlock **channel** automatically provides a backup ~~block~~ signal to **block** the **respective PMS division** Source Range Neutron Flux reactor trip

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

channel and also to de-energize the **respective PMS division** ~~PMS~~ **Source Range Neutron Flux** ~~source range~~ detector~~s~~.

(5) On decreasing power, the P-10 interlock automatically blocks reactor trips on the following Functions:

- Pressurizer Pressure – Low **Setpoint**,
- Pressurizer Water Level – High 3,
- Reactor Coolant Flow – Low, and
- RCP Speed – Low.

(6) On decreasing power, the **respective PMS division** P-10 interlock **channel** automatically enables the **respective** Power Range Neutron Flux – Low **Setpoint** reactor trip **channel** and the **respective** Intermediate Range Neutron Flux **– High** reactor trip (and rod stop) **channel**.

~~The LCO requires four channels of Power Range Neutron Flux, P-10 interlock to be OPERABLE in MODE 1 or 2.~~

~~In MODE 1, when the reactor is at power, the Power Range Neutron Flux, P-10 interlock must be OPERABLE. This Function must be OPERABLE in MODE 2 to ensure that core protection is provided during a startup or shutdown by the Power Range Neutron Flux - Low Setpoint and Intermediate Range Neutron Flux reactor trips. In MODE 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at power and the Source Range Neutron Flux reactor trip provides core protection.~~

Pressurizer Pressure, P-11

With pressurizer pressure channels less than the P-11 setpoint, the operator can manually block the Steam Generator Narrow Range Water Level – High 2 reactor Trip. This allows rod testing with the steam generators in cold wet layup. With pressurizer pressure channels **greater than the** ~~>~~ P-11 setpoint, the Steam Generator Narrow Range Water Level – High 2 reactor **trip Function** ~~Trip~~ is automatically enabled. The operator can also enable these actuations by use of the respective manual reset.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~The LCO generally requires OPERABILITY of three channels in each instrumentation Function.~~

Reactor Trip System Functions

The safety analyses and OPERABILITY requirements applicable to each RTS Function are discussed below:

1. Power Range Neutron Flux

The **Power Range Neutron Flux** ~~PMS power range~~ detectors are located external to the reactor vessel and measure neutrons leaking from the core. The **Power Range Neutron Flux** ~~PMS power range~~ detectors provide input to the PLS. Minimum requirements for protection and control **are** ~~is~~ achieved with three channels OPERABLE. The fourth channel is provided to increase plant availability, and permits the plant to run for an indefinite time with a single channel in trip or bypass. This Function also satisfies the requirements of IEEE 603 (Ref. 14) with 2/4 logic. This Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor.

a. Power Range Neutron Flux – High **Setpoint**

The Power Range Neutron Flux – High trip Function ensures that protection is provided, from all power levels, against a positive reactivity excursion during power operations. Positive reactivity excursions can be caused by rod withdrawal or reductions in RCS temperature.

The LCO requires four Power Range Neutron Flux – High channels to be OPERABLE in MODES 1 and 2.

In MODE 1 or 2, when a positive reactivity excursion could occur, the Power Range Neutron Flux – High trip must be OPERABLE. This Function will terminate the reactivity excursion and shutdown the reactor prior to reaching a power level that could damage the fuel. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – High trip does not have to be OPERABLE because the reactor is shutdown and a reactivity

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

excursion in the power range cannot occur. Other RTS Functions and administrative controls provide protection against reactivity additions when in MODE 3, 4, 5, or 6. In addition, the **Power Range Neutron Flux** ~~PMS power range~~ detectors cannot detect neutron **flux** levels in this range.

b. Power Range Neutron Flux – Low **Setpoint**

The LCO requirement for the Power Range Neutron Flux – Low trip Function ensures that protection is provided against a positive reactivity excursion from low power or subcritical conditions. The Trip Setpoint reflects only steady state instrument uncertainties as this Function does not provide primary protection for any event that results in a harsh environment.

The LCO requires four of the Power Range Neutron Flux – Low channels to be OPERABLE in MODE 1 below the Power Range Neutron Flux P-10 Setpoint and MODE 2.

In MODE 1, below the Power Range Neutron Flux P-10 setpoint and in MODE 2, the Power Range Neutron Flux – Low trip must be OPERABLE. **Each channel of this** ~~This~~ Function may be manually blocked by the operator when the respective **division Power Range Neutron Flux** ~~power range~~ channel is greater than approximately 10% of RTP (P-10 setpoint). **Each channel of this** ~~This~~ Function is automatically unblocked when the respective **division Power Range Neutron Flux** ~~power range~~ channel is below the P-10 setpoint. Above the P-10 setpoint, positive reactivity additions are mitigated by the Power Range Neutron Flux – High trip Function.

In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – Low trip Function does not have to be OPERABLE because the reactor is shutdown and the **Power Range Neutron Flux** ~~PMS power range~~ detectors cannot detect **the** neutron **flux** levels generated in MODES 3, 4, 5, and 6. Other RTS trip Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. Power Range Neutron Flux – High Positive Rate

The Power Range Neutron Flux – High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux which are characteristic of a rod cluster control assembly (RCCA) drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the Power Range Neutron Flux – High and Low trip Functions to ensure that the criteria are met for a rod ejection from the power range. The Power Range Neutron Flux **– High Positive** Rate trip uses the same **Power Range Neutron Flux** channels as discussed for Function 1 above.

The LCO requires four Power Range Neutron Flux – High Positive Rate channels to be OPERABLE. In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the Power Range Neutron Flux – High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – High Positive Rate trip Function does not have to be OPERABLE because other RTS trip Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a SDM in the event of an REA. In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the **Power Range Neutron Flux** ~~PMS power range~~ detectors cannot detect neutron **flux** levels present in ~~this~~ MODE **6**.

3. Overtemperature ΔT

The Overtemperature ΔT trip Function ensures that protection is provided to ensure that the design limit DNBR is met. This trip Function also limits the range over which the Overpower ΔT trip Function must provide protection. The inputs to the Overtemperature ΔT trip include all combinations of pressure, power, coolant temperature, and axial power distribution, assuming full reactor coolant flow. Protection from violating the DNBR limit is assured for those transients that are slow with respect to delays from the core to the measurement system. The Overtemperature ΔT trip Function uses the measured T_{HOT} and T_{COLD} in each loop,

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

together with the measured pressurizer pressure, to compute the reactor core thermal power. Equations to fit the properties of density and enthalpy are programmed in the software, such that the ΔT power signal is presented as a percent of RTP for direct comparison with measured calorimetric power. The **Overtemperature** ~~overtemperature~~ ΔT **Trip Setpoint** ~~setpoint~~ is automatically varied for changes in the parameters that affect DNB as follows:

- reactor core inlet temperature – the Trip Setpoint is varied to correct for changes in core inlet temperature based on measured changes in cold leg temperature with dynamic compensation to account for cold leg-to-core transit time;

- pressurizer pressure – the Trip Setpoint is varied to correct for changes in system pressure; and

- axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower **Power Range Neutron Flux** ~~power range~~ detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower **Power Range Neutron Flux** ~~PMS power range~~ detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

Dynamic compensation of the ΔT power signal is included for system piping delays from the core to the temperature measurement system. The Overtemperature ΔT trip Function is calculated for each loop as described in the SP. A detailed description of this trip is provided in Reference **6**~~7~~. This Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip. No credit is taken in the safety analyses for the turbine runback.

The LCO requires four channels (two per loop) of the Overtemperature ΔT trip Function to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. Note that the Overtemperature ΔT

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overtemperature ΔT trip **Function** must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

4. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the Overtemperature ΔT trip **Function** ~~function~~ and provides a backup to the Power Range Neutron Flux – High Setpoint trip **Function**. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the same ΔT power signal generated for the Overtemperature ΔT. The **Trip** setpoint is automatically varied with the following parameter:

- Axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the ~~PMS~~ upper and lower **Power Range Neutron Flux** ~~power range~~ detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower **Power Range Neutron Flux** ~~PMS power range~~ detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

The Overpower ΔT trip Function is calculated for each loop as described in the SP. A detailed description of this trip is provided in Reference **6**~~7~~. The Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties as the detectors provide protection for a steam line break and may be in a harsh environment. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback reduces turbine power and reactor power. A reduction in power normally alleviates the Overpower ΔT condition and may prevent a reactor trip.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires four channels (two per loop) of the Overpower ΔT trip Function to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. The Overpower ΔT **trip** Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overpower ΔT trip Function must be OPERABLE. These are the only times that enough heat is generated in the fuel to be concerned about the heat generation rates and overheating of the fuel. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about fuel overheating and fuel damage.

5. Pressurizer Pressure

The same sensors provide input to the Pressurizer Pressure – High and – Low trips and the Overtemperature ΔT trip.

a. Pressurizer Pressure – Low

The Pressurizer Pressure – Low trip Function ensures that protection is provided against violating the DNBR limit due to low pressure. The Trip Setpoint reflects both steady state and adverse environmental instrument uncertainties as the detectors provide primary protection for an event that results in a harsh environment.

The LCO requires four channels of Pressurizer Pressure – Low to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. In MODE 1, when DNB is a major concern, the Pressurizer Pressure – Low trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-10 interlock. On decreasing power, this trip Function is automatically blocked below P-10. Below the P-10 setpoint, no conceivable power distributions can occur that would cause DNB concerns.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Pressurizer Pressure – High

The Pressurizer Pressure – High trip Function ensures that protection is provided against overpressurizing the RCS. This trip Function operates in conjunction with the safety valves to prevent RCS overpressure conditions. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four channels of the Pressurizer Pressure – High to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, the Pressurizer Pressure – High trip must be OPERABLE to help prevent RCS overpressurization and ~~LCOs, and~~ minimize~~s~~ challenges to the safety valves. In MODE 3, 4, 5, or 6, the Pressurizer Pressure – High trip Function does not have to be OPERABLE because transients which could cause an overpressure condition will be slow to occur. Therefore, the operator will have sufficient time to evaluate plant conditions and take corrective actions. Additionally, low temperature overpressure protection systems provide overpressure protection when below MODE 4.

6. Pressurizer Water Level – High 3

The Pressurizer Water Level – High 3 trip Function provides a backup signal for the Pressurizer Pressure – High ~~3~~ trip **Function** and also provides protection against water relief through the pressurizer safety valves. These valves are designed to pass steam in order to achieve their design energy removal rate. A reactor trip is actuated prior to the pressurizer becoming water solid. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment. The level channels do not actuate the safety valves.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires four channels of Pressurizer Water Level – High 3 to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 when there is a potential for overfilling the pressurizer, the Pressurizer Water Level – High 3 trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-10 interlock. On decreasing power, this trip Function is automatically blocked below P-10. Below the P-10 setpoint, transients which could raise the pressurizer water level will be slow and the operator will have sufficient time to evaluate plant conditions and take corrective actions.

7. Reactor Coolant Flow – Low

The Reactor Coolant Flow – Low trip Function ensures that protection is provided against violating the DNBR limit due to low flow in one or more RCS hot legs. Above the P-10 setpoint, a loss of flow in any RCS hot leg will actuate a Reactor trip.

