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

Title: Changes Related to LCO 3.4.4, RCS Loops

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-153-A, Rev 0, Clarify Exception Notes to be Consistent with the Requirement Being Excepted
TSTF-425-A, Rev 3, Relocate Surveillance Frequencies to Licensee Control – RITSTF Initiative 5b
TSTF-438-A, Rev 0, Clarify Exception Notes to be Consistent with the Requirement Being Excepted
TSTF-449-A, Rev 4, Steam Generator Tube Integrity

STS NUREGs Affected:

TSTF-153-A, Rev 0: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-425-A, Rev 3: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-438-A, Rev 0: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-449-A, Rev 4: NUREGs 1430, 1431, and 1432

NRC Approval Date:

TSTF-153-A, Rev 0: 11-Apr-97
TSTF-425-A, Rev. 3: 06-Jul-09
TSTF-438-A, Rev 0: 21-Oct-02
TSTF-449-A, Rev 4: 06-May-05

TSTF Classification:

TSTF-153-A, Rev 0: Consistency/Standardization
TSTF-425-A, Rev 3: Technical Change
TSTF-438-A, Rev 0: Editorial Change
TSTF-449-A, Rev 4: Technical 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 departures applicable to Specification 3.4.4.

RCOL COL Item Number and Title:

There are no Vogtle COL items applicable to Specification 3.4.4.

RCOL PTS Change Number and Title:

VEGP LAR DOC A003:	References to various Chapters and Sections of the Final Safety Analysis Report (FSAR) are revised to include FSAR.
VEGP LAR DOC A042:	Relocate prohibition on RCP starts from LCO Notes to Required Actions
VEGP LAR DOC A047:	Clarify Exception Notes
VEGP LAR DOC L07:	Certain TS Required Actions requiring the RTBs to be opened are revised into two Required Actions.

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(1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

DOC A047 applies essentially the same TS change allowed by the application of TSTF-438-A.

TSTF-153-A, Revision 0, was not applied to the AP1000 GTS. However, TSTF-438-A, Revision 0, supersedes TSTF-153-A and is applied by this GTST.

TSTF-425-A deferred for future consideration.

TSTF-449-A, Revision 4, has been applied to AP1000 GTS 3.4.4, Rev 19 by Westinghouse. TSTF-449-A is not considered further as a part of this GTST. The Federal Register Notice (FRN) of Availability reference for TSTF-449-A is Volume 70, No. 87, Friday, May 6, 2005.

DOC M06 was initially applied to this GTS. 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 M06 was withdrawn.

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)

Add discussion of Notes for Conditions A and B prohibiting RCP start to the Bases.

Revise the last sentence of the third paragraph in the "ASA" section of the Bases to improve grammar (NRC Staff Comment):

> The DNBR limit defines a locus of pressure and temperature points ~~which result~~ **that results** in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

Grammatical errors are corrected in the Bases.

APOG Recommended Changes to Improve the Bases

In the "LCO" section of the Bases, delete the second paragraph discussion of 3,000 gpm and revise the TS 3.4.8 "LCO" section of the Bases to include the 3,000 gpm limit. Currently, there is no mention of 3,000 gpm in TS 3.4.8 Bases to align with the TS 3.4.8 LCO requirement. This change improves consistency with STS NUREG-1431, Rev. 4.

In the first paragraph under heading "A.1, A.2, A.3, and A.4" of the "Actions" section of Bases for Subsection 3.4.4, revise the last sentence to use "minimizing" in place of "minimizes" for clarity.

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 3.4.4, RCS Loops

Changes to the Generic Technical Specifications and Bases:

LCO 3.4.4 Note 1 is deleted and the corresponding prohibition on RCP starts is moved to Required Actions A.1 and B.1. The corresponding Bases are updated. This assures that, when the LCO is not met, no attempt to start an RCP will occur while in the Mode of Applicability. (DOC A042)

LCO 3.4.4 Note 4 and the corresponding Bases “LCO” section are revised to clarify when all RCPs may be removed from operation. This provides clarification of a confusing phrase. (TSTF-438-A and DOC A047)

LCO 3.4.4 Applicability is revised to break RTB statement into two parts. Similar revision is applied to Required Actions A.1 and B.1. The corresponding Bases are updated. This eliminates the potential for undesirable secondary effects of opening the reactor trip breakers. (DOC L07)

