

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

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**Title: Changes related to Section 3.1.5, Shutdown Bank Insertion Limits**

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**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:**

None

**STS NUREGs Affected:**

NA

**NRC Approval Date:**

NA

**TSTF Classification:**

NA

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**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:**

None

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

This section discusses changes: (1) that were applicable to previous designs, but are not to the current design; (2) that are already incorporated in the GTS; and (3) that are superseded by another change.

None

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**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)**

The following changes are proposed. These changes are editorial and their implementation will improve consistency among the requirements:

1. For Condition A and Required Action A.2, it is proposed to add "insertion" prior to the word "limits." Condition A will be revised to state "One or more shutdown banks not within insertion limits." Required Action A.2 will be revised to state "Restore shutdown bank(s) to within insertion limits."
  2. Required Action A.1.2 stating "Initiate boration to restore SDM to within limit" is revised to make "limit" plural (i.e. "limits").
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**V. Applicability**

**Affected Generic Technical Specifications and Bases:**

Section 3.1.5 Shutdown Bank Insertion Limits

**Changes to the Generic Technical Specifications and Bases:**

Condition A and Required Action A.2 are revised to replace "limits" with "insertion limits."

Required Action A.1.2 is revised to make "limit" plural, i.e. "limits."

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## **VI. Traveler Information**

### **Description of TSTF changes:**

NA

### **Rationale for TSTF changes:**

NA

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

NA

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

NA

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

1. Replacing "limits" with "insertion limits" In Condition A and Required Action A.2:

For Condition A and Required Action A.2, it is proposed to add "insertion" prior to the word "limits." Condition A will be revised to state "One or more shutdown banks not within insertion limits." Required Action A.2 will be revised to state "Restore shutdown bank(s) to within insertion limits."

2. Replacing "limit" with "limits" in Required action A.1.2

Required Action A.1.2 stating "Initiate boration to restore SDM to within limit" is revised to make "limit" plural (i.e. "limits").

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

1. Replacing "limits" with "insertion limits" In Condition A and Required Action A.2:

Including the word "insertion" in describing Condition A clearly specifies the limits being discussed.

2. Replacing "limit" with "limits" in Required Action A.1.2

The same Required Action in other requirements (TS 3.1.6) was revised to "limits" (VEGP LAR DOC A013). This change will provide consistency among the requirements.

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## VII. GTST Safety Evaluation

### **Technical Analysis:**

These changes are editorial in nature. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

### **References to Previous NRC Safety Evaluation Reports (SERs):**

None

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**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 Tuesday, May 20, 2014.

**NRC Final Approval Date:**

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

None

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**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. 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).
4. 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).
5. 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)
6. TSTF-GG-05-01, "Writer's Guide for Plant-Specific Improved Technical Specifications," June 2005.

**XI. MARKUP of the Applicable GTS Section 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.

## 3.1 REACTIVITY CONTROL SYSTEMS

## 3.1.5 Shutdown Bank Insertion Limits

LCO 3.1.5 Each Shutdown Bank shall be within insertion limits specified in the COLR.

APPLICABILITY: MODES 1 and 2.

## ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within <b>insertion</b> limits.	A.1.1 Verify SDM is within the limits specified in the COLR.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limits.	1 hour
	<u>AND</u>	
	A.2 Restore shutdown bank(s) to within <b>insertion</b> limits.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

## SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.5.1 Verify each shutdown bank is within the insertion limits specified in the COLR.	12 hours

## B 3.1 REACTIVITY CONTROL SYSTEMS

### B 3.1.5 Shutdown Bank Insertion Limits

#### BASES

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**BACKGROUND** The insertion limits of the shutdown and control rods are initial assumptions in the safety analyses which assume rod insertion upon reactor trip. The insertion limits directly affect core power and fuel burnup distributions and assumptions of available ejected rod worth SDM and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Control System Redundancy and Protection," GDC 28, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. The AP1000 design has seven control banks and four shutdown banks. See LCO 3.1.4, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.7, "Rod Position Indication," for position indication requirements.

The control banks are used for precise reactivity control of the reactor. The positions of the control banks are normally automatically controlled by the Plant Control System (PLS), but they can also be manually controlled. They are capable of adding negative reactivity very quickly (compared to borating). The control banks must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal full power operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature.