Each RCS hot leg has four flow detectors to monitor flow. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four Reactor Coolant Flow – Low channels per hot leg to be OPERABLE in MODE 1 above P-10. Four OPERABLE channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 above the P-10 setpoint, when a loss of flow in one RCS hot leg could result in DNB conditions in the core, the Reactor Coolant Flow – Low trip must be OPERABLE.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

8. Reactor Coolant Pump (RCP) Bearing Water Temperature – High

The RCP Bearing Water Temperature – High reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in one RCS cold leg. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four RCP Bearing Water Temperature – High channels per RCP to be OPERABLE in MODE 1 or 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, when a loss of flow in any RCS cold leg could result in DNB conditions in the core, the RCP Bearing Water Temperature – High trip must be OPERABLE.

9. Reactor Coolant Pump Speed – Low

The RCP Speed – Low trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS cold legs. The speed of each RCP is monitored. Above the P-10 setpoint a low speed detected on two or more RCPs will initiate a reactor trip. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four RCP Speed – Low channels (one per pump) to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 above the P-10 setpoint, the RCP Speed – Low trip must be OPERABLE. Below the P-10 setpoint, all reactor trips on loss of flow are automatically blocked since no power distributions are expected to occur that would cause a DNB concern at this low power level. Above the P-10 setpoint, the reactor trip on loss of flow in two or more RCS cold legs is automatically enabled.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Steam Generator Narrow Range Water Level – Low

The Steam Generator (SG) Narrow Range Water Level – Low trip Function ensures that protection is provided against a loss of heat sink. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range low level in any steam generator is indicative of a loss of heat sink for the reactor. The Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties as the detectors provide primary protection for an event that results in a harsh environment. This Function also contributes to the coincidence logic for the ESFAS Function of opening the Passive Residual Heat Removal (PRHR) discharge valves.

The LCO requires four channels of SG Water Level – Low per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, when the reactor requires a heat sink, the SG Water Level – Low trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater System (non-safety related). The Main Feedwater System is normally in operation in MODES 1 and 2. PRHR is the safety related backup heat sink for the reactor. During normal startups and shutdowns, the Main and Startup Feedwater Systems (non-safety related) can provide feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the SG Water Level – Low Function does not have to be OPERABLE because the reactor is not operating or even critical.

11. Steam Generator Narrow Range Water Level – High 2

The SG Narrow **Range** ~~range~~ Water Level – High 2 trip Function ensures that protection is provided against excessive feedwater flow by closing the main feedwater control valves, tripping the turbine, and tripping the reactor. While the transmitters (d/p cells) are located inside containment, the events which this function protects against cannot cause **a** severe environment in containment. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires four channels of **the** SG Narrow Range Water Level – High 2 **trip Function** per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODES 1 and 2 above the P-11 interlock, the SG Narrow Range Water Level – High 2 trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater System (non-safety related). The Main Feedwater System is only in operation in MODES 1 and 2. In MODE 3, 4, 5, or 6, the SG Narrow Range Water Level – High 2 Function does not have to be OPERABLE because the reactor is not operating or even critical. The P-11 interlock is provided on this Function to permit bypass of the trip Function when the pressure is below P-11. This bypass is necessary to permit rod testing when the steam generators are in wet layup.

12. Passive Residual Heat Removal Actuation

The Passive Residual Heat Removal (PRHR) Actuation reactor trip **Function** ensures that a reactivity excursion due to cold water injection will be minimized upon an inadvertent operation of the PRHR discharge valves. The two discharge valves for the PRHR HX are monitored by PMS using valve position indicators as inputs into PMS.

The LCO requires four channels of PRHR discharge valve position indication per valve to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODES 1 and 2, the **PRHR** ~~Passive Heat Removal~~ Actuation reactor trip **Function** must be OPERABLE. In MODES 3, 4, 5, and 6, the **PRHR Actuation** ~~Passive Heat Removal Initiation~~ reactor trip Function does not have to be **OPERABLE** ~~OPERATIONAL~~ because the reactor is not operating or critical.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

13. Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure reactor trips are in the correct configuration for the current plant status. They back up operator actions to ensure protection system Functions are not blocked during plant conditions under which the safety analysis assumes the Functions are OPERABLE. Therefore, the interlock Functions do not need to be OPERABLE when the associated reactor trip Functions are outside the applicable MODES. These are:

a. Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective PMS Intermediate Range Neutron Flux channel increases to approximately one decade above the channel lower range limit. The LCO requirement for the P-6 interlock ensures that the following Functions are performed:

(1) on increasing power, the P-6 interlock allows the manual block of the respective PMS Source Range, Neutron Flux reactor trip. This prevents a premature block of the source range trip and allows the operator to ensure that the intermediate range is OPERABLE prior to leaving the source range. When the source range trip is blocked, the high voltage to the detectors is also removed.

(2) on decreasing power, the P-6 interlock automatically energizes the PMS source range detectors and enables the PMS Source Range Neutron Flux reactor trip.

(3) on increasing power, the P-6 interlock provides a backup block signal to the source range neutron flux doubling circuit. Normally, this Function is manually blocked by the main control room operator during the reactor startup.

The LCO requires four channels of Intermediate Range Neutron Flux, P-6 interlock to be OPERABLE in MODE 2 when below the P-6 interlock setpoint.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~In MODE 2, when below the P-6 interlock setpoint, the P-6 interlock must be OPERABLE. Above the P-6 interlock setpoint, the PMS Source Range Neutron Flux reactor trip will be blocked; and this Function will no longer be necessary. In MODES 3, 4, 5, and 6, the P-6 interlock does not have to be OPERABLE because the PMS Source Range is providing core protection.~~

~~b. Power Range Neutron Flux, P-10~~

~~The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the respective PMS power-range detector. The LCO requirement for the P-10 interlock ensures that the following functions are performed:~~

~~(1) on increasing power, the P-10 interlock automatically enables reactor trips on the following Functions:~~

- ~~Pressurizer Pressure - Low,~~
- ~~Pressurizer Water Level - High 3,~~
- ~~Reactor Coolant Flow - Low, and~~
- ~~RCP Speed - Low.~~

~~These reactor trips are only required when operating above the P-10 setpoint (approximately 10% power). These reactor trips provide protection against violating the DNBR limit. Below the P-10 setpoint, the RCS is capable of providing sufficient natural circulation without any RCP running.~~

~~(2) on increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip.~~

~~(3) on increasing power, the P-10 interlock allows the operator to manually block the Power Range Neutron Flux - Low Setpoint reactor trip.~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~(4) on increasing power, the P-10 interlock automatically provides a backup block signal to the Source Range Neutron Flux reactor trip and also to de-energize the PMS source range detectors.~~

~~(5) on decreasing power, the P-10 interlock automatically blocks reactor trips on the following Functions:~~

- ~~Pressurizer Pressure - Low,~~
- ~~Pressurizer Water Level - High 3,~~
- ~~Reactor Coolant Flow - Low, and~~
- ~~RCP Speed - Low.~~

~~(6) on decreasing power, the P-10 interlock automatically enables the Power Range Neutron Flux - Low reactor trip and the Intermediate Range Neutron Flux reactor trip (and rod stop).~~

~~The LCO requires four channels of Power Range Neutron Flux, P-10 interlock to be OPERABLE in MODE 1 or 2.~~

~~In MODE 1, when the reactor is at power, the Power Range Neutron Flux, P-10 interlock must be OPERABLE. This Function must be OPERABLE in MODE 2 to ensure that core protection is provided during a startup or shutdown by the Power Range Neutron Flux - Low Setpoint and Intermediate Range Neutron Flux reactor trips. In MODE 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at power and the Source Range Neutron Flux reactor trip provides core protection.~~

~~c. Pressurizer Pressure, P-11~~

~~With pressurizer pressure channels less than the P-11 setpoint, the operator can manually block the Steam Generator Narrow Range Water Level - High 2 reactor Trip. This allows rod testing with the steam generators in cold wet layup. With pressurizer pressure channels > P-11 setpoint, the Steam Generator Narrow Range Water Level - High 2 reactor Trip is~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~automatically enabled. The operator can also enable these actuations by use of the respective manual reset.~~

The RTS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

ACTIONS

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.1-1.

In the event a channels as-found condition is outside the as-found tolerance described in the SP, or the channel is not functioning as required, or the transmitter, instrument loop, signal processing electronics, or trip output is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

A.1

Condition A addresses the situation where one required channel for one or more Functions is inoperable. With one channel inoperable, the inoperable channel must be placed in a bypass or trip condition within 6 hours. If one inoperable channel is bypassed, the logic becomes two out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) If one inoperable channel is tripped, the logic becomes one-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) The 6 hours allowed to place the inoperable channel(s) in the bypassed or tripped condition is justified in Reference **7**~~6~~.

~~As an alternative to placing the inoperable channel(s) in bypass or trip if THERMAL POWER is greater than the P-6 setpoint but less than the P-10 setpoint, 2 hours are allowed to reduce THERMAL POWER below the P-6 setpoint or to increase the THERMAL POWER above the P-10 setpoint. The Intermediate Range Neutron Flux channels must be OPERABLE when the power level is above the capability of the source range, P-6 setpoint, and below the capability of the power range, P-10 setpoint. If THERMAL POWER is greater than the P-10 setpoint, the Power Range Neutron Flux PMS power range detectors perform the monitoring and protective functions and the intermediate range is not required. The Completion Times allow for a slow and controlled power~~

ACTIONS (continued)

~~adjustment below the P-6 setpoint, and takes into account the redundant capability afforded by the two remaining OPERABLE channels and the low probability of their failure during this period.~~

B.1 and B.2

Condition B addresses the situation where one or more Functions have two required channels inoperable. With two channels for a Function inoperable, one inoperable channel must be placed in a bypass condition within 6 hours and one inoperable channel must be placed in a trip condition within 6 hours. If one channel is bypassed and one channel is tripped, the logic becomes one-out-of-two, while still meeting the single failure criterion. The 6 hours allowed to place the inoperable channels in the bypassed or tripped condition is justified in Reference **7**~~6~~.

C.1

Condition C addresses the situation where any Required Action and associated Completion Time of Condition A or B is not met**, or three or more channels are inoperable for one or more Functions**. Required Action C.1 directs entry into the appropriate Condition referenced in Table 3.3.1-1.

D.1

Condition D is entered from Required Action C.1 when any Required Action and associated Completion Time of Condition A or B is not met, or three or more channels are inoperable for one or more Functions, and it is identified as the appropriate Condition referenced in Table 3.3.1-1. If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, the plant must be placed in MODE 3. Six hours are allowed to place the plant in MODE 3. This is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems.

BASES

ACTIONS (continued)

E.1

Condition E is entered from Required Action C.1 when any Required Action and associated Completion Time of Condition A or B is not met, or three or more channels for one or more Functions are inoperable, and it is identified as the appropriate Condition referenced in Table 3.3.1-1. If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, **THERMAL POWER** ~~thermal power~~ must be reduced to below the P-10 **setpoint**~~interlock~~; a condition in which the LCO does not apply. The allowed Completion Time is reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems.

