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

Title: Changes to Section 3.8.4, Inverters - Shutdown

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-425, Rev. 3, Relocate Surveillance Frequencies to Licensee Control - RITSTF Initiative 5b
TSTF-471-A, Rev. 1, Eliminate Use of term CORE ALTERATIONS in ACTIONS and Notes

STS NUREGs Affected:

TSTF-425, Rev. 3: NUREG-1430, -1431, -1432, -1433, -1434
TSTF-471-A, Rev. 1: NUREG-1430, -1431

NRC Approval Date:

TSTF-425, Rev. 3: 18-Mar-2009
TSTF-471-A, Rev. 1: 07-Dec-2006

TSTF Classification:

TSTF-425, Rev. 3: Technical Change
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:

None

RCOL PTS Change Number and Title:

VEGP LAR DOC L03:	TS are revised to eliminate the use of the defined term “CORE ALTERATIONS” and incorporates changes reflected in TST-471-A.

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(1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

RCOL PTS Change VEGP LAR DOC L03 and TSTF-471-A changes are same. Following incorporation of TSTF-471-A changes, no additional change was needed for PTS Change VEGP LAR DOC L03.

TSTF-51-A, requiring addition of “recently” before “irradiated fuel assemblies” is deferred for future consideration.

TSTF-425 is deferred for future consideration.

Rev. 0 version of this GTST included a number of changes replacing “bus[es]” with “electric power distribution system(s)” or “division.” Based on APOG comments, it is recognized that the use of the term is appropriate in many locations and previous changes were withdrawn/corrected. However, some additional editorial changes are included, as presented in Section VI of this GTST, under heading “Description of additional changes proposed by NRC staff/preparer of GTST.” The changes also ensure use of “electrical power system, as opposed to “electric power system.”

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)

Clarification of nomenclature used for Class 1E electric power distribution subsystems, consistent with VEGP LAR DOC A112.

Editorial changes are made in the “Applicable Safety Analyses,” “LCO,” and “Actions” sections of the Bases.

In the “References” section of the Bases, “Accident Analysis” was changed to “Accident Analyses” in Reference 2.

APOG Recommended Changes to Improve the Bases

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)

In the first sentence of the third paragraph of the “Applicable Safety Analyses” section of the Bases, changes are made to be consistent with the TS requirement being discussed.

In the fourth sentence of the first paragraph in “Actions” section of the Bases, under “A.1, A.2.1, A.2.2, A.2.3, and A.2.4,” the word “suspend” is added before “movement of irradiated fuel assemblies,...” to be consistent with the TS requirement.

In “Surveillance Requirements” section of the Bases, under the heading “SR 3.8.4.1,” the phrase “the effectiveness of the voltage and frequency instruments” was deleted.

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.8.4, Inverters – Shutdown

Changes to the Generic Technical Specifications and Bases:

TS 3.8.4, “Inverters - Shutdown”, Required Action A.2.1 is deleted, resulting in the renumbering of the subsequent Required Actions. (TSTF-471)

In the ACTIONS Section of the Bases, “CORE ALTERATIONS” is deleted from discussions. (DOC L03)

In the “Applicable Safety Analyses” section of the Bases, the phrase “and during movement of irradiated fuel assemblies,” is added after “...during MODES 5 and 6” in the first sentence of the third paragraph. (APOG Comment)

In the “Actions” section of the Bases, under “A.1, A.2.1, A.2.2, A.2.3, and A.2.4,” “(i.e., movement of irradiated fuel assemblies,” was revised to “(i.e., suspend movement of fuel assemblies,” (APOG Comment)

The Bases for “Surveillance Requirements” was revised deleting the phrase “the effectiveness of the voltage and frequency instruments.” (APOG Comment)

Editorial changes are made in the “Applicable Safety Analyses,” “LCO,” and “Actions” sections of the Bases. (NRC staff comments)

VI. Traveler Information

Description of TSTF changes:

TSTF-471

TSTF-471 proposes elimination of the defined term CORE ALTERATIONS and all uses of the term for the Specifications and Bases. For AP1000 TS 3.8.4, this implies deletion of Required Action A.2.1, Suspend CORE ALTERATIONS, and removing corresponding discussions in the Bases.