The last sentence of the third paragraph of the “ASA” section of Bases is revised to improve grammar. (NRC Staff Comment)

The second paragraph of the “LCO” section of Bases is deleted to be consistent with NUREG-1431. (APOG Comment)

The last sentence of the first paragraph under heading “A.1, A.2, A.3, and A.4” in the “Actions” section of Bases is revised to improve clarity. (APOG Comment)

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:

Revise the Note to LCO 3.4.4 so that the Note, as an exception to the LCO requirement, is not subjected to different interpretations by control room operators. (TSTF-438-A)

Rationale for TSTF changes:

LCO Note 4 is revised to state that the pump that is required to be in operation "may be removed from operation." This wording is a better description of the exception to the LCO than "may be de-energized," which could leave the control room operators uncertain about how this allowance is intended to be done, e.g., opening the respective circuit breaker or just placing the control switch to the "Pull-to-Lock" position.

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

DOC A042 deletes LCO Note 1 stating "No RCP shall be started when the reactor trip breakers are closed." The prohibition on RCP starts is moved to Required Action A.1 and Required Action B.1.

DOC A047 revises Note 4 to allow all RCPs to be "removed from operation" instead of "de-energized" when in the specified conditions of the Note.

DOC L07 replaces Required Actions to open the reactor trip breakers with two Required Actions.

A more detailed description of each DOC can be found in Reference 2, VEGP TSU LAR Enclosure 1, and 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 in Reference 5 and the Southern Nuclear Operating Company RAI Response in Reference 6.

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

The prohibition against starting RCPs is relocated to Required Action A.1 and Required Action B.1 by DOC A042. This assures that, when the LCO is not met, no attempt to start an RCP will occur while in the Mode of Applicability.

Clarification of Note 4 per DOC A047 is provided similar to TSTF-438-A.

DOC L07 notes that when the RTBs are opened, certain other interlocks can be initiated. The initiation of the associated interlocks may have an undesirable secondary effect on operation of the plant such as the initiation of the P-4 interlock, which, in the event of low RCS temperature, can result in isolation of main feedwater to the steam generators.

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

A discussion of the Notes for Conditions A and B prohibiting RCP start is added to the Bases.

The last sentence of the third paragraph in the “ASA” section of the Bases to is revised to state (NRC Staff Comment):

> The DNBR limit defines a locus of pressure and temperature points ~~which result~~ **that results** in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

The second paragraph of the “LCO” section of the Bases is deleted. (APOG Comment)

In the first paragraph under heading “A.1, A.2, A.3, and A.4” of the “Actions” section of Bases for Subsection 3.4.4, revise the last sentence to use “minimizing” in place of “minimizes.” (APOG Comment)

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:

Language under each individual Condition describing the Note was removed. A statement regarding the validity of these Notes needs to be included in the Bases.

The non-technical change to the “ASA” section of the Bases provides improved clarity, consistency, and operator usability.

The change to the “LCO” section of the Bases improves consistency with STS NUREG-1431, Rev. 4.

The change under the heading “A.1, A.2, A.3, and A.4” of the “Actions” section of Bases is a non-technical change that provides added 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:

DCO A042 deletes LCO Note 1. Note 1 currently prohibits starting any Reactor Coolant Pump (RCP) while operating in the current applicable Modes. This requirement prevents startup of an RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed. As currently stated in the associated Bases, the requirements of the Notes ensure that no attempt is made to restart a pump with the reactor trip breakers closed, thus precluding events which are unanalyzed.

The proposed change deletes Note 1 and moves the prohibition on starting RCPs to STS 3.4.4 Required Action A.1 and Required Action B.1. This change provides the same assurance that, when the LCO is not met, no attempt to start an RCP will occur while in the Mode of Applicability. This change does not result in a technical change to the TS.

AP1000 GTS LCO 3.4.4 requires an RCS loop to be OPERABLE with four RCPs in operation. The LCO notes allow the operating loop to be stopped for a period of time to perform a variety of tests, e.g. Control Rod drop tests. In Revision 1 of the ITS NUREGs, these Notes were worded inconsistently. Some Notes stated that the pump could be “de-energized,” others stated that the pump could be “removed from operation.” The Bases also referred to the pump being “stopped.” TSTF-153 revised the Notes to state that the pump “may not be in operation,” as a direct exception to the requirement to “be in operation.” TSTF-153 was approved by the NRC April 11, 1997.