~~F.1.1, F.1.2, F.1.3, F.2.1, F.2.2, and F.3~~

~~Condition F applies to the Power Range Neutron Flux - High Function in MODES 1 and 2.~~

~~With one or two channels inoperable, one affected channel must be placed in a bypass or trip condition within 6 hours. If one channel is bypassed, the logic becomes two-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) If one channel is tripped, the logic becomes one-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) If one channel is bypassed and one channel is tripped, the logic becomes one-out-of-two, while still meeting the single failure criterion. The 6 hours allowed to place the inoperable channel(s) in the bypassed or tripped condition is justified in Reference 6.~~

~~In addition to placing the inoperable channel(s) in the bypassed or tripped condition, THERMAL POWER must be reduced to ≤ 75% RTP within 12 hours. Reducing the power level prevents operation of the core with radial power distributions beyond the design limits. With one or two of the PMS power range detectors inoperable, partial radial power distribution monitoring capability is lost. However, the protective function would still function even with a single failure of one of the two remaining channels.~~

BASES

ACTIONS (continued)

~~As an alternative to reducing power, the inoperable channel(s) can be placed in the bypassed or tripped condition within 6 hours and the QPTR monitored every 12 hours as per SR 3.2.4.2, QPTR verification. Calculating QPTR compensates for the lost monitoring capability and allows continued plant operation at power levels > 75% RTP. The 12 hour Frequency is consistent with LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."~~

~~Required Action F.2.2 has been modified by a Note which only requires SR 3.2.4.2 to be performed if OPDMS and the Power Range Neutron Flux input to QPTR become inoperable. Power distribution limits are normally verified in accordance with LCO 3.2.5, "OPDMS - Monitored Power Distribution Parameters." However, if OPDMS becomes inoperable, then LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)," becomes applicable. Failure of a component in the Power Range Neutron Flux Channel which renders the High Flux Trip Function inoperable may not affect the capability to monitor QPTR. If either OPDMS or the channel input to QPTR is OPERABLE, then performance of SR 3.2.4.2 once per 12 hours is not necessary.~~

~~As an alternative to the above Actions, the plant must be placed in a MODE where this Function is no longer required OPERABLE. Twelve hours are allowed to place the plant in MODE 3. This is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems. If Required Actions cannot be completed within their allowed Completion Times, LCO 3.0.3 must be entered.~~

~~G.1, G.2.1, G.2.2, and G.3~~

~~Condition G applies to the P-6, P-10, and P-11 interlocks. With one or two channels inoperable, the associated interlock must be verified to be in its required state for the existing plant condition within 1 hour, or the Functions associated with inoperable interlocks placed in a bypassed or tripped condition within 7 hours, or the unit must be placed in MODE 3 within 13 hours. Verifying the interlock manually accomplishes the interlock condition.~~

~~If one interlock channel is inoperable, the associated Function(s) must be placed in a bypass or trip condition within 7 hours. If one channel is bypassed, the logic becomes two-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels~~

ACTIONS (continued)

will not prevent the protective function.) If one channel is tripped, the logic becomes one-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.)

If two interlock channels are inoperable, one channel of the associated Function(s) must be bypassed and one channel of the associated Function(s) must be tripped. In this state, the logic becomes one-out-of-two, while still meeting the single failure criterion. The 7 hours allowed to place the inoperable channel(s) in the bypassed or tripped condition is justified in Reference 6.

If placing the associated Functions in bypass or trip is impractical, for instance as the result of other channels in bypass or trip, the Completion Time of an additional 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

The SRs for each RTS Function are identified in the SRs column of Table 3.3.1-1 for that Function.

A Note has been added to the SR table stating that Table 3.3.1-1 determines which SRs apply to which RTS Functions.

The CHANNEL CALIBRATION and RTCOT are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies. For channels that include dynamic transfer functions, such as, lag, lead/lag, rate/lag, the response time test may be performed with the transfer function set to one, with the resulting measured response time compared to the appropriate **FSAR** Chapter 7 response time (Ref. **2**1). Alternately, the response time test can be performed with the time constants set to their nominal value provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of even something more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment have drifted outside their corresponding limits.

~~The channels to be checked are:~~

- ~~Power Range Neutron Flux~~
- ~~Overtemperature Delta T~~
- ~~Overpower Delta T~~
- ~~Pressurizer Pressure~~
- ~~Reactor Coolant Flow - each hot leg~~
- ~~RCP Bearing Water Temperature - each RCP~~
- ~~RCP Speed~~
- ~~SG Narrow Range Level - each SG~~

The Frequency is based on operating experience that demonstrates that channel failure is rare. Automated operator aids may be used to facilitate the performance of the CHANNEL CHECK.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.2

SR 3.3.1.2 compares the calorimetric heat balance to the nuclear instrumentation channel output every 24 hours. If the calorimetric measurement between 70% and 100% RTP~~,~~ differs from the nuclear instrument channel output by > 1% RTP, the nuclear instrument channel is not declared inoperable, but must be adjusted. If the nuclear instrument channel output cannot be properly adjusted, the channel is declared inoperable.

Three Notes modify SR 3.3.1.2. The first Note indicates that the nuclear instrument channel output shall be adjusted consistent with the calorimetric results if the absolute difference between the nuclear instrument channel output and the calorimetric measurement between 70% and 100% RTP is > 1% RTP. The second Note clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 12 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels the calorimetric data from feedwater flow venturi measurements are less accurate. The third Note is required because, at power levels between 15% and 70% calorimetric uncertainty and control rod insertion create the potential for miscalibration of the nuclear instrumentation channel in cases where the channel is adjusted downward to match the calorimetric power. Therefore, if the calorimetric heat measurement is less than 70% RTP, and if the nuclear instrumentation channel indicated power is lower than the calorimetric measurement by > 1%, then the nuclear instrumentation channel shall be adjusted upward to match the calorimetric measurement. No nuclear instrumentation channel adjustment is required if the nuclear instrumentation channel is higher than the calorimetric measurement (see Westinghouse Technical Bulletin NSD-TB-92-14, Rev. 1.)

The Frequency of every 24 hours is adequate based on plant operating experience, considering instrument reliability and operating history data for instrument drift.

Together, these factors demonstrate the change in the absolute difference between nuclear instrumentation and heat balance calculated powers rarely exceeds 1% RTP in any 24 hours period.

In addition, main control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3

SR 3.3.1.3 compares the calorimetric heat balance to the calculated ΔT power (qΔT) in each Division every 24 hours. If the calorimetric measurement between 70% and 100% RTP~~,~~ differs from the calculated ΔT power by > 1% RTP, the Function is not declared inoperable, but the conversion factor, ΔT°, must be adjusted. If ΔT° cannot be properly adjusted, the Function is declared inoperable in the affected Division(s).

Three Notes modify SR 3.3.1.3. The first Note indicates that ΔT° shall be adjusted consistent with the calorimetric results if the absolute difference between the calculated ΔT power and the calorimetric measurement between 70% and 100% RTP is > 1% RTP.

The second Note clarifies that this Surveillance is required only if reactor power is ≥ 50% RTP and that 12 hours is allowed for performing the first Surveillance after reaching 50% RTP. At lower power levels, the calorimetric data from feedwater flow venturi measurements are less accurate. The calculated ΔT power is normally stable (less likely to need adjustment or to be grossly affected by changes in the core loading pattern than the nuclear instrumentation), and its calibration should not be unnecessarily altered by a possibly inaccurate calorimetric measurement at low power.

The third Note is required because at power levels below 70%, calorimetric uncertainty creates the potential for non-conservative adjustment of the ΔT° conversion factor, in cases where the calculated ΔT power would be reduced to match the calorimetric power. Therefore, if the calorimetric heat measurement is less than 70% RTP, and if the calculated ΔT power is lower than the calorimetric measurement by > 5%, then the ΔT° conversion factor shall be adjusted so that the calculated ΔT power matches the calorimetric measurement. No ΔT° conversion factor adjustment is required if the calculated ΔT power is higher than the calorimetric measurement.

The Frequency of every 24 hours is based on plant operating experience, considering instrument reliability and the limited effects of fuel burnup and rod position changes on the accuracy of the calculated ΔT power.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.4

SR 3.3.1.4 compares the AXIAL FLUX DIFFERENCE determined using the incore **neutron flux detector** system to the **excore** nuclear instrument channel AXIAL FLUX DIFFERENCE every 31 effective full power days (EFPD) **and adjusts the excore nuclear instrument channel if the absolute difference between the incore and excore AFD is ≥ 3% AFD**.~~.~~

If the absolute difference is ≥ 3% AFD the **excore** nuclear instrument channel is still OPERABLE, but must be readjusted. If the **excore** nuclear instrument channel cannot be properly readjusted, the channel is declared inoperable. This surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip Function** ~~function~~.

Two Notes modify SR 3.3.1.4. The first Note indicates that the excore nuclear instrument channel shall be adjusted if the absolute difference between the incore and excore AFD is ≥ 3% AFD. Note 2 clarifies that the Surveillance is required only if reactor power is ≥ 20% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore channels.

The Frequency of every 31 EFPD is adequate based on plant operating experience, considering instrument reliability and operating history data for instrument drift. Also, the slow changes in neutron flux during the fuel cycle can be detected during this interval.

SR 3.3.1.5

SR 3.3.1.5 is a calibration of the excore **nuclear instrument (Power Range Neutron Flux) detectors** ~~channels~~ to the incore **neutron flux detectors** ~~channels~~. If the measurements do not agree, the excore **nuclear instrument** channels are not declared inoperable but must be adjusted to agree with the incore **neutron flux** detector measurements. If the excore **nuclear instrument** channels cannot be adjusted, the **excore nuclear instrument** channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT **reactor trip** Function.

BASES

SURVEILLANCE REQUIREMENTS (continued)

A Note modifies SR 3.3.1.5. The Note states that this Surveillance is required only if reactor power is > 50% RTP and that 24 hours is allowed for performing the first surveillance after reaching 50% RTP.

The Frequency of 92 EFPD is adequate based on industry operating experience, considering instrument reliability and operating history data for instrument drift.

SR 3.3.1.6

SR 3.3.1.6 is the performance of a ~~REACTOR TRIP~~ CHANNEL OPERATIONAL TEST (~~RT~~COT) every 92 days. The SR 3.3.1.6 testing is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTS (within the allowed **as-left** tolerance), and evaluating the channel~~s~~ response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

A ~~RT~~COT is performed on each required channel to provide reasonable assurance that the entire channel will perform the intended Function.

A test subsystem is provided with the Protection and Safety Monitoring System **(PMS)** to aid the plant staff in performing the ~~RT~~COT. The test subsystem is designed to allow for complete functional testing by using a combination of system self checking features, functional testing features, and other testing features. Successful functional testing consists of verifying that the capability of the system to perform the safety function has not failed or degraded.

For hardware functions this would involve verifying that the hardware components and connections have not failed or degraded. Generally this verification includes a comparison of the outputs from two or more redundant subsystems or channels.

SURVEILLANCE REQUIREMENTS (continued)

Since software does not degrade, software functional testing involves verifying that the software code has not changed and that the software code is executing.

To the extent possible, **PMS** ~~Protection and Safety Monitoring System~~ functional testing is accomplished with continuous system self-checking features and the continuous functional testing features. The ~~RT~~COT shall include a review of the operation of the test subsystem to verify the completeness and adequacy of the results.

If the ~~RT~~COT can~~-~~not be completed using the built-in test subsystem, either because of failures in the test subsystem or failures in redundant channel hardware used for functional testing, the ~~RT~~COT can be performed using portable test equipment.

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this COT. This portion of the COT ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The COT Surveillance Frequency ~~This test frequency~~ of 92 days is justified based on Reference 7~~6~~ **(which refers to this test as "RTCOT")** and the use of continuous diagnostic test features, such as deadman timers, cross-check of redundant channels, memory checks, numeric coprocessor checks, and tests of timers, counters and crystal time bases, which will report a failure within the **PMS** ~~Protection and Safety Monitoring System~~ cabinets to the operator within 10 minutes of a detectable failure.