Rationale for TSTF changes:

TSTF-471

The rationale for removing CORE ALTERATIONS from Specifications and Bases is as follows:

CORE ALTERATIONS only occur when the reactor vessel head is removed, i.e. it only applies in MODE 6. There are only two accidents considered during MODE 6 for PWRs: a fuel handling accident and a boron dilution accident. According to the Standard Review Plan, a fuel handling accident is initiated by the dropping of an irradiated fuel assembly, either in the containment or in the fuel building. There are no mitigation actions, except some plants credit ventilation systems to reduce the dose consequences. Suspension of CORE ALTERATIONS, except for suspension of movement of irradiated fuel, will not prevent or impair the mitigation of a fuel handling accident.

The second analyzed event is a boron dilution accident. A boron dilution accident is initiated by a dilution source which results in the boron concentration dropping below that required to maintain the SHUTDOWN MARGIN. As described in the Bases of Specification 3.9.1, “Boron Concentration,” (which applies in MODE 6), “The refueling boron concentration limit is specified in the COLR. Unit procedures ensure the specified boron concentration in order to maintain an overall core reactivity of $k_{eff} \leq 0.95$ during fuel handling, with control element assemblies (CEAs) and fuel assemblies assumed to be in the most adverse configuration (least negative reactivity) allowed by unit procedures.” The accident is mitigated by stopping the dilution. Suspension of CORE ALTERATIONS has no effect on the mitigation of a boron dilution accident. Movement of control rods or fuel do not affect the initial conditions of a boron dilution accident as it is assumed that the control rods and fuel are in the most adverse conditions with a large safety margin ($k_{eff} \leq 0.95$). To address the possibility of a misloaded fuel assembly, Technical Specification 3.9.3, Required Action A.1 is revised to require suspending positive reactivity additions if one of the two required source range neutron flux nuclear instrumentation monitors is inoperable. This precludes movement of fuel assemblies which could add reactivity to the core.

In summary, with the exception of suspending movement of irradiated fuel assemblies, there are no DBAs or transients that are initiated by, or mitigation affected by, suspension of CORE ALTERATIONS. Therefore, if 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.

In TS 3.8.5 of NUREG-1431, when a one or more required DC electrical power subsystem is inoperable, the Required Actions require:

- Suspension of CORE ALTERATIONS
- Suspension of movement of irradiated fuel assemblies, and
- Suspension of operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.

As discussed above, because the Required Actions require the suspension of movement of irradiated fuel assemblies, the initiating conditions for a fuel handling accident are prohibited. Because the Required Actions require the suspension of positive reactivity additions that could result in a loss of SDM, the initial conditions for a boron dilution accident are prevented. Therefore, the action to suspend CORE ALTERATIONS provides no safety benefit and is not needed.
There are several benefits to eliminating the ACTIONS which reference CORE ALTERATIONS.

The term CORE ALTERATIONS unnecessarily complicates plant operation. Plants go to great lengths to ensure that no prohibited CORE ALTERATIONS take place, such as pausing the lift of the reactor vessel head and having individuals lay on the floor or use video cameras to look under the head to ensure that no control rod drive mechanisms are still latched to avoid accidentally lifting a control rod and violating a Required Action which prohibits CORE ALTERATIONS. These actions have no safety benefit as the boron concentration limit ensures adequate SDM even with the worst configuration of control rods. These actions result in increased personnel dose and provide no safety benefit.

There are a large number of reportable events regarding CORE ALTERATIONS. A review of Licensee Event Reports over approximately ten years revealed 12 LERs related to failure to suspend CORE ALTERATIONS. As described above, these actions have no effect on plant safety and distract the plant and the NRC from more safety significant issues.

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

VEGP LAR DOC L03:

VEGP LAR DOC L03 eliminates the use of the defined term “CORE ALTERATION.” For TS 3.8.4, it implies:

- Required Action A.2.1 is deleted, resulting in the renumbering of the subsequent Required Actions
- Removal of “CORE ALTERATIONS” from the discussion in ACTIONS Section of the Bases.

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

Please refer to VEGP Units 3 and 4, Technical Specification Upgrade LAR Enclosure 1, DOC L03 for the Technical Evaluation in support of the change. The Technical Evaluation is consistent with the Technical Evaluation in TSTF-471-A.

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

The changes addressed in different Bases sections, based on APOG comments and NRC staff proposed changes, are as follows:

The first paragraph of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> The initial conditions of Design Basis Accident (DBA) and transient analyses in **FSAR** Chapter 6 (Ref. 1) and **FSAR** Chapter 15 (Ref. 2), assume engineered safety features **(ESF)** are OPERABLE. The ~~DC to AC~~ inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Protection and Monitoring System **(PMS)** ~~Engineered Safety Feature Actuation System~~ instrumentation and controls so that the fuel, Reactor Coolant System **(RCS)**, and containment design limits are not exceeded.

