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

Title: Revision of AP1000 GTS Subsection 3.9.3, Nuclear 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-471-A, Rev. 1: Eliminate use of term CORE ALTERATIONS in ACTIONS and Notes

STS NUREGs Affected:

TSTF-471-A, Rev. 1: NUREG-1430, -1431, -1432

NRC Approval Date:

TSTF-471-A, Rev. 1: 07-Dec-06

TSTF Classification:

TSTF-471-A, Rev. 1: 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:

None

RCOL COL Item Number and Title:

Not Applicable

RCOL PTS Change Number and Title:

The Vogtle Electric Generating Plant Units 3 and 4 License Amendment Request (VEGP 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 Less Restrictive Changes (L) and are addressed in enumerated discussions of change (DOCs). These changes are discussed in Sections VI and VII of this GTST.

DOC L03: Modify Required Action A.1

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(1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

Based on TSTF 471-A, Rev. 1, this GTST removes the term “CORE ALTERATIONS” and makes corresponding adjustments to the text in each section of AP1000 LCO and Bases GTS 3.9.3: Nuclear Instrumentation. In most cases, this change consists of removing the words “CORE ALTERATIONS” and leaving or inserting the phrase “positive reactivity additions.”

The effects of these changes are visible in NUREG-1431, Rev. 4.

Similar to TSTF 471-A, Rev. 1, DOC L03 modifies Required Action A.1 by replacing “CORE ALTERATIONS” with “positive reactivity additions.”

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)

Renumber the references in the order they appear in the text (e.g. in “Applicable Safety Analyses). Update the order of the list of references in Bases accordingly.

Modify the phrase “consisting of” to “consists of” in the text for SR 3.9.3.2.

APOG Recommended Changes to Improve Bases 3.9.3

Replace, in the Background of Bases, the term “neutron flux (1x10+6 cps)” with “neutron flux (1 cps to 1E6 cps)” for clarity. (APOG #491 and SPSB)

Replace the phrase “The Completion Time of 4 hours” to “The Completion Time of 12 hours” in the second paragraph of B.2 Actions. (APOG #492)

Modify the text in the second paragraph of B.2 Actions by replacing “The Completion Time of 12 hours is sufficient” with “The Completion Time of 12 hours for the initial verification that reactor coolant boron concentration is within limit is sufficient.” (SPSB C1 for APOG #492)

Modify the third sentence of “Applicability” section of Bases by replacing the text

> “In MODES 2, 3, 4, and 5, the source range detectors and associated circuitry are also required to be OPERABLE by LCO 3.3.1, “Reactor Trip System Instrumentation”

with

> “In MODES 2, 3, 4, and 5, the source range neutron flux detectors and associated circuitry are also required to be OPERABLE by LCO 3.3.2, “Reactor Trip System (RTS) Source Range Instrumentation,” and LCO 3.3.8, “Engineered Safety Feature Actuation System (ESFAS) Instrumentation,” Function 17, “Source Range Neutron Flux Doubling.” (SPSB C1 for APOG #492)

Revise the last sentence in “SR 3.9.3.2” Surveillance Requirements from:

> Operating experience has shown these components usually pass the Surveillance when performed during the refueling outage.

to:

> Operating experience has shown these components usually pass the Surveillance when performed at a 24 month Frequency. (APOG #493)

Revise references 1 and 2 in Bases by replacing the phrase “Chapter 15” by “FSAR Chapter 15” in Ref. 1 and “Section 14.2.6.1” to “FSAR Section 14.2.7.1” in Ref. 2. (APOG #494 and #3)

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.9.3, Nuclear Instrumentation

Changes to the Generic Technical Specifications and Bases:

Remove the term “CORE ALTERATIONS” and make corresponding adjustments to the text in each section. (STST-471-A, Rev. 1 and DOC L03)

Replace, in the second paragraph of Bases - Background, the term “neutron flux (1x10+6 cps)” with “neutron flux (1 cps to 1E6 cps)” for clarity. (APOG #491 and SPSB)

Renumber the references in the order they appear in the text in “Applicable Safety Analyses.”

Update the list of references in Bases accordingly.

Modify the third sentence of “Applicability” section of Bases. (SPSB C1 for APOG #492)

Insert new text in the Bases for Actions section A.1 and A.2. (DOC L03)

Modify the text in B.2 Actions for clarification. (SPSB C1 for APOG #492)

Replace the phrase “The Completion Time of 4 hours” to “The Completion Time of 12 hours” in the second paragraph of B.2 Actions. (APOG #492)

Change the phrase “consisting of” to “consists of” in the text for “SR 3.9.3.2.”