During the ~~RT~~COT, the **PMS** ~~protection and safety monitoring system~~ cabinets in the division under test may be placed in bypass.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.7

SR 3.3.1.7 is the performance of a RTCOT as described in SR 3.3.1.6 **(note that Reference 7 refers to this test as an "RTCOT")**, except it is modified by a Note that this test shall include verification that the P-10 interlock is in its required state for the existing unit condition **allows this surveillance to be satisfied if it has been performed within the previous 92 days**. The test is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** setpoint to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this COT. This portion of the COT ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The Frequency is modified by a Note that allows this surveillance to be satisfied if it has been performed within 92 days of the Frequencies prior to reactor startup and four hours after reducing power below P-10 and P-6. The Frequency of "prior to **reactor** startup" ensures this surveillance is performed prior to critical operations and applies to the source, intermediate and **Power Range Neutron Flux – Low Setpoint** power range low instrument channels. The Frequency of "4 hours after reducing power below P-10" allows a normal shutdown to be completed

SURVEILLANCE REQUIREMENTS (continued)

and the unit removed from the MODE of Applicability for this surveillance without a delay to perform the testing required by this surveillance. The Frequency of ~~every~~ 92 days thereafter applies **to the performance of this COT** if the plant remains in the MODE of Applicability after the initial performances of prior to reactor startup and **4** ~~four~~ hours after reducing power below P-10. The MODE of Applicability for this surveillance is < P-10 for the **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** ~~power range low~~ channels. Once the unit is in MODE 3, this surveillance is no longer required. If power is to be maintained < P-10 for more than 4 hours, then the testing required by this surveillance must be performed prior to the expiration of the 4 hour limit. Four hours is a reasonable time to complete the required testing or place the unit in a MODE where this surveillance is no longer required. **The Surveillance Frequencies for this COT ensure** ~~This test ensures~~ that the **Power Range Neutron Flux – Low Setpoint reactor trip Function instrument** ~~NIS power range low~~ channels are OPERABLE prior to taking the reactor critical and after reducing power into the applicable MODE (< P-10) for periods **greater than four** ~~> 4~~ hours.

SR 3.3.1.8

A CHANNEL CALIBRATION is performed every 24 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

The **CHANNEL CALIBRATION** ~~test~~ is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** ~~setpoint~~ to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation. Transmitter calibration must be performed consistent with the assumptions of the setpoint methodology. The differences between the current as-found values and the previous as-left values must be

SURVEILLANCE REQUIREMENTS (continued)

consistent with the transmitter drift allowance used in the setpoint methodology.

The setpoint methodology requires that 30 months drift be used (1.25 times the surveillance calibration interval, 24 months).

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this CHANNEL CALIBRATION. This portion of the CHANNEL CALIBRATION ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

SR 3.3.1.8 is modified by a Note stating that this test shall include verification that the time constants are adjusted to **within limits** ~~the prescribed values~~ where applicable.

SR 3.3.1.9

A ~~SR 3.3.1.9 is the performance of a~~ CHANNEL CALIBRATION **is performed** every 24 months**, or approximately at every refueling**. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. ~~The test is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable.~~

The CHANNEL CALIBRATION is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel **Trip Setpoint** ~~setpoint~~ to the NTS (within the allowed **as-left** tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel

SURVEILLANCE REQUIREMENTS (continued)

is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

This Surveillance does not include the ~~The~~ CHANNEL CALIBRATION for the **Power Range Neutron Flux** ~~power range neutron~~ detectors**, which** consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore **Power Range Neutron Flux detectors** ~~channels~~. ~~This Surveillance is not required for the power range detectors for entry into MODES 2 and 1 because the plant must be in at least MODE 1 to perform the test.~~

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this CHANNEL CALIBRATION. This portion of the CHANNEL CALIBRATION ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed **at** ~~on~~ the 24 month Frequency.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.10

SR 3.3.1.10 is the performance of a TADOT of the Passive Residual Heat Removal **(PRHR)** Actuation **reactor trip Function**. This TADOT is performed every 24 months.

The Frequency is based on the known reliability of the Function and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The Function~~s~~ **(reactor trip on PRHR Actuation)** affected **by this SR has** ~~have~~ no setpoints associated with **it**~~them~~.

SR 3.3.1.11

This SR 3.3.1.11 verifies that the individual channel/division actuation response times are less than or equal to the maximum values assumed in the accident analysis. Response Time testing criteria are included in Reference **2**~~1~~.

For channels that include dynamic transfer Functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer Function set to one, with the resulting measured response time compared to the appropriate **FSAR** ~~DCD~~ Chapter 7 response time. Alternately, the response time test can be performed with the time constants set to their nominal value, provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

Response time may be verified by actual response time tests in any series of sequential, overlapping or total channel measurements, or by the summation of allocated sensor, signal processing and actuation logic response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g. vendor) test measurements, or (3) utilizing vendor engineering specifications. WCAP-13632-P-A, Revision 2, “Elimination of Pressure Sensor Response Time Testing Requirements” (Ref. 8), provides the basis and methodology for using allocated sensor response times in the

BASES

SURVEILLANCE REQUIREMENTS (continued)

overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types must be demonstrated by test.

Each division response must be verified every 24 months on a STAGGERED TEST BASIS (i.e., all four Protection Channel Sets would be tested after 96 months). Response times cannot be determined during plant operation because equipment operation is required to measure response times. Experience has shown that these components usually pass this surveillance when performed on a refueling frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

~~The~~ SR 3.3.1.11 is modified by a **Note indicating that neutron detectors are** ~~note exempting neutron detectors from response time testing. A Note to the Surveillance indicates that neutron detectors may be~~ excluded from RTS RESPONSE TIME testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

REFERENCES

1. **Institute of Electrical and Electronic Engineers, IEEE 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," June 27, 1991.** ~~Chapter 7.0, "Instrumentation and Controls."~~

2. **FSAR Chapter 7.0, "Instrumentation and Controls."** ~~Chapter 15.0, "Accident Analysis."~~

3. **FSAR Chapter 15.0, "Accident Analyses."** ~~WCAP 16361-P, "Westinghouse Setpoint Methodology for Protection Systems - AP1000," February 2011 (proprietary).~~

4. **WCAP 16361-P, "Westinghouse Setpoint Methodology for Protection Systems - AP1000," February 2011 (proprietary).** ~~Institute of Electrical and Electronic Engineers, IEEE 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," June 27, 1991.~~

REFERENCES (continued)

5. 10 CFR 50.49, “Environmental Qualifications of Electric Equipment Important to Safety for Nuclear Power Plants.”

6. **APP-GW-GLR-137, Revision 1, “Bases of Digital Overpower and Overtemperature Delta-T (OPΔT/ OTΔT) Reactor Trips,” Westinghouse Electric Company LLC.** ~~APP-GW-GSC-020, “Technical Specification Completion Time and Surveillance Frequency Justification.”~~

7. **APP-GW-GSC-020, “Technical Specification Completion Time and Surveillance Frequency Justification.”** ~~APP-GW-GLR-137, Revision 1, “Bases of Digital Overpower and Overtemperature Delta-T (OPΔT/ OTΔT) Reactor Trips,” Westinghouse Electric Company LLC.~~

8. WCAP-13632-P-A (Proprietary) and WCAP-13787-A (Non Proprietary), Revision 2, “Elimination of Pressure Sensor Response Time Testing Requirements,” January 1996.

XII. Applicable STS Subsection After Incorporation of this GTST's Modifications

The entire subsection of the Specifications and the Bases associated with this GTST, following incorporation of the modifications, is presented next.

3.3 INSTRUMENTATION

3.3.1 Reactor Trip System (RTS) Instrumentation

LCO 3.3.1 The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

--NOTE--

Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel inoperable.	A.1 Place inoperable channel in bypass or trip.	6 hours
B. One or more Functions with two channels inoperable.	B.1 Place one inoperable channel in bypass.	6 hours
	<u>AND</u>	
	B. 2 Place one inoperable channel in trip.	6 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met. <u>OR</u> One or more Functions with three or more channels inoperable.	C.1	Enter the Condition referenced in Table 3.3.1-1 for the channel(s).	Immediately
D. As required by Required Action C.1 and referenced in Table 3.3.1-1.	D.1	Be in MODE 3.	6 hours
E. As required by Required Action C.1 and referenced in Table 3.3.1-1.	E.1	Reduce THERMAL POWER to < P-10.	6 hours

SURVEILLANCE REQUIREMENTS

---NOTE---

Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2	-------------------------------NOTES------------------------------ 1. Adjust nuclear instrument channel in the Protection and Safety Monitoring System (PMS) if absolute difference is > 1% RTP. 2. Required to be met within 12 hours after reaching 15% RTP. 3. If the calorimetric heat balance is < 70% RTP, and if the nuclear instrumentation channel indicated power is: a. lower than the calorimetric measurement by > 1%, then adjust the nuclear instrumentation channel upward to match the calorimetric measurement. b. higher than the calorimetric measurement, then no adjustment is required. --- Compare results of calorimetric heat balance to nuclear instrument channel output.	24 hours

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.3	-------------------------------NOTES------------------------------ 1. Adjust the conversion factor, ΔT°, in the ΔT power calculation ($q_{\Delta T}$) if absolute difference between $q_{\Delta T}$ and the calorimetric measurement is > 1% RTP. 2. Required to be met within 12 hours after reaching 50% RTP. 3. If the calorimetric heat balance is < 70% RTP, and if $q_{\Delta T}$ is: a. lower than the calorimetric measurement by > 5%, then adjust ΔT° to match the calorimetric measurement. b. higher than the calorimetric measurement, then no adjustment is required. --- Compare results of calorimetric heat balance to the ΔT power calculation ($q_{\Delta T}$) output.	24 hours
SR 3.3.1.4	-------------------------------NOTES------------------------------ 1. Adjust nuclear instrument channel in PMS if absolute difference is ≥ 3% AFD. 2. Required to be met within 24 hours after reaching 20% RTP. --- Compare results of the incore detector measurements to nuclear instrument channel AXIAL FLUX DIFFERENCE.	31 effective full power days (EFPD)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.5	-------------------------------NOTE------------------------------ Required to be met within 24 hours after reaching 50% RTP. --- Calibrate excore channels to agree with incore detector measurements.	92 EFPD
SR 3.3.1.6	Perform COT in accordance with Setpoint Program.	92 days
SR 3.3.1.7	-------------------------------NOTE------------------------------ Only required to be performed when not performed within previous 92 days. --- Perform COT in accordance with Setpoint Program.	Prior to reactor startup <u>AND</u> 4 hours after reducing power below P-10 <u>AND</u> 92 days thereafter
SR 3.3.1.8	-------------------------------NOTE------------------------------ This Surveillance shall include verification that the time constants are adjusted to within limits. --- Perform CHANNEL CALIBRATION in accordance with Setpoint Program.	24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.9	-------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION in accordance with Setpoint Program.	24 months
SR 3.3.1.10	-------------------------------NOTE------------------------------ Verification of setpoint is not required. --- Perform TADOT.	24 months
SR 3.3.1.11	-------------------------------NOTE------------------------------ Neutron detectors are excluded from response time testing. --- Verify RTS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

Table 3.3.1-1 (page 1 of 2)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
1. Power Range Neutron Flux				
a. High Setpoint	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.6 SR 3.3.1.9 SR 3.3.1.11
b. Low Setpoint	1[(a)],2	4	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.11
2. Power Range Neutron Flux High Positive Rate	1,2	4	D	SR 3.3.1.6 SR 3.3.1.9 SR 3.3.1.11
3. Overtemperature ΔT	1,2	4 (2/loop)	D	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
4. Overpower ΔT	1,2	4 (2/loop)	D	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
5. Pressurizer Pressure				
a. Low Setpoint	1[(b)]	4	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
b. High Setpoint	1,2	4	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
6. Pressurizer Water Level – High 3	1[(b)]	4	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11

Table 3.3.1-1 (page 2 of 2)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
7. Reactor Coolant Flow – Low	1[(b)]	4 per hot leg	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
8. Reactor Coolant Pump (RCP) Bearing Water Temperature – High	1,2	4 per RCP	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
9. RCP Speed – Low	1[(b)]	4 (1/pump)	E	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
10. Steam Generator (SG) Narrow Range Water Level – Low	1,2	4 per SG	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
11. Steam Generator (SG) Narrow Range Water Level – High 2	1,2[(c)]	4 per SG	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
12. Passive Residual Heat Removal Actuation	1,2	4 per valve	D	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11

(a) Below the P-10 (Power Range Neutron Flux) interlocks.