The third paragraph, first sentence, of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> The OPERABILITY of the minimum inverters to each Class 1E AC instrument and control bus during MODES 5 and 6, **and during movement of irradiated fuel assemblies,** ensures that (Refs. 1 and 2)

The fourth paragraph, second sentence, of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> . . . However, assuming a single failure and concurrent loss of all offsite or all onsite **AC** power is not required. . . .

The fourth paragraph, third sentence, of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> . . . The rationale for this is based on the fact that many ~~Design Basis Accidents (~~DBAs~~)~~ that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6 because the energy contained within the reactor **coolant system** pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. . . .

The second sentence in the next to last paragraph, of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> . . . Worst case ~~Design Basis Accidents~~ **DBAs,** which are analyzed for operating MODES**,** are generally viewed **as** not ~~to be~~ **being** a significant concern during shutdown MODES due to the lower energies involved. . . .

The last paragraph, of the “Applicable Safety Analyses” section of the Bases, was revised as follows:

> The Class 1E **uninterruptible power supply (**UPS**)** inverters are part of the **Class 1E AC instrument and control electrical power** distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

The “LCO” section of the Bases was revised as follows:

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence **(AOO)** or postulated DBA. The **250 VDC station** battery powered inverters provide an uninterruptible supply of AC electrical power to the Class 1E AC instrument and control buses, even if the normal power supply from **a standby diesel generator backed non-Class 1E 480 VAC motor control center** ~~the 480 VAC~~ is deenergized. ~~OPERABILITY of the inverters requires that the Class 1E instrument and control buses be powered by the inverter with output voltage and frequency within tolerances, and the power input to the inverter from a 250 VDC station battery.~~ **An inverter OPERABLE when it powers its associated Class 1E AC instrument and control bus with output voltage and frequency within tolerances, and the associated 250 VDC station battery provides the inverter's power input by way of the associated Class 1E DC electrical power distribution system bus.** This ensures the availability of sufficient inverter power sources to operate the plant in a safe manner and to mitigate the consequences of postulated events during shutdown (**e.g.,** fuel handling accidents, inadvertent reactor vessel draindown).

The first paragraph, fourth sentence, in the "Actions" section of the Bases, under heading "A.1, A.2.1, A.2.2, A.2.3, and A.2.4," was revised as follows (existing markup shown in black):

. . . Therefore, the allowance for sufficiently conservative actions is made (i.e., ~~suspend CORE ALTERATIONS,~~ **suspend** movement of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions that could result in loss of required SDM (MODE 5) or boron concentration (MODE 6)). . . .

The first paragraph, sixth sentence, in the "Actions" section of the Bases, under heading "A.1, A.2.1, A.2.2, A.2.3, and A.2.4," was revised as follows:

. . . Introduction of coolant inventory must be from sources that have a boron concentration greater than ~~that~~ what would be required in the RCS for minimum SDM or refueling boron concentration. . . .

The first paragraph, eight (last) sentence, in the "Actions" section of the Bases, under heading "A.1, A.2.1, A.2.2, A.2.3, and A.2.4," was revised as follows:

. . . Introduction of temperature changes including temperature increases when operating with a positive ~~MTC~~ **moderator temperature coefficient (MTC)** must also be evaluated to ensure they do not result in a loss of required SDM.

The last sentence in the "Surveillance Requirements" section of the Bases, under the heading SR 3.8.4.1, was revised as follows:

. . . The 7 day Frequency takes into account ~~the effectiveness of the voltage and frequency instruments,~~ the redundant capability of the inverters, and other indications available in the control room that alert the operator to inverter malfunctions.

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

The nomenclature used for Class 1E electrical power distribution subsystems were inconsistent across different section of the TS. These inconsistencies cause confusion and could lead to erroneous interpretations. The changes made as part of VEGP LAR DOC A112 clarify that both DC and AC instrument and control divisions are electrical power distribution subsystems. Also, Actions were revised to present inoperabilities of divisions. Similar changes are made here to make this section consistent with other sections in this STS. This is acceptable as it provides clarity and consistency in the use of terminology within and across the TS sections. These changes are considered editorial in nature.

The changes in the “Applicable Safety Analyses” and “Actions” sections of the Bases are editorial for clarity and consistency with the TS requirements.