Subsequent to the approval of TSTF-153, a consensus was reached between the NRC and the Industry that this wording was confusing. The Notes could be read as a prohibition, i.e., the pump must be stopped, instead of the intended meaning that the pump may be stopped. DOC A047 and TSTF-438 revised the Notes to allow that the RCPs “may be removed from operation,” instead of “may be de-energized.”

DCO L07 replaces Required Actions to open the reactor trip breakers with two Required Actions. Each of the Required Actions to open the RTBs is intended to assure that rods cannot be withdrawn thereby eliminating the possibility for control rod related positive reactivity additions and associated heat input into the reactor coolant. Additionally, opening the RTBs would result in all rods being inserted. Therefore, replacing the Required Actions to open RTBs with two actions to “initiate action to fully insert all rods” and “place the Plant Control System in a condition incapable of rod withdrawal,” maintains the intent of the existing requirement. This change replaces the specific method of precluding rod withdrawal and ensuring all rods are inserted while maintaining the requirement for establishing the plant conditions equivalent to opening RTBs.

The remaining changes 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 3.4.4 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:

STS (NUREG-1431) 3.4.4, 3.4.5, 3.4.6, and 3.4.7 are equivalent to AP1000 GTS 3.4.4.

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/16/2014.

APOG Comments (Ref. 7) and Resolutions:

1. (Internal # 3) 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 # 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.

3. (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.

4. (Internal # 237) In GTST for Subsection 3.4.4, Section III, last paragraph states that the NRC Staff RAIs are Reference 8 and the Southern Nuclear responses are Reference 9. The correct references are References 5 and 6. This is resolved by making the recommended change.

5. (Internal # 238) In GTST for Subsection 3.4.4, Section VI, “DCO” should be corrected to “DOC” in five places. This is resolved by making the recommended change.

6. (Internal # 239) In the “LCO” section of the Bases, delete the second paragraph discussion of 3,000 gpm and revise the TS 3.4.8 “LCO” section of the Bases to include the 3,000 gpm limit. Currently, there is no mention of 3,000 gpm in TS 3.4.8 Bases to align with the TS 3.4.8 LCO requirement. This change improves consistency with STS NUREG-1431, Rev. 4. This is resolved by making the recommended change with an additional edit. Revise the last sentence of the third paragraph in the “ASA” section of the Bases to improve grammar as follows:

   > The DNBR limit defines a locus of pressure and temperature points ~~which result~~ **that results** in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

7. (Internal # 240) In the first paragraph under heading “A.1, A.2, A.3, and A.4” of the “Actions” section of Bases for Subsection 3.4.4, revise the last sentence to use “minimizing” in place of “minimizes” for clarity. This is resolved by making the recommended change.

NRC Final Approval Date: 12/7/2015

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

None

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.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops

LCO 3.4.4 Two RCS loops shall be OPERABLE with four Reactor Coolant Pumps (RCPs) in operation with variable speed control bypassed.

----------NOTES----------

~~1. No RCP shall be started when the reactor trip breakers are closed.~~

1.~~2.~~ No RCP shall be started when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%.

2.~~3.~~ No RCP shall be started with any RCS cold leg temperature ≤ 350°F unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures and the RCP is started at ≤ 25% of RCP speed.

3.~~4.~~ All RCPs may be ~~de-energized~~ **removed from operation** in MODE 3, 4, or 5 for ≤ 1 hour per 8 hour period provided:

a. No operations are permitted that would cause introduction into the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature.