Revise the last sentence in the Bases for “SR 3.9.3.2” Surveillance Requirements. (APOG #493)

Revise references 1 and 2 in Bases. (APOG #494 and #3)

VI. Traveler Information

Description of TSTF changes:

According to TSTF-471-A, Rev. 1, in the ACTIONS Section of LCO 3.9.3, Required Action A.1, "Suspend CORE ALTERATIONS" is revised to read "Suspend positive reactivity additions."

In the Bases Section B 3.9.3: Nuclear Instrumentation, in the ACTIONS section A.1 an A.2, the second sentence is modified to remove the words "CORE ALTERATIONS." Thus the sentence:

> "Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions must be suspended immediately. "

is changed to read as follows:

> "Since these instruments are the only direct means of monitoring core reactivity conditions, positive reactivity additions must be suspended immediately. "

Similarly, in Bases ACTIONS section B.2, the second sentence is modified to remove the words "CORE ALTERATIONS and."

Rationale for TSTF changes:

TSTF-51-A, Rev. 2 eliminated all uses of the defined term "CORE ALTERATIONS" from Applicability statements in the PWR NUREGs and most uses of "CORE ALTERATIONS" in Required Actions. TSTF-471-A, Rev. 1 eliminates the few remaining instances of the defined term "CORE ALTERATIONS" from the PWR IRS NUREGs. This GTST continues the removal of the defined term "CORE ALTERATIONS" from the AP1000 Technical Specifications.

This includes the removal of the defined term "CORE ALTERATIONS" from the list of definitions found in GTS 1.1.

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

DOC L03:

Similar to TSTF-471-A, Rev. 1, DOC L03 modifies Required Action A.1 in LCO 3.9.3 by replacing "CORE ALTERATIONS" with "positive reactivity additions."

Also DOC L03 deletes the words "CORE ALTERATIONS and" from the Bases in the Actions sections A.1, A.2, and in B.2.

Furthermore, DOC L03 introduced new text in the Bases for Actions section A.1 and A.2. The paragraph is modified from:

> "Redundancy has been lost if only one source range neutron flux monitor is OPERABLE. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions must be suspended

immediately. Performance of Required Action A.1 shall not preclude completion of actions to establish a safe condition."

to:

"Redundancy has been lost if only one source range neutron flux monitor is OPERABLE. Since these instruments are the only direct means of monitoring core reactivity conditions, ~~CORE ALTERATIONS and~~ positive reactivity additions and introduction of coolant into the RCS with boron concentration less than required to meet the minimum boron concentration of LCO 3.9.1 must be suspended immediately. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Performance of Required Action A.1 shall not preclude completion of actions to establish a safe condition."

where the deleted text is crossed out and the inserted text is underlined.

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

According to DOC L03 for the modification of Required Action A.1 in LCO 3.9.3, "if a required source range neutron flux monitor is inoperable, current actions require that core alterations must be suspended and suspension of operations that would cause introduction into the RCS of coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1." Also according to VEGP TSU, "an inoperable source range detector has no effect on the initiation or mitigation of a fuel handling accident. Suspending introduction of RCS coolant at less than the required boron concentration prevents a boron dilution incident. Required Action A.1 is revised to preclude positive reactivity additions, which adequately precludes potential unexpected positive reactivity changes. Suspension of all other core alterations in this circumstance is not required to meet analyses in the safety analysis report and that Required Action is removed."

The inserted text in the Bases for Actions section A.1 and A.2 is acceptable because it clarifies and explains the text used for the Required Action A.1 and A.2 in LCO 3.9.3 and the inserted text does not result in technical changes to the Technical Specifications.

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

Renumber the references in the order they appear in the text (in "Applicable Safety Analyses"). Update the order of the list of references in Bases accordingly.

Change the phrase "consisting of" to "consists of" in the text for "SR 3.9.3.2."

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

The changes are editorial and are made for clarity and consistency.

VII. GTST Safety Evaluation

Technical Analysis:

In the WOG and BWOG NUREGs CORE ALTERATION is defined as the movement of any fuel, sources, or reactivity control components, within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.

Evaluations performed for TSTF-471-A, Rev. 1 indicate that CORE ALTERATIONS can only occur in Mode 6 when the reactor vessel head is removed. The only accidents considered for Mode 6 for PWR reactors is a fuel handling accident and a boron dilution accident. If all Required Actions that require suspension of CORE ALTERATIONS also require suspension of movement of {recently] irradiated fuel, suspension of CORE ALTERATIONS provides no safety benefit.