(b) Above the P-10 (Power Range Neutron Flux) interlock.

(c) Above the P-11 (Pressurizer Pressure) interlock.

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

BASES

BACKGROUND

The RTS initiates a unit shutdown, based upon the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Feature Actuation System (ESFAS) in mitigating accidents.

The Protection and Safety Monitoring System (PMS) has been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

Technical Specifications are required by 10 CFR 50.36 to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as “Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded.” The Safety Analysis Limit (SAL) is the limit of the process variable at which a protective action is initiated, as established by the safety analysis, to assure that a SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Safety Analysis Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. The LSSS values are identified and maintained in the Setpoint Program (SP) and are controlled by 10 CFR 50.59.

The Nominal Trip Setpoint (NTS) specified in the SP is a predetermined field setting for a protection channel chosen to initiate automatic actuation prior to the process variable reaching the Safety Analysis Limit and, thus, assures that the SL is not exceeded. As such, the NTS accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the NTS assures that the SLs are not exceeded. Therefore, the NTS meets the 10 CFR 50.36 definition of an LSSS.

BASES

BACKGROUND (continued)

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of performing its safety functions(s)." Relying solely on the NTS to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as-found" value of a protection channel setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the NTS due to some drift of the setting may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the NTS, and thus, the automatic protective action would still have assured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE since it would have performed its safety function. If the as-found condition of the channel is near the as-found tolerance, recalibration is considered appropriate to allow for drift during the next surveillance interval.

During AOOs, which are those events expected to occur one or more times during the unit life, the acceptable limits are:

1. The Departure from Nucleate Boiling Ratio (DNBR) shall be maintained above the Safety Limit (SL) value to prevent departure from nucleate boiling (DNB);

2. Fuel centerline melt shall not occur; and

3. The RCS pressure SL of 2750 psia shall not be exceeded.

Operation within the SLs of Specification 2.0, "Safety Limits (SLs)," also maintains the above values and assures that offsite doses are within the acceptance criteria during AOOs.

Design Basis Accidents (DBA) are events that are analyzed even though they are not expected to occur during the unit life. The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of the limits. Different accident categories are allowed a different fraction of these limits, based on the probability of

BASES

BACKGROUND (continued)

occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RTS maintains surveillance on key process variables which are directly related to equipment mechanical limitations, such as pressure, and on variables which directly affect the heat transfer capability of the reactor, such as flow and temperature. Some limits, such as Overtemperature ΔT, are calculated in the Protection and Safety Monitoring System cabinets from other parameters when direct measurement of the variable is not possible.

The RTS instrumentation is segmented into four distinct but interconnected modules as identified below:

- Field inputs from process sensors, nuclear instrumentation;
- Protection and Safety Monitoring System Cabinets;
- Voting Logic; and
- Reactor Trip Switchgear Interface.

<u>Field Transmitters and Sensors</u>

Normally, four redundant measurements using four separate sensors are made for each variable used for reactor trip. The use of four channels for protection functions is based on a minimum of two channels being required for a trip or actuation, one channel in test or bypass, and a single failure on the remaining channel. The signal selector algorithm in the Plant Control System (PLS) will function with only three channels. This includes two channels properly functioning and one channel having a single failure. For protection channels providing data to the control system, the fourth channel permits one channel to be in test or bypass. Minimum requirements for protection and control are achieved with only three channels OPERABLE. The fourth channel is provided to increase plant availability, and permits the plant to run for an indefinite time with a single channel out of service. The circuit design is able to withstand both an input failure to the control system, which may then require the protection Function actuation, and a single failure in the other channels providing the protection Function actuation. Again, a single failure will neither cause nor prevent the protection Function actuation. These

BACKGROUND (continued)

requirements are described in IEEE-603 (Ref. 1). The actual number of channels required for each plant parameter is specified in Reference 2.

Selected analog measurements are converted to digital form by digital converters within the Protection and Safety Monitoring System cabinets. Signal conditioning may be applied to selected inputs following the conversion to digital form. Following necessary calculations and processing, the measurements are compared against the applicable setpoint for that variable. A partial trip signal for the given parameter is generated if one channel measurement exceeds its predetermined or calculation limit. Processing on all variables for reactor trip is duplicated in each of the four redundant divisions of the protection system. Each division sends its partial trip status to each of the other three divisions over isolated multiplexed links. Each division is capable of generating a reactor trip signal if two or more of the redundant channels of a single variable are in the partial trip state.

The reactor trip signal from each division is sent to the corresponding reactor trip actuation division. Each of the four reactor trip actuation divisions consists of two reactor trip circuit breakers. The reactor is tripped when two or more actuation divisions receive a reactor trip signal. This automatic trip demand initiates the following two actions:

1. It de-energizes the undervoltage trip attachment on each reactor trip breaker, and

2. It energizes the shunt trip device on each reactor trip breaker.

Either action causes the breakers to trip. Opening of the appropriate trip breakers removes power to the control rod drive mechanism (CRDM) coils, allowing the rods to fall into the core. This rapid negative reactivity insertion shuts down the reactor.

BASES

BACKGROUND (continued)

Protection and Safety Monitoring System Cabinets

The PMS cabinets contain the necessary equipment to:

- Permit acquisition and analysis of the sensor inputs, including plant process sensors and nuclear instrumentation, required for reactor trip and Engineered Safety Features (ESF) calculations;

- Perform computation or logic operations on variables based on these inputs;

- Provide trip signals to the reactor trip switchgear and ESF actuation data to the ESF coincidence logic as required;

- Permit manual trip or bypass of each individual reactor trip Function and permit manual actuation or bypass of each individual voted ESF Function;

- Provide data to other systems in the Instrumentation and Control (I&C) architecture;

- Provide separate input circuitry for control Functions that require input from sensors that are also required for protection Functions.

Each of the four divisions provides signal conditioning, comparable output signals for indications in the main control room, and comparison of measured input signals with established setpoints. The bases of the setpoints are described in References 3 and 4. If the measured value of a unit parameter exceeds the predetermined setpoint, an output is generated which is transmitted to the ESF coincidence logic for logic evaluation.

Within the PMS, redundancy is generally provided for active equipment such as processors and communication hardware. This redundancy is provided to increase plant availability and facilitate surveillance testing. A division or channel is OPERABLE if it is capable of performing its specified safety function(s) and all the required supporting functions or systems are also capable of performing their related support functions. Thus, a division or channel is OPERABLE as long as one set of redundant components within the division or channel is capable of performing its specified safety function(s).

BASES

BACKGROUND (continued)

Voting Logic

The voting logic provides a reliable means of opening the reactor trip switchgear in its own division as demanded by the individual protection functions.

Reactor Trip Switchgear Interface

The final stage of the voting logic provides the signal to energize the undervoltage trip attachment on each reactor trip breaker (RTB) within the reactor trip switchgear, which allows RTB closure. Loss of the signal deenergizes the undervoltage trip attachments and results in the opening of those reactor trip switchgear. An additional external relay is deenergized with loss of the signal. The normally closed contacts of the relay energize the shunt trip attachments on each switchgear at the same time that the undervoltage trip attachment is deenergized. This diverse trip actuation is performed external to the PMS cabinets. The switchgear interface including the trip attachments and the external relay are within the scope of the PMS. Separate outputs are provided for each switchgear. Testing of the interface allows trip actuation of the breakers by either the undervoltage trip attachment or the shunt trip attachment.

Nominal Trip Setpoint (NTS)

The NTS is the nominal value at which the trip output is set. Any trip output is considered to be properly adjusted when the “as-left” value is within the band for CHANNEL CALIBRATION (i.e., plus or minus rack calibration accuracy).

The trip setpoints used in the trip output are based on the Safety Analysis Limits stated in Reference 3. The determination of these NTSs is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the NTSs specified in the SP are conservative with respect to the Safety Analysis Limits. A detailed description of the methodology used to calculate the NTSs, including their explicit uncertainties, is provided in the “Westinghouse Setpoint Methodology for Protection Systems” (Ref. 4). The as-left tolerance and as-found tolerance band methodology is provided in the SP. The as-found OPERABILITY limit for the purpose of the CHANNEL OPERATIONAL TEST (COT) is defined as

BACKGROUND (continued)

the as-left limit about the NTS (i.e., plus or minus rack calibration accuracy).

The NTSs listed in the SP are based on the methodology described in Reference 4, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each NTS. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes. Transmitter and signal processing equipment calibration tolerances and drift allowances must be specified in plant calibration procedures, and must be consistent with the values used in the setpoint methodology.

The OPERABILITY of each transmitter or sensor can be evaluated when its “as-found” calibration data are compared against the “as-left” data and are shown to be within the setpoint methodology assumptions. The basis of the setpoints is described in References 3 and 4. Trending of calibration results is required by the program description in Technical Specification 5.5.14.d.

Note that the as-left and as-found tolerances listed in the SP define the OPERABILITY limits for a channel during a periodic CHANNEL CALIBRATION or COT that requires trip setpoint verification.

The PMS testing features are designed to allow for complete functional testing by using a combination of system self-checking features, functional testing features, and other testing features. Successful functional testing consists of verifying that the capability of the system to perform the safety function has not failed or degraded. For hardware functions this would involve verifying that the hardware components and connections have not failed or degraded. Since software does not degrade, software functional testing involves verifying that the software code has not changed and that the software code is executing. To the extent possible, PMS functional testing will be accomplished with continuous system self-checking features and the continuous functional testing features.

The PMS incorporates continuous system self-checking features wherever practical. Self-checking features include on-line diagnostics for the computer system and the hardware and communications tests. These self-checking tests do not interfere with normal system operation.

BASES

BACKGROUND (continued)

In addition to the self-checking features, the system includes functional testing features. Functional testing features include continuous functional testing features and manually initiated functional testing features. To the extent practical, functional testing features are designed not to interfere with normal system operation.

In addition to the system self-checking features and functional testing features, other test features are included for those parts of the system which are not tested with self-checking features or functional testing features. These test features allow for instruments/sensor checks, calibration verification, response time testing, setpoint verification and component testing. The test features again include a combination of continuous testing features and manual testing features.

All of the testing features are designed so that the duration of the testing is as short as possible. Testing features are designed so that the actual logic is not modified. To prevent unwanted actuation, the testing features are designed with either the capability to bypass a Function during testing and/or limit the number of signals allowed to be placed in test at one time.

Reactor Trip (RT) Channel

An RT Channel extends from the sensor to the output of the associated reactor trip subsystem in the Protection and Safety Monitoring System cabinets, and includes the sensor (or sensors), the signal conditioning, any associated datalinks, and the associated reactor trip subsystem. For RT Channels containing nuclear instrumentation, the RT Channel also includes the nuclear instrument signal conditioning and the associated Nuclear Instrumentation Signal Processing and Control (NISPAC) subsystem.