The deletion of the phrase “the effectiveness of the voltage and frequency instruments” makes it consistent with other STS and removes unnecessary details.

VII. GTST Safety Evaluation

Technical Analysis:

Removing CORE ALTERATIONS from Specifications and Bases

AP1000 defines CORE ALTERATION as follows "CORE ALTERATION shall be 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."

For Pressurized water Reactors (PWRs) like AP1000, as discussed in TSTF-471, CORE ALTERATIONS can only occur when the reactor vessel head is removed, which only applies in MODE 6.

There are only two accidents considered during MODE 6 for PWRs: a fuel handling accident and a boron dilution accident. According to the Standard Review Plan, a fuel handling accident is initiated by the dropping of an irradiated fuel assembly, either in the containment or in the fuel building. There are no mitigation actions, except to credit ventilation systems to reduce the dose consequences. Suspension of CORE ALTERATIONS, except for suspension of movement of irradiated fuel, will not prevent or impair the mitigation of a fuel handling accident.

A boron dilution accident is initiated by a dilution source which results in the boron concentration dropping below that required to maintain the SHUTDOWN MARGIN. The accident is mitigated by stopping the dilution. Suspension of CORE ALTERATIONS has no effect on the mitigation of a boron dilution accident. Movement of control rods or fuel do not affect the initial conditions of a boron dilution accident as it is assumed that the control rods and fuel are in the most adverse conditions with a large safety margin ($k_{eff} \leq 0.95$). To address the possibility of a misloaded fuel assembly, Technical Specification 3.9.3, Required Action A.1 is revised to require suspending positive reactivity additions if one of the two required source range neutron flux nuclear instrumentation monitors is inoperable. This precludes movement of fuel assemblies which could add reactivity to the core.

Therefore, with the exception of suspending movement of irradiated fuel assemblies, there are no DBAs or transients that are initiated by, or mitigation affected by, suspension of CORE ALTERATIONS. Accordingly, if Required Actions that require suspension of CORE ALTERATIONS also require suspension of movement of irradiated fuel, suspension of CORE ALTERATIONS provides no safety benefit.

In TS 3.8.4 of AP1000, when a one or more required DC electrical power subsystem is inoperable, the Required Actions require:

- Suspension of CORE ALTERATIONS
- Suspension of movement of irradiated fuel assemblies,
- Suspension of operation with a potential for draining the reactor vessel, and
- Suspension of operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.

As discussed above, because the Required Actions require the suspension of movement of irradiated fuel assemblies, the initiating conditions for a fuel handling accident are prohibited. Because the Required Actions require the suspension of positive reactivity additions that could result in a loss of SDM, the initial conditions for a boron dilution accident are prevented.

Therefore, the action to suspend CORE ALTERATIONS provides no safety benefit and is not needed.

Several benefits are expected. Plants will not be required to take actions to ensure that no prohibited CORE ALTERATIONS take place. This will avoid unnecessary personnel dose and will not distract the plant and NRC from more safety significant issues.

Remaining 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 3.8.4 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:

None

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/22/2014.

APOG Comments (Ref. 7) and Resolutions

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

(Internal #457) 3.8.04, Pg. 04, APOG requested removal of additional clarifications of nomenclature proposed by the NRC staff. Replacement of “bus[es]” with “electric power distribution system(s)” or “division(s)” was corrected. However, other clarifications in the Bases discussion were added and proper use of the term “electrical power distribution” was ensured.

(Internal #459) In GTST Section VI on page 6, under heading “Rationale for TSTF changes,” under heading “TSTF-471,” third paragraph was revised to clarify the possibility of misloaded fuel assembly. Clarifications, additional to that suggested by APOG, were made by NRC staff.

(Internal #460) In GTST Section VII on page 9, under heading “Removing CORE ALTERATIONS from Specifications and Bases,” fourth paragraph, changes similar to that Internal #459 were made.

(Internal # 461) The first sentence in the third paragraph of the “Applicable Safety Analyses” section of the Bases was revised to be consistent with the TS requirements.

(Internal #462) The fourth sentence, in the first paragraph of the “Applicable Safety Analyses” section of the Bases was revised by adding “suspend” before “movement of irradiated fuel assemblies” for clarity.

(Internal #463) The last sentence in the “Surveillance Requirements” section of the Bases, under the heading “SR 3.8.4.1,” was revised to delete the phrase “the effectiveness of the voltage and frequency instruments.” The phrase was not considered unnecessary.