The removal of the term CORE ALTERATIONS is usually replaced by or leaves remaining, the term “positive reactivity additions.” A review of circumstances related to fuel handling accidents and boron dilution accidents concludes that the action to suspend CORE ALTERATIONS provides no benefit, and is not needed. Hence a finding of “no significant hazards consideration” is justified.

TSTF-51-A, Rev. 2 eliminated all uses of the defined term CORE ALTERATIONS from Applicability statements in the PWR NUREGs and most uses of CORE ALTERATIONS in Required Actions.

Thus the term CORE ALTERATIONS can be removed from the definitions of Chapter 1 and removed from usage in all other places in the Technical Specifications of NUREG-1431 and AP1000 GTS.

Technical discussion for the changes proposed by DOC L03 is covered in the previous section VI of this GTST under “Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes.”

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 3.9.3 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 5/21/2014.

APOG Comments (Ref. 8) and Resolutions:

1. (Internal #491) 3.9.3, Background: APOG recommended replacing the term “neutron flux (1x10+6 cps)” with “neutron flux (1 to 1x10+6 cps)” for improved clarity. SPSB (C1) suggested additional edits based on Writer’s Guide paragraphs 3.3.3.d and 3.3.4.c, where the text is replaced by “neutron flux (1 cps to 1E6 cps)” for clarity. This item is resolved by replacing the text as recommended by APOG and SPSB.

2. (Internal #492) 3.9.3, B.2 Actions: APOG requested replacing the phrase “The Completion Time of 4 hours” by “The Completion Time of 12 hours” in the second paragraph of B.2 Actions. SPSB suggested a correction in the Applicability” section of Bases and suggested also more clarification for the Required Action B2 Completion Time. This item is resolved by modifying the text in the Applicability” section and in B.2 Actions of Bases as recommended by APOG and SPSB.

3. (Internal #493) 3.9.3, SR 3.9.3.2: APOG requested modifying the text of the last sentence of “SR 3.9.3.2” Surveillance Requirements. APOG comments that the changes are made for consistency with the TS requirement(s) being discussed in the TS Bases. This change is made as recommended to improve the Bases.

4. (Internal # 494 and # 3) APOG requested changing Reference 2 from “14.2.6.1” to “14.2.7.1” as DCD/FSAR Section 14.2.7.1 discusses Initial Fuel Loading. Also the phrase “Chapter 15” is revised to “FSAR Chapter 15” in Ref. 1 and “Section 14.2.6.1” is revised to “FSAR Section 14.2.7.1” in Ref. 2. 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 (APOG #3) to include the “FSAR” modifier. This is resolved by adding the FSAR modifier as appropriate.

NRC Final Approval Date: 12/14/2015

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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. Vogtle Electric Generating Plant (VEGP), Units 3 &4 COL Application, Part 4, Technical Specifications, Revision 3 (ML11180A102, 07/01/2011).

3. Vogtle Electric Generating Plant (VEGP) Units 3 and 4 - Final Safety Evaluation Report (ML110450302, 08/10/2011)

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

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 07, 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. 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)

8. 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 (ML 14265A493).

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.

3.9 REFUELING OPERATIONS

3.9.3 Nuclear Instrumentation

LCO 3.9.3 Two source range neutron flux monitors shall be OPERABLE.

APPLICABILITY: MODE 6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required source range neutron flux monitor inoperable.	A.1 Suspend ~~CORE ALTERATIONS~~**positive reactivity additions**. AND A.2 Suspend operations that would cause introduction into the Reactor Coolant System (RCS), coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1.	Immediately Immediately
B. Two required source range neutron flux monitors inoperable.	B.1 Initiate action to restore one source range neutron flux monitor to OPERABLE status. AND B.2 Perform SR 3.9.1.1.	Immediately Once per 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.3.1	Perform a CHANNEL CHECK.	12 hours
SR 3.9.3.2	----------NOTE---------- Neutron detectors are excluded from CHANNEL CALIBRATION. ---------- Perform CHANNEL CALIBRATION.	 24 months

B 3.9 REFUELING OPERATIONS

B 3.9.3 Nuclear Instrumentation

BASES

BACKGROUND

The source range neutron flux monitors are used to monitor the core reactivity during refueling operations. The source range neutron flux monitors are part of the Protection and Safety Monitoring System (PMS). These detectors are located external to the reactor vessel and detect neutrons leaking from the core.