Automatic Trip Logic

The Automatic Trip Logic extends from, but does not include, the outputs of the various RT Channels to, but does not include, the reactor trip breakers. Operator bypass of a reactor trip function is performed within the Automatic Trip Logic.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The RTS functions to maintain compliance with the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

Each of the analyzed accidents and transients which require reactor trip can be detected by one of more RTS Functions. The accident analysis described in Reference 3 takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the plant. These RTS trip Functions may provide protection for conditions which do not require dynamic transient analysis to demonstrate function performance. These RTS trip Functions may also serve as backups to RTS trip Functions that were credited in the accident analysis.

Permissive and interlock functions are based upon the associated protection function instrumentation. Because they do not have to operate in adverse environmental conditions, the trip settings of the permissive and interlock functions use the normal environment, steady-state instrument uncertainties of the associated protection function instrumentation. This results in OPERABILITY criteria (i.e., as-found tolerance and as-left tolerance) that are the same as the associated protection function sensor and process rack modules. The NTSs for permissives and interlocks are based on the associated protection function OPERABILITY requirements; i.e., permissives and interlocks performing enabling functions must be set to occur prior to the specified trip setting of the associated protection function.

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 in the accompanying LCO, to be OPERABLE. The as-left and as-found tolerances specified in the SP define the OPERABILITY limits for a channel during a CHANNEL CALIBRATION or COT. As such, the as-left and as-found tolerances differ from the NTS by plus or minus the PMS rack calibration accuracy and envelope the expected calibration.

If the actual setting of the channel is found outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTS (within the allowed tolerance), and evaluating the channel's response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

A trip setpoint may be set more conservative than the NTS as necessary in response to plant conditions. However, in this case, the OPERABILITY of this instrument must be verified based on the actual field setting and not the NTS. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of four channels in each instrumentation Function. If a required channel becomes inoperable, operation can continue provided the inoperable channel is placed in bypass or trip within the specified Completion Time.

Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure reactor trips are in the correct configuration for the current plant status. They back up operator actions to ensure protection system Functions are not blocked during plant conditions under which the safety analysis assumes the Functions are OPERABLE. Therefore, the interlock Functions do not need to be OPERABLE when the associated reactor trip Functions are outside the applicable MODES. Proper operation of these interlocks supports OPERABILITY of the associated reactor trip Functions and/or the requirement for actuation logic OPERABILITY. Interlocks must be in the required state, as appropriate, to support OPERABILITY of the associated Functions. The interlocks are:

Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective PMS division Intermediate Range Neutron Flux channel increases to approximately one decade above the channel lower range limit. The P-6 interlock ensures that the following are performed:

(1) On increasing power, the P-6 interlock allows the manual block of the respective PMS division Source Range Neutron Flux – High Setpoint reactor trip Function channel. This prevents a premature block of the Source Range Neutron Flux – High reactor trip Function channel and allows the operator to ensure that the Intermediate Range Neutron Flux – High reactor trip Function channels are

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

OPERABLE prior to leaving the source range. When a Source Range Neutron Flux – High reactor trip Function channel is blocked, the high voltage to the detector of the Source Range Neutron Flux channel is also removed.

(2) On decreasing power, the P-6 interlock automatically energizes the respective PMS division Source Range Neutron Flux detector and enables the respective PMS division Source Range Neutron Flux – High reactor trip Function channel.

(3) On increasing power, the P-6 interlock provides a backup signal to automatically block the respective PMS division Source Range Neutron Flux Doubling Engineered Safety Feature Actuation System (ESFAS) Function channel. Normally, this Boron Dilution Block ESFAS Function is manually blocked by the main control room operator during the reactor startup.

Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the respective PMS division Power Range Neutron Flux channel detectors. The P-10 interlock ensures that the following are performed:

(1) On increasing power, the P-10 interlock automatically enables reactor trips on the following Functions:

- Pressurizer Pressure – Low Setpoint,
- Pressurizer Water Level – High 3,
- Reactor Coolant Flow – Low, and
- RCP Speed – Low.

These reactor trips are only required when operating above the P-10 setpoint (approximately 10% power). These reactor trips provide protection against violating the DNBR limit. Below the P-10 setpoint, the RCS is capable of providing sufficient natural circulation without any RCP running.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

(2) On increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip.

(3) On increasing power, the P-10 interlock allows the operator to manually block the Power Range Neutron Flux – Low Setpoint reactor trip.

(4) On increasing power, the respective PMS division P-10 interlock channel automatically provides a backup signal to block the respective PMS division Source Range Neutron Flux reactor trip channel and also to de-energize the respective PMS division Source Range Neutron Flux detector.

(5) On decreasing power, the P-10 interlock automatically blocks reactor trips on the following Functions:

- Pressurizer Pressure – Low Setpoint,
- Pressurizer Water Level – High 3,
- Reactor Coolant Flow – Low, and
- RCP Speed – Low.

(6) On decreasing power, the respective PMS division P-10 interlock channel automatically enables the respective Power Range Neutron Flux – Low Setpoint reactor trip channel and the respective Intermediate Range Neutron Flux – High reactor trip (and rod stop) channel.

Pressurizer Pressure, P-11

With pressurizer pressure channels less than the P-11 setpoint, the operator can manually block the Steam Generator Narrow Range Water Level – High 2 reactor Trip. This allows rod testing with the steam generators in cold wet layup. With pressurizer pressure channels greater than the P-11 setpoint, the Steam Generator Narrow Range Water Level – High 2 reactor trip Function is automatically enabled. The operator can also enable these actuations by use of the respective manual reset.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Reactor Trip System Functions

The safety analyses and OPERABILITY requirements applicable to each RTS Function are discussed below:

1. Power Range Neutron Flux

The Power Range Neutron Flux detectors are located external to the reactor vessel and measure neutrons leaking from the core. The Power Range Neutron Flux detectors provide input to the PLS. Minimum requirements for protection and control are achieved with three channels OPERABLE. The fourth channel is provided to increase plant availability, and permits the plant to run for an indefinite time with a single channel in trip or bypass. This Function also satisfies the requirements of IEEE 603 (Ref. 1) with 2/4 logic. This Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor.

a. Power Range Neutron Flux – High Setpoint

The Power Range Neutron Flux – High trip Function ensures that protection is provided, from all power levels, against a positive reactivity excursion during power operations. Positive reactivity excursions can be caused by rod withdrawal or reductions in RCS temperature.

The LCO requires four Power Range Neutron Flux – High channels to be OPERABLE in MODES 1 and 2.

In MODE 1 or 2, when a positive reactivity excursion could occur, the Power Range Neutron Flux – High trip must be OPERABLE. This Function will terminate the reactivity excursion and shutdown the reactor prior to reaching a power level that could damage the fuel. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – High trip does not have to be OPERABLE because the reactor is shutdown and a reactivity excursion in the power range cannot occur. Other RTS Functions and administrative controls provide protection against reactivity additions when in MODE 3, 4, 5, or 6. In

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

addition, the Power Range Neutron Flux detectors cannot detect neutron flux levels in this range.

b. Power Range Neutron Flux – Low Setpoint

The LCO requirement for the Power Range Neutron Flux – Low trip Function ensures that protection is provided against a positive reactivity excursion from low power or subcritical conditions. The Trip Setpoint reflects only steady state instrument uncertainties as this Function does not provide primary protection for any event that results in a harsh environment.

The LCO requires four of the Power Range Neutron Flux – Low channels to be OPERABLE in MODE 1 below the Power Range Neutron Flux P-10 Setpoint and MODE 2.

In MODE 1, below the Power Range Neutron Flux P-10 setpoint and in MODE 2, the Power Range Neutron Flux – Low trip must be OPERABLE. Each channel of this Function may be manually blocked by the operator when the respective division Power Range Neutron Flux channel is greater than approximately 10% of RTP (P-10 setpoint). Each channel of this Function is automatically unblocked when the respective division Power Range Neutron Flux channel is below the P-10 setpoint. Above the P-10 setpoint, positive reactivity additions are mitigated by the Power Range Neutron Flux – High trip Function.

In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – Low trip Function does not have to be OPERABLE because the reactor is shutdown and the Power Range Neutron Flux detectors cannot detect the neutron flux levels generated in MODES 3, 4, 5, and 6. Other RTS trip Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. Power Range Neutron Flux – High Positive Rate

The Power Range Neutron Flux – High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux which are characteristic of a rod cluster control assembly (RCCA) drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the Power Range Neutron Flux – High and Low trip Functions to ensure that the criteria are met for a rod ejection from the power range. The Power Range Neutron Flux – High Positive Rate trip uses the same Power Range Neutron Flux channels as discussed for Function 1 above.

The LCO requires four Power Range Neutron Flux – High Positive Rate channels to be OPERABLE. In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the Power Range Neutron Flux – High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux – High Positive Rate trip Function does not have to be OPERABLE because other RTS trip Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a SDM in the event of an REA. In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the Power Range Neutron Flux detectors cannot detect neutron flux levels present in MODE 6.

3. Overtemperature ΔT

The Overtemperature ΔT trip Function ensures that protection is provided to ensure that the design limit DNBR is met. This trip Function also limits the range over which the Overpower ΔT trip Function must provide protection. The inputs to the Overtemperature ΔT trip include all combinations of pressure, power, coolant temperature, and axial power distribution, assuming full reactor coolant flow. Protection from violating the DNBR limit is assured for those transients that are slow with respect to delays from the core to the measurement system. The Overtemperature ΔT trip Function uses the measured T_{HOT} and T_{COLD} in each loop, together with the measured pressurizer pressure, to compute the

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

reactor core thermal power. Equations to fit the properties of density and enthalpy are programmed in the software, such that the ΔT power signal is presented as a percent of RTP for direct comparison with measured calorimetric power. The Overtemperature ΔT Trip Setpoint is automatically varied for changes in the parameters that affect DNB as follows:

- reactor core inlet temperature – the Trip Setpoint is varied to correct for changes in core inlet temperature based on measured changes in cold leg temperature with dynamic compensation to account for cold leg-to-core transit time;

- pressurizer pressure – the Trip Setpoint is varied to correct for changes in system pressure; and

- axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the upper and lower Power Range Neutron Flux detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower Power Range Neutron Flux detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

Dynamic compensation of the ΔT power signal is included for system piping delays from the core to the temperature measurement system. The Overtemperature ΔT trip Function is calculated for each loop as described in the SP. A detailed description of this trip is provided in Reference 6. This Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip. No credit is taken in the safety analyses for the turbine runback.

The LCO requires four channels (two per loop) of the Overtemperature ΔT trip Function to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In MODE 1 or 2, the Overtemperature ΔT trip Function must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

4. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the Overtemperature ΔT trip Function and provides a backup to the Power Range Neutron Flux – High Setpoint trip Function. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the same ΔT power signal generated for the Overtemperature ΔT. The Trip setpoint is automatically varied with the following parameter:

- Axial power distribution – the Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the upper and lower Power Range Neutron Flux detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower Power Range Neutron Flux detectors, the Trip Setpoint is reduced in accordance with algorithms documented in the SP.

The Overpower ΔT trip Function is calculated for each loop as described in the SP. A detailed description of this trip is provided in Reference 6. The Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties as the detectors provide protection for a steam line break and may be in a harsh environment. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback reduces turbine power and reactor power. A reduction in power normally alleviates the Overpower ΔT condition and may prevent a reactor trip.