NRC Final Approval Date: 12/10/2015

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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, Unit 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. TSTF-GG-05-01, Technical Specification Task Force (TSTF) Writer's Guide for Plant-Specific Improved Technical Specifications, Revision 1.

4. 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).

5. 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).

6. 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)

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 (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.

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 Inverters – Shutdown

LCO 3.8.4 Inverters shall be OPERABLE to support the onsite Class 1E power distribution subsystems required by LCO 3.8.6, “Distribution Systems - Shutdown.”

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

----------NOTE----------
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required inverters inoperable	A.1 Declare affected required features inoperable. OR ~~A.2.1 Suspend CORE ALTERATIONS.~~ ~~AND~~ A.2.1~~2~~ Suspend movement of irradiated fuel assemblies. AND A.2.2~~3~~ Suspend operations with a potential for draining the reactor vessel. AND	Immediately ~~Immediately~~ Immediately Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.34 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration. AND A.2.45 Initiate action to restore required inverters to OPERABLE status.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify correct inverter voltage, frequency, and alignments to required AC instrument and control buses.	7 days

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 Inverters – Shutdown

BASES

BACKGROUND

A description of the inverters is provided in the Bases for Specification 3.8.3, “Inverters - Operating.”

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in **FSAR** Chapter 6 (Ref. 1) and **FSAR** Chapter 15 (Ref. 2), assume engineered safety features **(ESF)** are OPERABLE. The ~~DC to AC~~ inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Protection and Monitoring System **(PMS)** ~~Engineered Safety Feature Actuation System~~ instrumentation and controls so that the fuel, Reactor Coolant System **(RCS)**, and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems’ OPERABILITY.

The OPERABILITY of the minimum inverters to each Class 1E AC instrument and control bus during MODES 5 and 6, **and during movement of irradiated fuel assemblies,** ensures that (Refs. 1 and 2):

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is available to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite **AC** power is not required. The rationale for this is based on the fact that many ~~Design Basis Accidents (~~DBAs~~)~~ that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6 because the energy contained

BASES

APPLICABLE SAFETY ANALYSES (continued)

within the reactor **coolant system** pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specification requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case **DBAs** ~~Design Basis Accidents~~ which are analyzed for operating MODES are generally viewed **as** not ~~to~~ be**ing** a significant concern during shutdown MODES due to the lower energies involved. The Technical specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, “Guidelines for Industry Actions to Assess Shutdown Management,” as an Industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The Class 1E **uninterruptible power supply (**UPS**)** inverters are part of the **Class 1E AC instrument and control electrical power** distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence **(AOO)** or postulated DBA. The **250 VDC station** battery powered inverters provide an uninterruptible supply of AC electrical power to the Class 1E AC instrument and control buses, even if the normal power supply from **a standby diesel generator backed non-Class 1E 480 VAC motor control center** ~~the 480 VAC~~ is deenergized. ~~OPERABILITY of the inverters requires that the Class 1E instrument and control buses be powered by the inverter with output voltage and frequency within tolerances, and the power input to the inverter from a 250 VDC station battery.~~**An inverter is OPERABLE when it powers its**

BASES

LCO (continued)

associated Class 1E AC instrument and control bus with output voltage and frequency within tolerances, and the associated 250 VDC station battery provides the inverter's power input by way of the associated Class 1E DC electrical power distribution system bus. This ensures the availability of sufficient inverter power sources to operate the plant in a safe manner and to mitigate the consequences of postulated events during shutdown (**e.g.,** fuel handling accidents, inadvertent reactor vessel draindown).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core in case of an inadvertent draindown of the reactor vessel;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Class 1E UPS inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.3, “Inverters - Operating.”

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Entering LCO 3.0.3, while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily.

BASES

ACTIONS (continued)

A.1**, A.2.1, A.2.2, A.2.3,** and A.2.**4**

If one or more required (per LCO 3.8.6, Distribution Systems - Shutdown) inverters are inoperable, the remaining OPERABLE inverters may be capable of supporting required features to allow continuation of ~~CORE ALTERATIONS,~~ fuel movement, and operations with a potential for draining the reactor vessel. By allowance of the option to declare required features inoperable with associated inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCOs' Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., ~~suspend CORE ALTERATIONS,~~ **suspend** movement of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions that could result in loss of required SDM (MODE 5) or boron concentration (MODE 6)). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or 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~~ what would be required in the RCS for minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive **moderator temperature coefficient (**MTC**)** must also be evaluated to ensure they do not result in a loss of required SDM.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required inverters should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power or powered from a regulating transformer.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and Class 1E AC instrument and control buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the instrumentation connected to the Class 1E AC instrument and control buses. The 7 day Frequency takes into account ~~the effectiveness of the voltage and frequency instruments,~~ the redundant capability of the inverters, and ~~other~~ indications available in the control room that alert the operator to inverter malfunctions.