APPLICABILITY: MODES 1 and 2,
MODES 3, 4, and 5~~, whenever the reactor trip breakers are closed~~ **with Plant Control System capable of rod withdrawal or one or more rods not fully inserted**.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. ----------NOTE---------- Required Actions ~~A.1~~ must be completed whenever Condition A is entered. ---------- Requirements of LCO not met in MODE 1 or 2.	**A.1**	**Suspend start of any RCP.**	**Immediately**
	AND		
	A.~~1~~**2**	Be in MODE 3~~ with the reactor trip breakers open~~.	6 hours
	AND		
	A.3	**Initiate action to fully insert all rods.**	**6 hours**
	AND		
	A.4	**Place the Plant Control System in a condition incapable of rod withdrawal.**	**6 hours**
B. ----------NOTE---------- Required Actions ~~B.1~~ must be completed whenever Condition B is entered. ---------- Requirements of LCO not met in MODE 3, 4, or 5.	B.1	~~Open reactor trip breakers~~**Suspend start of any RCP**.	~~1 hour~~**Immediately**
	AND		
	B.2	**Initiate action to fully insert all rods.**	**1 hour**
	AND		
	B.3	**Place the Plant Control System in a condition incapable of rod withdrawal.**	**1 hour**

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.4.1	Verify each RCS loop is in operation with variable speed control bypassed.	12 hours

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.4 RCS Loops

BASES

BACKGROUND

The primary function of the RCS is removal of the heat generated in the fuel due to the fission process, and transfer of this heat, via the steam generators (SGs) to the secondary plant.

The secondary functions of the RCS include:

a. Moderating the neutron energy level to the thermal state, to increase the probability of fission;

b. Improving the neutron economy by acting as a reflector;

c. Carrying the soluble neutron poison, boric acid;

d. Providing a second barrier against fission-product release to the environment; and

e. Removal of the heat generated in the fuel due to fission-product decay following a unit shutdown.

The reactor coolant is circulated through two loops connected in parallel to the reactor vessel, each containing a SG, two reactor coolant pumps (RCPs), and appropriate flow and temperature instrumentation for both control and protection. The reactor vessel contains the fuel. The SGs provide the heat sink to the isolated secondary coolant. The RCPs circulate the primary coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage. This forced circulation of the reactor coolant ensures mixing of the coolant for proper boration and chemistry control.

The RCPs must be started using the variable speed controller with the ~~reactor trip breakers open~~ **Plant Control System (PLS) incapable of rod withdrawal and all rods fully inserted**. The controller shall be bypassed prior to ~~closure of the reactor trip breakers~~ **making the PLS capable of rod withdrawal or withdrawing one or more rods**.

BASES

APPLICABLE SAFETY ANALYSES

MODES 1 and 2

Safety analyses contain various assumptions for the design bases accident initial conditions including RCS pressure, RCS temperature, reactor power level, core parameters, and safety system setpoints. The important aspect for this LCO is the reactor coolant forced flow rate, which is represented by the number of RCS loops and RCPs in service.

Both transient and steady state analyses have been performed to establish the effect of flow on the departure from nucleate boiling (DNB). The transient and accident analyses for the plant have been performed assuming two RCS loops are initially in operation. The majority of the plant safety analyses **is** ~~are~~ based on initial conditions at high core power or zero power. The accident analyses, where RCP operation is most important are the four pump coastdown, single pump locked rotor, single pump broken shaft or coastdown, and rod withdrawal events (Ref. 1).

Steady state DNB analysis has been performed for the two RCS loop operation. For two RCS loop operation, the steady state DNB analysis, which generates the pressure and temperature Safety Limit (SL) (i.e., the departure from nucleate boiling ratio (DNBR) limit) assumes a maximum power level of 100% RATED THERMAL POWER (RTP). This is the design overpower condition for two RCS loop operation. The value for the accident analysis setpoint of the nuclear overpower (high flux) trip is 118% and is based on an analysis assumption that bounds possible instrumentation errors. The DNBR limit defines a locus of pressure and temperature points **that results** ~~which result~~ in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

The plant is designed to operate with both RCS loops in operation to maintain DNBR above the SL, during all normal operations and anticipated transients. By ensuring heat transfer in the nucleate boiling region, adequate heat transfer is provided between the fuel cladding and the reactor coolant.

MODES 3, 4, and 5

Whenever the ~~reactor trip breakers are in the closed position and the control rod drive mechanisms (CRDMs) are energized~~ **PLS is capable of rod withdrawal or one or more rods are not fully inserted**, there is the possibility of an inadvertent rod withdrawal from subcritical, resulting in a power excursion in the area of the withdrawn rod. Such a transient could be caused by a malfunction of the ~~Plant Control System (~~PLS~~)~~. In addition, the possibility of a power excursion due to the ejection of an

BASES

APPLICABLE SAFETY ANALYSES (continued)

inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM. The initial power rise is terminated by doppler broadening in the fuel pins, followed by rod insertion. During this event, if there is not adequate coolant flow along the clad surface of the fuel, there is a potential to exceed the departure from nucleate boiling ratio (DNBR) limit. Therefore, the required coolant flow is an initial condition of a design basis event that presents a challenge to the integrity of a fission product barrier.