The LCO requires four channels (two per loop) of the Overpower ΔT trip Function to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Overpower ΔT trip Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overpower ΔT trip Function must be OPERABLE. These are the only times that enough heat is generated in the fuel to be concerned about the heat generation rates and overheating of the fuel. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about fuel overheating and fuel damage.

5. Pressurizer Pressure

The same sensors provide input to the Pressurizer Pressure – High and – Low trips and the Overtemperature ΔT trip.

a. Pressurizer Pressure – Low

The Pressurizer Pressure – Low trip Function ensures that protection is provided against violating the DNBR limit due to low pressure. The Trip Setpoint reflects both steady state and adverse environmental instrument uncertainties as the detectors provide primary protection for an event that results in a harsh environment.

The LCO requires four channels of Pressurizer Pressure – Low to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. In MODE 1, when DNB is a major concern, the Pressurizer Pressure – Low trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-10 interlock. On decreasing power, this trip Function is automatically blocked below P-10. Below the P-10 setpoint, no conceivable power distributions can occur that would cause DNB concerns.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Pressurizer Pressure – High

The Pressurizer Pressure – High trip Function ensures that protection is provided against overpressurizing the RCS. This trip Function operates in conjunction with the safety valves to prevent RCS overpressure conditions. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four channels of the Pressurizer Pressure – High to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, the Pressurizer Pressure – High trip must be OPERABLE to help prevent RCS overpressurization and minimize challenges to the safety valves. In MODE 3, 4, 5, or 6, the Pressurizer Pressure – High trip Function does not have to be OPERABLE because transients which could cause an overpressure condition will be slow to occur. Therefore, the operator will have sufficient time to evaluate plant conditions and take corrective actions. Additionally, low temperature overpressure protection systems provide overpressure protection when below MODE 4.

6. Pressurizer Water Level – High 3

The Pressurizer Water Level – High 3 trip Function provides a backup signal for the Pressurizer Pressure – High trip Function and also provides protection against water relief through the pressurizer safety valves. These valves are designed to pass steam in order to achieve their design energy removal rate. A reactor trip is actuated prior to the pressurizer becoming water solid. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment. The level channels do not actuate the safety valves.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires four channels of Pressurizer Water Level – High 3 to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 when there is a potential for overfilling the pressurizer, the Pressurizer Water Level – High 3 trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-10 interlock. On decreasing power, this trip Function is automatically blocked below P-10. Below the P-10 setpoint, transients which could raise the pressurizer water level will be slow and the operator will have sufficient time to evaluate plant conditions and take corrective actions.

7. Reactor Coolant Flow – Low

The Reactor Coolant Flow – Low trip Function ensures that protection is provided against violating the DNBR limit due to low flow in one or more RCS hot legs. Above the P-10 setpoint, a loss of flow in any RCS hot leg will actuate a Reactor trip.

Each RCS hot leg has four flow detectors to monitor flow. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four Reactor Coolant Flow – Low channels per hot leg to be OPERABLE in MODE 1 above P-10. Four OPERABLE channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 above the P-10 setpoint, when a loss of flow in one RCS hot leg could result in DNB conditions in the core, the Reactor Coolant Flow – Low trip must be OPERABLE.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

8. Reactor Coolant Pump (RCP) Bearing Water Temperature – High

The RCP Bearing Water Temperature – High reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in one RCS cold leg. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four RCP Bearing Water Temperature – High channels per RCP to be OPERABLE in MODE 1 or 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, when a loss of flow in any RCS cold leg could result in DNB conditions in the core, the RCP Bearing Water Temperature – High trip must be OPERABLE.

9. Reactor Coolant Pump Speed – Low

The RCP Speed – Low trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS cold legs. The speed of each RCP is monitored. Above the P-10 setpoint a low speed detected on two or more RCPs will initiate a reactor trip. The Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires four RCP Speed – Low channels (one per pump) to be OPERABLE in MODE 1 above P-10. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 above the P-10 setpoint, the RCP Speed – Low trip must be OPERABLE. Below the P-10 setpoint, all reactor trips on loss of flow are automatically blocked since no power distributions are expected to occur that would cause a DNB concern at this low power level. Above the P-10 setpoint, the reactor trip on loss of flow in two or more RCS cold legs is automatically enabled.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Steam Generator Narrow Range Water Level – Low

The Steam Generator (SG) Narrow Range Water Level – Low trip Function ensures that protection is provided against a loss of heat sink. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range low level in any steam generator is indicative of a loss of heat sink for the reactor. The Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties as the detectors provide primary protection for an event that results in a harsh environment. This Function also contributes to the coincidence logic for the ESFAS Function of opening the Passive Residual Heat Removal (PRHR) discharge valves.

The LCO requires four channels of SG Water Level – Low per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, when the reactor requires a heat sink, the SG Water Level – Low trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater System (non-safety related). The Main Feedwater System is normally in operation in MODES 1 and 2. PRHR is the safety related backup heat sink for the reactor. During normal startups and shutdowns, the Main and Startup Feedwater Systems (non-safety related) can provide feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the SG Water Level – Low Function does not have to be OPERABLE because the reactor is not operating or even critical.

11. Steam Generator Narrow Range Water Level – High 2

The SG Narrow Range Water Level – High 2 trip Function ensures that protection is provided against excessive feedwater flow by closing the main feedwater control valves, tripping the turbine, and tripping the reactor. While the transmitters (d/p cells) are located inside containment, the events which this function protects against cannot cause a severe environment in containment. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires four channels of the SG Narrow Range Water Level – High 2 trip Function per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODES 1 and 2 above the P-11 interlock, the SG Narrow Range Water Level – High 2 trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater System (non-safety related). The Main Feedwater System is only in operation in MODES 1 and 2. In MODE 3, 4, 5, or 6, the SG Narrow Range Water Level – High 2 Function does not have to be OPERABLE because the reactor is not operating or even critical. The P-11 interlock is provided on this Function to permit bypass of the trip Function when the pressure is below P-11. This bypass is necessary to permit rod testing when the steam generators are in wet layup.

12. <u>Passive Residual Heat Removal Actuation</u>

The Passive Residual Heat Removal (PRHR) Actuation reactor trip Function ensures that a reactivity excursion due to cold water injection will be minimized upon an inadvertent operation of the PRHR discharge valves. The two discharge valves for the PRHR HX are monitored by PMS using valve position indicators as inputs into PMS.

The LCO requires four channels of PRHR discharge valve position indication per valve to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODES 1 and 2, the PRHR Actuation reactor trip Function must be OPERABLE. In MODES 3, 4, 5, and 6, the PRHR Actuation reactor trip Function does not have to be OPERABLE because the reactor is not operating or critical.

The RTS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

ACTIONS

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.1-1.

In the event a channels as-found condition is outside the as-found tolerance described in the SP, or the channel is not functioning as required, or the transmitter, instrument loop, signal processing electronics, or trip output is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

A.1

Condition A addresses the situation where one required channel for one or more Functions is inoperable. With one channel inoperable, the inoperable channel must be placed in a bypass or trip condition within 6 hours. If one inoperable channel is bypassed, the logic becomes two out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) If one inoperable channel is tripped, the logic becomes one-out-of-three, while still meeting the single failure criterion. (A failure in one of the three remaining channels will not prevent the protective function.) The 6 hours allowed to place the inoperable channel(s) in the bypassed or tripped condition is justified in Reference 7.

B.1 and B.2

Condition B addresses the situation where one or more Functions have two required channels inoperable. With two channels for a Function inoperable, one inoperable channel must be placed in a bypass condition within 6 hours and one inoperable channel must be placed in a trip condition within 6 hours. If one channel is bypassed and one channel is tripped, the logic becomes one-out-of-two, while still meeting the single failure criterion. The 6 hours allowed to place the inoperable channels in the bypassed or tripped condition is justified in Reference 7.

C.1

Condition C addresses the situation where any Required Action and associated Completion Time of Condition A or B is not met, or three or more channels are inoperable for one or more Functions. Required Action C.1 directs entry into the appropriate Condition referenced in Table 3.3.1-1.

BASES

ACTIONS (continued)

D.1

Condition D is entered from Required Action C.1 when any Required Action and associated Completion Time of Condition A or B is not met, or three or more channels are inoperable for one or more Functions, and it is identified as the appropriate Condition referenced in Table 3.3.1-1. If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, the plant must be placed in MODE 3. Six hours are allowed to place the plant in MODE 3. This is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems.

E.1

Condition E is entered from Required Action C.1 when any Required Action and associated Completion Time of Condition A or B is not met, or three or more channels for one or more Functions are inoperable, and it is identified as the appropriate Condition referenced in Table 3.3.1-1. If the channel(s) is not restored to OPERABLE status or placed in trip or bypass, as applicable, within the allowed Completion Time, or three or more channels are inoperable for a Function, THERMAL POWER must be reduced to below the P-10 setpoint; a condition in which the LCO does not apply. The allowed Completion Time is reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

The SRs for each RTS Function are identified in the SRs column of Table 3.3.1-1 for that Function.

A Note has been added to the SR table stating that Table 3.3.1-1 determines which SRs apply to which RTS Functions.

The CHANNEL CALIBRATION and COT are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies. For channels that include dynamic transfer functions, such as, lag, lead/lag, rate/lag, the response time test may be performed with the transfer function set to one, with the resulting measured response time compared to the appropriate FSAR Chapter 7 response time (Ref. 2). Alternately, the response time test can be performed with the time constants set to their nominal value provided the

BASES

SURVEILLANCE REQUIREMENTS (continued)

required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of even something more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment have drifted outside their corresponding limits.

The Frequency is based on operating experience that demonstrates that channel failure is rare. Automated operator aids may be used to facilitate the performance of the CHANNEL CHECK.

SR 3.3.1.2

SR 3.3.1.2 compares the calorimetric heat balance to the nuclear instrumentation channel output every 24 hours. If the calorimetric measurement between 70% and 100% RTP differs from the nuclear instrument channel output by > 1% RTP, the nuclear instrument channel is not declared inoperable, but must be adjusted. If the nuclear instrument channel output cannot be properly adjusted, the channel is declared inoperable.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Three Notes modify SR 3.3.1.2. The first Note indicates that the nuclear instrument channel output shall be adjusted consistent with the calorimetric results if the absolute difference between the nuclear instrument channel output and the calorimetric measurement between 70% and 100% RTP is > 1% RTP. The second Note clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 12 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels the calorimetric data from feedwater flow venturi measurements are less accurate. The third Note is required because, at power levels between 15% and 70% calorimetric uncertainty and control rod insertion create the potential for miscalibration of the nuclear instrumentation channel in cases where the channel is adjusted downward to match the calorimetric power. Therefore, if the calorimetric heat measurement is less than 70% RTP, and if the nuclear instrumentation channel indicated power is lower than the calorimetric measurement by > 1%, then the nuclear instrumentation channel shall be adjusted upward to match the calorimetric measurement. No nuclear instrumentation channel adjustment is required if the nuclear instrumentation channel is higher than the calorimetric measurement (see Westinghouse Technical Bulletin NSD-TB-92-14, Rev. 1.)

The Frequency of every 24 hours is adequate based on plant operating experience, considering instrument reliability and operating history data for instrument drift.

Together, these factors demonstrate the change in the absolute difference between nuclear instrumentation and heat balance calculated powers rarely exceeds 1% RTP in any 24 hours period.

In addition, main control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

SR 3.3.1.3 compares the calorimetric heat balance to the calculated ΔT power (qΔT) in each Division every 24 hours. If the calorimetric measurement between 70% and 100% RTP differs from the calculated ΔT power by > 1% RTP, the Function is not declared inoperable, but the conversion factor, ΔT°, must be adjusted. If ΔT° cannot be properly adjusted, the Function is declared inoperable in the affected Division(s).