REFERENCES

1. **FSAR** Chapter 6, “Engineered Safety Features.”
2. **FSAR** Chapter 15, “Accident Analyse~~i~~s.”

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.

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 Inverters – Shutdown

LCO 3.8.4 Inverters shall be OPERABLE to support the onsite Class 1E power distribution subsystems required by LCO 3.8.6, “Distribution Systems - Shutdown.”

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

----------NOTE----------
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required inverters inoperable	A.1 Declare affected required features inoperable.	Immediately
	OR	
	A.2.1 Suspend movement of irradiated fuel assemblies.	Immediately
	AND	
	A.2.2 Suspend operations with a potential for draining the reactor vessel.	Immediately
	AND	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.3 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration. AND A.2.4 Initiate action to restore required inverters to OPERABLE status.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify correct inverter voltage, frequency, and alignments to required AC instrument and control buses.	7 days

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 Inverters – Shutdown

BASES

BACKGROUND

A description of the inverters is provided in the Bases for Specification 3.8.3, “Inverters - Operating.”

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR Chapter 6 (Ref. 1) and FSAR Chapter 15 (Ref. 2), assume engineered safety features (ESF) are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Protection and Monitoring System (PMS) instrumentation and controls so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems’ OPERABILITY.

The OPERABILITY of the minimum inverters to each Class 1E AC instrument and control bus during MODES 5 and 6, and during movement of irradiated fuel assemblies, ensures that (Refs. 1 and 2):

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is available to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite AC power is not required. The rationale for this is based on the fact that many DBAs that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6 because the energy contained within the reactor coolant system pressure boundary, reactor coolant temperature and pressure,

BASES

APPLICABLE SAFETY ANALYSES (continued)

and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specification requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed as not being a significant concern during shutdown MODES due to the lower energies involved. The Technical specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, “Guidelines for Industry Actions to Assess Shutdown Management,” as an Industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The Class 1E uninterruptible power supply (UPS) inverters are part of the Class 1E AC instrument and control electrical power distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or postulated DBA. The 250 VDC station battery powered inverters provide an uninterruptible supply of AC electrical power to the Class 1E AC instrument and control buses, even if the normal power supply from a standby diesel generator backed non-Class 1E 480 VAC motor control center is deenergized. An inverter is OPERABLE when it powers its associated Class 1E AC instrument and control bus with output voltage and frequency within tolerances, and the associated 250 VDC station battery provides the inverter's power input by way of the associated Class 1E DC electrical power distribution system bus. This ensures the availability of sufficient inverter power sources to operate the plant in a safe manner and to mitigate the consequences of postulated

BASES

LCO (continued)

events during shutdown (e.g., fuel handling accidents, inadvertent reactor vessel draindown).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core in case of an inadvertent draindown of the reactor vessel;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Class 1E UPS inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.3, “Inverters - Operating.”

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Entering LCO 3.0.3, while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily.

A.1, A.2.1, A.2.2, A.2.3, and A.2.4

If one or more required (per LCO 3.8.6, Distribution Systems - Shutdown) inverters are inoperable, the remaining OPERABLE inverters may be capable of supporting required features to allow continuation of fuel movement, and operations with a potential for draining the reactor vessel. By allowance of the option to declare required features inoperable with associated inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features

BASES

ACTIONS (continued)

LCOs' Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., suspend movement of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions that could result in loss of required SDM (MODE 5) or boron concentration (MODE 6)). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or 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 what would be required in the RCS for minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive moderator temperature coefficient (MTC) must also be evaluated to ensure they do not result in a loss of required SDM.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter power to the unit safety systems.

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SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and Class 1E AC instrument and control buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the instrumentation connected to the Class 1E AC instrument and control buses. The 7 day Frequency takes into account the redundant capability of the inverters, and indications available in the control room that alert the operator to inverter malfunctions.

BASES

REFERENCES

1. FSAR Chapter 6, “Engineered Safety Features.”

2. FSAR Chapter 15, “Accident Analyses.”