Therefore, in MODE 3, 4 or 5 with the ~~RTBs in the closed position and the PLS capable of rod withdrawal~~ **PLS capable of rod withdrawal or one or more rods not fully inserted**, accidental control rod withdrawal from subcritical is postulated and requires the RCPs to be OPERABLE and in operation to ensure that the accident analysis limits are met.

In MODES 3, 4 and 5 with the ~~RTBs open~~ **PLS incapable of rod withdrawal and all rods fully inserted**, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. This is addressed in LCO 3.4.8, “Minimum RCS Flow.”

RCS Loops satisfy Criteria 2 and 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require an adequate forced flow rate for core heat removal. Flow is represented by the number of RCPs in operation for removal of heat by the SGs. To meet safety analysis acceptance criteria for DNB, four pumps are required in MODES 1 and 2. The requirement that at least four RCPs must be operating in MODES 3, 4, and 5 when the ~~RTBs are closed~~ **PLS is capable of rod withdrawal or one or more rods are not fully inserted** provides assurance that, in the event of a rod withdrawal accident, there will be adequate flow in the core to avoid exceeding the DNBR limit. Bypass of the RCP variable speed control ensures that the pumps are operating at full flow.

~~With the RTBs in the open position, the PLS is not capable of rod withdrawal; therefore only a minimum RCS flow of 3,000 gpm is necessary to ensure removal of decay heat from the core in accordance with LCO 3.4.8, Minimum RCS Flow.~~

BASES

LCO (continued)

~~Note 1 prohibits startup of a RCP when the reactor trip breakers are closed. This requirement prevents startup of a RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed.~~

Note 1~~2~~ prohibits startup of an RCP when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2~~3~~ requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 350°F, and the RCP must be started at ≤ 25% of RCP speed. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This limitation also helps to ensure that the RNS system pressure remains below both the piping design pressure and the acceptable RNS relief valve inlet pressure.

Note 3~~4~~ permits all RCP**s**~~S~~ to be ~~de-energized~~ **removed from operation** in MODE 3, 4, or 5 for ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are designed to validate various accident analysis values. One of these tests is for the validation of the pump coastdown curve, used as input to a number of accident analyses including a loss of flow accident.

This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve may need to be revalidated by conducting the test again.

Another test performed during the startup testing program is the validation of the rod drop times during cold conditions, both with and without flow.

The no-flow tests may be performed in MODE 3, 4, or 5, and require that the pumps be stopped for a short period of time. The Note permits **removing all RCPs from operation** ~~the de-energizing of the pumps~~ in order to perform this test and validate the assumed analysis values. As with the validation of the pump coastdown curve, this test should only be performed once, unless the flow characteristics of the RCS are changed.

BASES

LCO (continued)

The 1 hour time period specified is adequate to perform the desired tests and experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of the Note is permitted provided the following conditions are met along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, thereby maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation and

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause natural circulation flow obstruction.

An OPERABLE RCS loop is composed of two OPERABLE RCPs in operation providing forced flow for heat transport and an OPERABLE SG.

APPLICABILITY

In MODES 1 and 2, the reactor is critical and thus has the potential to produce maximum THERMAL POWER. Thus, to ensure that the assumptions of the accident analyses remain valid, both RCS loops are required to be OPERABLE and in operation in these MODES to prevent DNB and core damage.

In MODES 3, 4 and 5, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. For these purposes and because the ~~reactor trip breakers are closed~~ **PLS is capable of rod withdrawal or one or more rods are not fully inserted**, there is the possibility of an inadvertent rod withdrawal event. Four RCPs are required to be operating in MODES 3, 4 and 5, whenever the ~~reactor trip breakers are closed~~ **PLS is capable of rod withdrawal or one or more rods are not fully inserted**.

BASES

ACTIONS

Conditions A and B are modified by Notes which require completion of all Required Actions whenever the Condition is entered. This ensures that no attempt is made to restart a pump when all rods are not fully inserted, or when the PLS is capable of rod withdrawal, thus precluding events which are unanalyzed.