BASES

SURVEILLANCE REQUIREMENTS (continued)

Three Notes modify SR 3.3.1.3. The first Note indicates that ΔT° shall be adjusted consistent with the calorimetric results if the absolute difference between the calculated ΔT power and the calorimetric measurement between 70% and 100% RTP is > 1% RTP.

The second Note clarifies that this Surveillance is required only if reactor power is ≥ 50% RTP and that 12 hours is allowed for performing the first Surveillance after reaching 50% RTP. At lower power levels, the calorimetric data from feedwater flow venturi measurements are less accurate. The calculated ΔT power is normally stable (less likely to need adjustment or to be grossly affected by changes in the core loading pattern than the nuclear instrumentation), and its calibration should not be unnecessarily altered by a possibly inaccurate calorimetric measurement at low power.

The third Note is required because at power levels below 70%, calorimetric uncertainty creates the potential for non-conservative adjustment of the ΔT° conversion factor, in cases where the calculated ΔT power would be reduced to match the calorimetric power. Therefore, if the calorimetric heat measurement is less than 70% RTP, and if the calculated ΔT power is lower than the calorimetric measurement by > 5%, then the ΔT° conversion factor shall be adjusted so that the calculated ΔT power matches the calorimetric measurement. No ΔT° conversion factor adjustment is required if the calculated ΔT power is higher than the calorimetric measurement.

The Frequency of every 24 hours is based on plant operating experience, considering instrument reliability and the limited effects of fuel burnup and rod position changes on the accuracy of the calculated ΔT power.

<u>SR 3.3.1.4</u>

SR 3.3.1.4 compares the AXIAL FLUX DIFFERENCE determined using the incore neutron flux detector system to the excore nuclear instrument channel AXIAL FLUX DIFFERENCE every 31 effective full power days (EFPD) and adjusts the excore nuclear instrument channel if the absolute difference between the incore and excore AFD is ≥ 3% AFD.

If the absolute difference is ≥ 3% AFD the excore nuclear instrument channel is still OPERABLE, but must be readjusted. If the excore nuclear instrument channel cannot be properly readjusted, the channel is

BASES

SURVEILLANCE REQUIREMENTS (continued)

declared inoperable. This surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT reactor trip Function.

Two Notes modify SR 3.3.1.4. The first Note indicates that the excore nuclear instrument channel shall be adjusted if the absolute difference between the incore and excore AFD is ≥ 3% AFD. Note 2 clarifies that the Surveillance is required only if reactor power is ≥ 20% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore channels.

The Frequency of every 31 EFPD is adequate based on plant operating experience, considering instrument reliability and operating history data for instrument drift. Also, the slow changes in neutron flux during the fuel cycle can be detected during this interval.

SR 3.3.1.5

SR 3.3.1.5 is a calibration of the excore nuclear instrument (Power Range Neutron Flux) detectors to the incore neutron flux detectors. If the measurements do not agree, the excore nuclear instrument channels are not declared inoperable but must be adjusted to agree with the incore neutron flux detector measurements. If the excore nuclear instrument channels cannot be adjusted, the excore nuclear instrument channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature ΔT reactor trip Function.

A Note modifies SR 3.3.1.5. The Note states that this Surveillance is required only if reactor power is > 50% RTP and that 24 hours is allowed for performing the first surveillance after reaching 50% RTP.

The Frequency of 92 EFPD is adequate based on industry operating experience, considering instrument reliability and operating history data for instrument drift.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.6

SR 3.3.1.6 is the performance of a CHANNEL OPERATIONAL TEST (COT) every 92 days. The SR 3.3.1.6 testing is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the NTS (within the allowed as-left tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

A COT is performed on each required channel to provide reasonable assurance that the entire channel will perform the intended Function.

A test subsystem is provided with the Protection and Safety Monitoring System (PMS) to aid the plant staff in performing the COT. The test subsystem is designed to allow for complete functional testing by using a combination of system self checking features, functional testing features, and other testing features. Successful functional testing consists of verifying that the capability of the system to perform the safety function has not failed or degraded.

For hardware functions this would involve verifying that the hardware components and connections have not failed or degraded. Generally this verification includes a comparison of the outputs from two or more redundant subsystems or channels.

Since software does not degrade, software functional testing involves verifying that the software code has not changed and that the software code is executing.

To the extent possible, PMS functional testing is accomplished with continuous system self-checking features and the continuous functional testing features. The COT shall include a review of the operation of the test subsystem to verify the completeness and adequacy of the results.

SURVEILLANCE REQUIREMENTS (continued)

If the COT cannot be completed using the built-in test subsystem, either because of failures in the test subsystem or failures in redundant channel hardware used for functional testing, the COT can be performed using portable test equipment.

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this COT. This portion of the COT ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The COT Surveillance Frequency of 92 days is justified based on Reference 7 (which refers to this test as "RTCOT") and the use of continuous diagnostic test features, such as deadman timers, cross-check of redundant channels, memory checks, numeric coprocessor checks, and tests of timers, counters and crystal time bases, which will report a failure within the PMS cabinets to the operator within 10 minutes of a detectable failure.

During the COT, the PMS cabinets in the division under test may be placed in bypass.

SR 3.3.1.7

SR 3.3.1.7 is the performance of a COT as described in SR 3.3.1.6 (note that Reference 7 refers to this test as an "RTCOT"), except it is modified by a Note that allows this surveillance to be satisfied if it has been performed within the previous 92 days. The test is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel Trip Setpoint to the NTS (within the allowed as-left tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel

BASES

SURVEILLANCE REQUIREMENTS (continued)

is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this COT. This portion of the COT ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The Frequency of prior to reactor startup ensures this surveillance is performed prior to critical operations and applies to the Power Range Neutron Flux – Low Setpoint instrument channels. The Frequency of 4 hours after reducing power below P-10 allows a normal shutdown to be completed and the unit removed from the MODE of Applicability for this surveillance without a delay to perform the testing required by this surveillance. The Frequency of 92 days thereafter applies to the performance of this COT if the plant remains in the MODE of Applicability after the initial performances of prior to reactor startup and 4 hours after reducing power below P-10. The MODE of Applicability for this surveillance is < P-10 for the Power Range Neutron Flux – Low Setpoint reactor trip Function instrument channels. Once the unit is in MODE 3, this surveillance is no longer required. If power is to be maintained < P-10 for more than 4 hours, then the testing required by this surveillance must be performed prior to the expiration of the 4 hour limit. Four hours is a reasonable time to complete the required testing or place the unit in a MODE where this surveillance is no longer required. The Surveillance Frequencies for this COT ensure that the Power Range Neutron Flux – Low Setpoint reactor trip Function instrument channels are OPERABLE prior to taking the reactor critical and after reducing power into the applicable MODE (< P-10) for periods greater than four hours.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.8

A CHANNEL CALIBRATION is performed every 24 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

The CHANNEL CALIBRATION is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel Trip Setpoint to the NTS (within the allowed as-left tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation. Transmitter calibration must be performed consistent with the assumptions of the setpoint methodology. The differences between the current as-found values and the previous as-left values must be consistent with the transmitter drift allowance used in the setpoint methodology.

The setpoint methodology requires that 30 months drift be used (1.25 times the surveillance calibration interval, 24 months).

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this CHANNEL CALIBRATION. This portion of the CHANNEL CALIBRATION ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function's OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function's OPERABILITY at the existing plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.8 is modified by a Note stating that this test shall include verification that the time constants are adjusted to within limits where applicable.

SR 3.3.1.9

A CHANNEL CALIBRATION is performed every 24 months, or approximately at every refueling. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION.

The CHANNEL CALIBRATION is performed in accordance with the SP. If the actual setting of the channel is found to be outside the as-found tolerance, the channel is considered inoperable. This condition of the channel will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel Trip Setpoint to the NTS (within the allowed as-left tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

This Surveillance does not include the CHANNEL CALIBRATION for the Power Range Neutron Flux detectors, which consists of a normalization of the detectors based on a power calorimetric and flux map performed above 20% RTP. Below 20% RTP, the design of the incore detector system, low core power density, and detector accuracy make use of the incore detectors inadequate for use as a reference standard for comparison to the excore Power Range Neutron Flux detectors.

Interlocks implicitly required to support the Function's OPERABILITY are also addressed by this CHANNEL CALIBRATION. This portion of the CHANNEL CALIBRATION ensures the associated Function is not bypassed when required to be enabled. This can be accomplished by ensuring the interlocks are calibrated properly in accordance with the SP. If the interlock is not automatically functioning as designed, the condition is entered into the Corrective Action Program and appropriate OPERABILITY evaluations performed for the affected Function. The affected Function’s OPERABILITY can be met if the interlock is manually enforced to properly enable the affected Function. When an interlock is not supporting the associated Function’s OPERABILITY at the existing

SURVEILLANCE REQUIREMENTS (continued)

plant conditions, the affected Function's channels must be declared inoperable and appropriate ACTIONS taken.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.10

SR 3.3.1.10 is the performance of a TADOT of the Passive Residual Heat Removal (PRHR) Actuation reactor trip Function. This TADOT is performed every 24 months.

The Frequency is based on the known reliability of the Function and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The Function (reactor trip on PRHR Actuation) affected by this SR has no setpoints associated with it.

SR 3.3.1.11

This SR 3.3.1.11 verifies that the individual channel/division actuation response times are less than or equal to the maximum values assumed in the accident analysis. Response Time testing criteria are included in Reference 2.

For channels that include dynamic transfer Functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer Function set to one, with the resulting measured response time compared to the appropriate FSAR Chapter 7 response time. Alternately, the response time test can be performed with the time constants set to their nominal value, provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Response time may be verified by actual response time tests in any series of sequential, overlapping or total channel measurements, or by the summation of allocated sensor, signal processing and actuation logic response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g. vendor) test measurements, or (3) utilizing vendor engineering specifications. WCAP-13632-P-A, Revision 2, “Elimination of Pressure Sensor Response Time Testing Requirements” (Ref. 8), provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types must be demonstrated by test.

Each division response must be verified every 24 months on a STAGGERED TEST BASIS (i.e., all four Protection Channel Sets would be tested after 96 months). Response times cannot be determined during plant operation because equipment operation is required to measure response times. Experience has shown that these components usually pass this surveillance when performed on a refueling frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.3.1.11 is modified by a Note indicating that neutron detectors are excluded from RTS RESPONSE TIME testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

REFERENCES

1. Institute of Electrical and Electronic Engineers, IEEE 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations,” June 27, 1991.

2. FSAR Chapter 7.0, “Instrumentation and Controls.”

3. FSAR Chapter 15.0, “Accident Analyses.”

4. WCAP 16361-P, “Westinghouse Setpoint Methodology for Protection Systems - AP1000,” February 2011 (proprietary).

BASES

REFERENCES (continued)

5. 10 CFR 50.49, "Environmental Qualifications of Electric Equipment Important to Safety for Nuclear Power Plants."

6. APP-GW-GLR-137, Revision 1, "Bases of Digital Overpower and Overtemperature Delta-T (OPΔT/ OTΔT) Reactor Trips," Westinghouse Electric Company LLC.

7. APP-GW-GSC-020, "Technical Specification Completion Time and Surveillance Frequency Justification."

8. WCAP-13632-P-A (Proprietary) and WCAP-13787-A (Non Proprietary), Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," January 1996.