The source range neutron flux monitors are BF3 detectors operating in the proportional region of the gas filled detector characteristic curve. The detectors monitor the neutron flux in counts per second. The instrument range covers six decades of neutron flux (~~1x10+6 cps~~**1 cps to 1E6 cps**) with a 5% instrument accuracy. The detectors also provide continuous visual and audible indication in the main control room and an audible alarm in the main control room and containment building.

APPLICABLE SAFETY ANALYSES

Two OPERABLE source range neutron flux monitors are required to provide a signal to alert the operator to unexpected changes in core reactivity such as those associated with an improperly loaded fuel assembly. During initial fuel loading, or when otherwise required, temporary neutron detectors may be used to provide additional reactivity monitoring (Ref. ~~2~~**1**). The potential for an uncontrolled boron dilution accident is eliminated by isolating all unborated water sources as required by LCO 3.9.2 (Ref. ~~1~~**2**).

The source range neutron flux monitors satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires two source range neutron flux monitors to be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity.

APPLICABILITY

In MODE 6, the source range neutron flux monitors are required to be OPERABLE to determine possible changes in core reactivity. There are no other direct means available to monitor the core reactivity conditions. In MODES 2, 3, 4, and 5, the source range **neutron flux** detectors and associated circuitry are also required to be OPERABLE by LCO ~~3.3.1, "Reactor Trip System Instrumentation."~~ **3.3.2, "Reactor Trip System**

BASES

APPLICABILITY (continued)

(RTS) Source Range Instrumentation," and LCO 3.3.8, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," Function 17, "Source Range Neutron Flux Doubling."

ACTIONS

A.1 and A.2

Redundancy has been lost if only one source range neutron flux monitor is OPERABLE. Since these instruments are the only direct means of monitoring core reactivity conditions, ~~CORE ALTERATIONS and~~ positive reactivity additions **and introduction of coolant into the RCS with boron concentration less than required to meet the minimum boron concentration of LCO 3.9.1** must be suspended immediately. **Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation.** Performance of Required Action A.1 shall not preclude completion of actions to establish a safe condition.

B.1

If no source range neutron flux monitors are OPERABLE, actions to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, actions shall be continued until a source range neutron flux monitor is restored to OPERABLE status.

B.2

If no source range neutron flux monitors are OPERABLE, there is no direct means of detecting changes in core reactivity. However, since ~~CORE ALTERATIONS and~~ positive reactivity additions are discontinued, the core reactivity condition is stabilized and no changes are permitted until the source range neutron flux monitors are restored to OPERABLE status. This stable condition is confirmed by performing SR 3.9.1.1 to verify that the required boron concentration exists.

BASES

ACTIONS (continued)

The Completion Time of ~~4~~**12** hours **for the initial verification that reactor coolant boron concentration is within limit** is sufficient to obtain and analyze a reactor coolant sample for boron concentration. The Frequency of once per 12 hours ensures that unplanned changes in boron concentration would be identified. The 12 hour Frequency is reasonable considering the low probability of a change in core reactivity during this time period.

SURVEILLANCE REQUIREMENTS

SR 3.9.3.1

SR 3.9.3.1 is the performance of a CHANNEL CHECK, which is the comparison of the indicated parameter values monitored by each of these instruments. It is based on the assumption that the two indication channels should be consistent for the existing core conditions. Changes in core geometry due to fuel loading can result in significant differences between the source range channels, however each channel should be consistent with its local conditions.

The Frequency of 12 hours is consistent with the CHANNEL CHECK Frequency specified for these same instruments in LCO 3.3.1, “Reactor Trip System Instrumentation.”

SR 3.9.3.2

SR 3.9.3.2 is the performance of a CHANNEL CALIBRATION every 24 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the source range neutron flux monitors consist**s**~~ing~~ of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer’s data. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed ~~during the refueling outage~~ **at a 24 month Frequency**.

BASES

REFERENCES

1. ~~Chapter 15, "Accident Analysis."~~ **FSAR Section 14.2.7.1, "Initial Fuel Loading."**

2. **FSAR Chapter 15, "Accident Analyses."** ~~Section 14.2.7.1, "Initial Fuel Loading."~~

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.

3.9 REFUELING OPERATIONS

3.9.3 Nuclear Instrumentation

LCO 3.9.3 Two source range neutron flux monitors shall be OPERABLE.