A.1**, A.2, A.3, and A.4**

If the requirements of the LCO are not met while in MODE 1 or 2, the Required Action**s are** ~~is~~ to **suspend the start of any RCP,** reduce power and bring the plant to MODE 3 ~~with the reactor trip breakers open~~, **initiate action to fully insert all rods, and place the PLS in a condition incapable of rod withdrawal**. **This prevents startup of a RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed and** ~~This~~ lowers power level**;** ~~and~~ thus reduc~~es~~**ing** the core heat removal needs and **minimizing** ~~minimizes~~ the possibility of violating DNB limits.

~~Condition A is modified by a Note which requires completion of Required Action A.1 whenever the Condition is entered. This ensures that no attempt is made to restart a pump with the reactor trip breakers closed, thus precluding events which are unanalyzed.~~

When all four reactor coolant pumps are operating, a loss of a single reactor coolant pump above power level P-10 will result in an automatic reactor trip.

The Completion Time of 6 hours is reasonable to allow for an orderly transition to MODE 3. The applicable safety analyses described above bound Design Basis Accidents (DBA) initiated with three reactor coolant pumps operating at power levels below P-10.

B.1**, B.2, and B.3**

If the requirements of the LCO are not met while in MODE 3, 4 or 5, the Required Action**s are** ~~is to remain in MODE 3, 4 or 5 and open the reactor trip breakers. This action~~ **to suspend the start of any RCP, initiate action to fully insert all rods, and place the PLS in a condition incapable of rod withdrawal. The actions prevent startup of a RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed and** eliminate~~s~~ the possibility

BASES

ACTIONS (continued)

of a rod withdrawal event with one or more pumps not operating and thus minimizing the possibility of violating DNB limits.

~~Condition B is modified by a Note which requires completion of Required Action B.1 whenever the Condition is entered. This ensures that no attempt is made to restart a pump with the reactor trip breakers closed, thus precluding events which are unanalyzed.~~

The Completion Time of 1 hour is reasonable to allow for ~~planned opening of the reactor trip breakers~~ **making PLS incapable of rod withdrawal and fully inserting all control rods**, since plant cool-down is not required.

SURVEILLANCE REQUIREMENTS

SR 3.4.4.1

This SR requires verification every 12 hours that each RCS loop is in operation with the pump variable speed control bypassed. Verification includes flow rate and temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal while maintaining the margin to DNB. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to monitor RCS loop performance.

REFERENCES

1. **FSAR** Chapter 15, “Accident **Analyses** ~~Analysis~~.”

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.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops

LCO 3.4.4 Two RCS loops shall be OPERABLE with four Reactor Coolant Pumps (RCPs) in operation with variable speed control bypassed.

----------NOTES----------

1. No RCP shall be started when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%.

2. No RCP shall be started with any RCS cold leg temperature ≤ 350°F unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures and the RCP is started at ≤ 25% of RCP speed.

3. All RCPs may be removed from operation in MODE 3, 4, or 5 for ≤ 1 hour per 8 hour period provided:

   a. No operations are permitted that would cause introduction into the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; and

   b. Core outlet temperature is maintained at least 10°F below saturation temperature.

APPLICABILITY: MODES 1 and 2,
MODES 3, 4, and 5 with Plant Control System capable of rod withdrawal or one or more rods not fully inserted.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. ----------NOTE---------- Required Actions must be completed whenever Condition A is entered. ---------- Requirements of LCO not met in MODE 1 or 2.	A.1	Suspend start of any RCP. AND	Immediately
	A.2	Be in MODE 3. AND	6 hours
	A.3	Initiate action to fully insert all rods. AND	6 hours
	A.4	Place the Plant Control System in a condition incapable of rod withdrawal.	6 hours
B. ----------NOTE---------- Required Actions must be completed whenever Condition B is entered. ---------- Requirements of LCO not met in MODE 3, 4, or 5.	B.1	Suspend start of any RCP. AND	Immediately
	B.2	Initiate action to fully insert all rods. AND	1 hour
	B.3	Place the Plant Control System in a condition incapable of rod withdrawal.	1 hour

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.4.1	Verify each RCS loop is in operation with variable speed control bypassed.	12 hours

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.4 RCS Loops

BASES

BACKGROUND

The primary function of the RCS is removal of the heat generated in the fuel due to the fission process, and transfer of this heat, via the steam generators (SGs) to the secondary plant.

The secondary functions of the RCS include:

a. Moderating the neutron energy level to the thermal state, to increase the probability of fission;

b. Improving the neutron economy by acting as a reflector;

c. Carrying the soluble neutron poison, boric acid;

d. Providing a second barrier against fission-product release to the environment; and

e. Removal of the heat generated in the fuel due to fission-product decay following a unit shutdown.

The reactor coolant is circulated through two loops connected in parallel to the reactor vessel, each containing a SG, two reactor coolant pumps (RCPs), and appropriate flow and temperature instrumentation for both control and protection. The reactor vessel contains the fuel. The SGs provide the heat sink to the isolated secondary coolant. The RCPs circulate the primary coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage. This forced circulation of the reactor coolant ensures mixing of the coolant for proper boration and chemistry control.

The RCPs must be started using the variable speed controller with the Plant Control System (PLS) incapable of rod withdrawal and all rods fully inserted. The controller shall be bypassed prior to making the PLS capable of rod withdrawal or withdrawing one or more rods.

BASES

APPLICABLE SAFETY ANALYSES

MODES 1 and 2

Safety analyses contain various assumptions for the design bases accident initial conditions including RCS pressure, RCS temperature, reactor power level, core parameters, and safety system setpoints. The important aspect for this LCO is the reactor coolant forced flow rate, which is represented by the number of RCS loops and RCPs in service.

Both transient and steady state analyses have been performed to establish the effect of flow on the departure from nucleate boiling (DNB). The transient and accident analyses for the plant have been performed assuming two RCS loops are initially in operation. The majority of the plant safety analyses is based on initial conditions at high core power or zero power. The accident analyses, where RCP operation is most important are the four pump coastdown, single pump locked rotor, single pump broken shaft or coastdown, and rod withdrawal events (Ref. 1).

Steady state DNB analysis has been performed for the two RCS loop operation. For two RCS loop operation, the steady state DNB analysis, which generates the pressure and temperature Safety Limit (SL) (i.e., the departure from nucleate boiling ratio (DNBR) limit) assumes a maximum power level of 100% RATED THERMAL POWER (RTP). This is the design overpower condition for two RCS loop operation. The value for the accident analysis setpoint of the nuclear overpower (high flux) trip is 118% and is based on an analysis assumption that bounds possible instrumentation errors. The DNBR limit defines a locus of pressure and temperature points that results in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

The plant is designed to operate with both RCS loops in operation to maintain DNBR above the SL, during all normal operations and anticipated transients. By ensuring heat transfer in the nucleate boiling region, adequate heat transfer is provided between the fuel cladding and the reactor coolant.

MODES 3, 4, and 5

Whenever the PLS is capable of rod withdrawal or one or more rods are not fully inserted, there is the possibility of an inadvertent rod withdrawal from subcritical, resulting in a power excursion in the area of the withdrawn rod. Such a transient could be caused by a malfunction of the PLS. In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The initial power rise is terminated by doppler broadening in the fuel pins, followed by rod insertion. During this event, if there is not adequate coolant flow along the clad surface of the fuel, there is a potential to exceed the departure from nucleate boiling ratio (DNBR) limit. Therefore, the required coolant flow is an initial condition of a design basis event that presents a challenge to the integrity of a fission product barrier.

Therefore, in MODE 3, 4 or 5 with the PLS capable of rod withdrawal or one or more rods not fully inserted, accidental control rod withdrawal from subcritical is postulated and requires the RCPs to be OPERABLE and in operation to ensure that the accident analysis limits are met.

In MODES 3, 4 and 5 with the PLS incapable of rod withdrawal and all rods fully inserted, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. This is addressed in LCO 3.4.8, “Minimum RCS Flow.”

RCS Loops satisfy Criteria 2 and 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require an adequate forced flow rate for core heat removal. Flow is represented by the number of RCPs in operation for removal of heat by the SGs. To meet safety analysis acceptance criteria for DNB, four pumps are required in MODES 1 and 2. The requirement that at least four RCPs must be operating in MODES 3, 4, and 5 when the PLS is capable of rod withdrawal or one or more rods are not fully inserted provides assurance that, in the event of a rod withdrawal accident, there will be adequate flow in the core to avoid exceeding the DNBR limit. Bypass of the RCP variable speed control ensures that the pumps are operating at full flow.