APPLICABILITY: MODE 6

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required source range neutron flux monitor inoperable.	A.1	Suspend positive reactivity additions.	Immediately
	AND		
	A.2	Suspend operations that would cause introduction into the Reactor Coolant System (RCS), coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1.	Immediately
B. Two required source range neutron flux monitors inoperable.	B.1	Initiate action to restore one source range neutron flux monitor to OPERABLE status.	Immediately
	AND		
	B.2	Perform SR 3.9.1.1.	Once per 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.3.1	Perform a CHANNEL CHECK.	12 hours
SR 3.9.3.2	----------NOTE---------- Neutron detectors are excluded from CHANNEL CALIBRATION. ----------	
	Perform CHANNEL CALIBRATION.	24 months

B 3.9 REFUELING OPERATIONS

B 3.9.3 Nuclear Instrumentation

BASES

BACKGROUND

The source range neutron flux monitors are used to monitor the core reactivity during refueling operations. The source range neutron flux monitors are part of the Protection and Safety Monitoring System (PMS). These detectors are located external to the reactor vessel and detect neutrons leaking from the core.

The source range neutron flux monitors are BF3 detectors operating in the proportional region of the gas filled detector characteristic curve. The detectors monitor the neutron flux in counts per second. The instrument range covers six decades of neutron flux (1 cps to 1E6 cps) with a 5% instrument accuracy. The detectors also provide continuous visual and audible indication in the main control room and an audible alarm in the main control room and containment building.

APPLICABLE SAFETY ANALYSES

Two OPERABLE source range neutron flux monitors are required to provide a signal to alert the operator to unexpected changes in core reactivity such as those associated with an improperly loaded fuel assembly. During initial fuel loading, or when otherwise required, temporary neutron detectors may be used to provide additional reactivity monitoring (Ref. 1). The potential for an uncontrolled boron dilution accident is eliminated by isolating all unborated water sources as required by LCO 3.9.2 (Ref. 2).

The source range neutron flux monitors satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires two source range neutron flux monitors to be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity.

APPLICABILITY

In MODE 6, the source range neutron flux monitors are required to be OPERABLE to determine possible changes in core reactivity. There are no other direct means available to monitor the core reactivity conditions. In MODES 2, 3, 4, and 5, the source range neutron flux detectors and associated circuitry are also required to be OPERABLE by LCO 3.3.2, “Reactor Trip System (RTS) Source Range Instrumentation,” and

BASES

APPLICABILITY (continued)

LCO 3.3.8, “Engineered Safety Feature Actuation System (ESFAS) Instrumentation,” Function 17, “Source Range Neutron Flux Doubling.”

ACTIONS

A.1 and A.2

Redundancy has been lost if only one source range neutron flux monitor is OPERABLE. Since these instruments are the only direct means of monitoring core reactivity conditions, positive reactivity additions and introduction of coolant into the RCS with boron concentration less than required to meet the minimum boron concentration of LCO 3.9.1 must be suspended immediately. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Performance of Required Action A.1 shall not preclude completion of actions to establish a safe condition.

B.1

If no source range neutron flux monitors are OPERABLE, actions to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, actions shall be continued until a source range neutron flux monitor is restored to OPERABLE status.

B.2

If no source range neutron flux monitors are OPERABLE, there is no direct means of detecting changes in core reactivity. However, since positive reactivity additions are discontinued, the core reactivity condition is stabilized and no changes are permitted until the source range neutron flux monitors are restored to OPERABLE status. This stable condition is confirmed by performing SR 3.9.1.1 to verify that the required boron concentration exists.

The Completion Time of 12 hours for the initial verification that reactor coolant boron concentration is within limit is sufficient to obtain and analyze a reactor coolant sample for boron concentration. The Frequency of once per 12 hours ensures that unplanned changes in

BASES

ACTIONS (continued)

boron concentration would be identified. The 12 hour Frequency is reasonable considering the low probability of a change in core reactivity during this time period.

SURVEILLANCE REQUIREMENTS

SR 3.9.3.1

SR 3.9.3.1 is the performance of a CHANNEL CHECK, which is the comparison of the indicated parameter values monitored by each of these instruments. It is based on the assumption that the two indication channels should be consistent for the existing core conditions. Changes in core geometry due to fuel loading can result in significant differences between the source range channels, however each channel should be consistent with its local conditions.

The Frequency of 12 hours is consistent with the CHANNEL CHECK Frequency specified for these same instruments in LCO 3.3.1, “Reactor Trip System Instrumentation.”

SR 3.9.3.2

SR 3.9.3.2 is the performance of a CHANNEL CALIBRATION every 24 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the source range neutron flux monitors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer’s data. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at a 24 month Frequency.

REFERENCES

1. FSAR Section 14.2.7.1, “Initial Fuel Loading.”

2. FSAR Chapter 15, “Accident Analyses.”