Note 1 prohibits startup of an RCP when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 350°F, and the RCP must be started at ≤ 25% of RCP speed. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This limitation also helps to ensure that the RNS system

LCO (continued)

pressure remains below both the piping design pressure and the acceptable RNS relief valve inlet pressure.

Note 3 permits all RCPs to be removed from operation in MODE 3, 4, or 5 for ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are designed to validate various accident analysis values. One of these tests is for the validation of the pump coastdown curve, used as input to a number of accident analyses including a loss of flow accident.

This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve may need to be revalidated by conducting the test again.

Another test performed during the startup testing program is the validation of the rod drop times during cold conditions, both with and without flow.

The no-flow tests may be performed in MODE 3, 4, or 5, and require that the pumps be stopped for a short period of time. The Note permits removing all RCPs from operation in order to perform this test and validate the assumed analysis values. As with the validation of the pump coastdown curve, this test should only be performed once, unless the flow characteristics of the RCS are changed. The 1 hour time period specified is adequate to perform the desired tests and experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of the Note is permitted provided the following conditions are met along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, thereby maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation and

LCO (continued)

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause natural circulation flow obstruction.

An OPERABLE RCS loop is composed of two OPERABLE RCPs in operation providing forced flow for heat transport and an OPERABLE SG.

APPLICABILITY

In MODES 1 and 2, the reactor is critical and thus has the potential to produce maximum THERMAL POWER. Thus, to ensure that the assumptions of the accident analyses remain valid, both RCS loops are required to be OPERABLE and in operation in these MODES to prevent DNB and core damage.

In MODES 3, 4 and 5, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. For these purposes and because the PLS is capable of rod withdrawal or one or more rods are not fully inserted, there is the possibility of an inadvertent rod withdrawal event. Four RCPs are required to be operating in MODES 3, 4 and 5, whenever the PLS is capable of rod withdrawal or one or more rods are not fully inserted.

ACTIONS

Conditions A and B are modified by Notes which require completion of all Required Actions whenever the Condition is entered. This ensures that no attempt is made to restart a pump when all rods are not fully inserted, or when the PLS is capable of rod withdrawal, thus precluding events which are unanalyzed.

A.1, A.2, A.3, and A.4

If the requirements of the LCO are not met while in MODE 1 or 2, the Required Actions are to suspend the start of any RCP, reduce power and bring the plant to MODE 3 , initiate action to fully insert all rods, and place the PLS in a condition incapable of rod withdrawal. This prevents startup of a RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed and lowers power level; thus reducing the core heat removal needs and minimizing the possibility of violating DNB limits.

BASES

ACTIONS (continued)

When all four reactor coolant pumps are operating, a loss of a single reactor coolant pump above power level P-10 will result in an automatic reactor trip.

The Completion Time of 6 hours is reasonable to allow for an orderly transition to MODE 3. The applicable safety analyses described above bound Design Basis Accidents (DBA) initiated with three reactor coolant pumps operating at power levels below P-10.

B.1, B.2, and B.3

If the requirements of the LCO are not met while in MODE 3, 4 or 5, the Required Actions are to suspend the start of any RCP, initiate action to fully insert all rods, and place the PLS in a condition incapable of rod withdrawal. The actions prevent startup of a RCP and the resulting circulation of cold and/or unborated water from an inactive loop into the core, precluding reactivity excursion events which are unanalyzed and eliminate the possibility of a rod withdrawal event with one or more pumps not operating and thus minimizing the possibility of violating DNB limits.

The Completion Time of 1 hour is reasonable to allow for making PLS incapable of rod withdrawal and fully inserting all control rods, since plant cool-down is not required.

SURVEILLANCE REQUIREMENTS

SR 3.4.4.1

This SR requires verification every 12 hours that each RCS loop is in operation with the pump variable speed control bypassed. Verification includes flow rate and temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal while maintaining the margin to DNB. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to monitor RCS loop performance.

REFERENCES

1. FSAR Chapter 15, “Accident Analyses.”