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**BASES**

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**BACKGROUND (continued)**

The design calculations are performed with the assumption that the shutdown banks are withdrawn first. The shutdown banks can be fully withdrawn without the core going critical. This provides available negative reactivity in the event of boration errors. The shutdown banks are controlled manually by the control room operator. During normal unit operation, the shutdown banks are either fully withdrawn or fully inserted. The shutdown banks must be completely withdrawn from the core, prior to withdrawing any control banks during an approach to criticality. The shutdown banks are then left in this position until the reactor is shut down. They affect core power and burnup distribution, and add negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

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**APPLICABLE  
SAFETY  
ANALYSES**

On a reactor trip, all RCCAs (shutdown banks and control banks exclusive of the GRCAs), except the most reactive RCCA, are assumed to insert into the core. The shutdown banks shall be at or above their insertion limits and available to insert the maximum amount of negative reactivity on a reactor trip signal. The control banks may be partially inserted in the core as allowed by LCO 3.1.6, "Control Bank Insertion Limits." The shutdown bank and control bank insertion limits are established to ensure that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM)") following a reactor trip from full power. The combination of control banks and shutdown banks (less the most reactive RCCA which is assumed to be fully withdrawn) is sufficient to take the reactor from full power conditions at rated temperature to zero power, and to maintain the required SDM at the rated no load temperature (Ref. 3). The shutdown bank insertion limit also limits the reactivity worth of an ejected shutdown bank rod.

The acceptance criteria for addressing shutdown and control rod bank insertion limits and inoperability or misalignment is that:

- a. There be no violations of:
  1. specified acceptable fuel design limits, or,
  2. RCS pressure boundary integrity; and
- b. The core remains subcritical after accident transients.

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**BASES**

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**APPLICABLE SAFETY ANALYSES (continued)**

As such, the shutdown bank insertion limits affect safety analysis involving core reactivity and SDM (Ref. 3).

The shutdown bank insertion limits preserve an initial condition assumed in the safety analyses and satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

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**LCO**

The shutdown banks must be within their insertion limits any time the reactor is critical or approaching criticality. This in conjunction with LCO 3.1.6, "Control Bank Insertion Limits," and 3.2.5.d, Online Power Distribution Monitoring System (OPDMS) Monitored Parameters, "SDM," ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip.

The shutdown bank insertion limits are defined in the COLR.

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**APPLICABILITY**

The shutdown banks must be within their insertion limits with the reactor in MODE 1 and MODE 2. The shutdown banks do not have to be within their insertion limits in MODE 3, unless an approach to criticality is being made. In MODE 3, 4, 5, or 6 the shutdown banks are fully inserted in the Core and contribute to the SDM. Refer to LCO 3.1.1 for SDM requirements in MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration" ensures adequate SDM in MODE 6.

The Applicability requirements have been modified by a Note indicating that the LCO requirement is suspended during SR 3.1.4.2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

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**ACTIONS**A.1.1, A.1.2, and A.2

When one or more shutdown banks is not within insertion limits, 2 hours are allowed to restore the shutdown banks to within the insertion limits. This is necessary because the available SDM may be significantly reduced with one or more of the shutdown banks not within their insertion limits. Also, verification of SDM or initiation of boration within 1 hour is required, since the SDM in MODES 1 and 2 is ensured by the continuous monitoring of SDM by the OPDMS (see LCO 3.2.5) and adhering to the

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**BASES**

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**ACTIONS (continued)**

control and shutdown bank insertion limits (see LCO 3.1.1). If shutdown banks are not within their insertion limits, then SDM will be verified by the OPDMS or by performing a reactivity balance calculation, considering the effects listed in the BASES for SR 3.1.1.1.

The allowed Completion Time of 2 hours provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

**B.1**

If the shutdown banks cannot be restored to within their insertion limits within 2 hours, the unit must be brought to a MODE where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

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**SURVEILLANCE  
REQUIREMENTS****SR 3.1.5.1**

Verification that the shutdown banks are within their insertion limits prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown banks will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown banks are withdrawn before the control banks are withdrawn during a unit startup.

Since the shutdown banks are positioned manually by the main control room operator, a verification of shutdown bank position at a Frequency of 12 hours, after the reactor is taken critical, is adequate to ensure that they are within their insertion limits. Also, the 12 hours Frequency takes into account other information available in the main control room for the purpose of monitoring the status of shutdown rods.



**BASES**

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- REFERENCES
1. 10 CFR 50, Appendix A, GDC 10, GDC 26, and GDC 28.
  2. 10 CFR 50.46.
  3. Chapter 15, "Accident Analysis."
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**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.

## 3.1 REACTIVITY CONTROL SYSTEMS

## 3.1.5 Shutdown Bank Insertion Limits

LCO 3.1.5 Each Shutdown Bank shall be within insertion limits specified in the COLR.

APPLICABILITY: MODES 1 and 2.

## ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within insertion limits.	A.1.1 Verify SDM is within the limits specified in the COLR.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limits.	1 hour
	<u>AND</u>	
	A.2 Restore shutdown bank(s) to within insertion limits.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

## SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.5.1 Verify each shutdown bank is within the insertion limits specified in the COLR.	12 hours

## B 3.1 REACTIVITY CONTROL SYSTEMS

### B 3.1.5 Shutdown Bank Insertion Limits

#### BASES

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**BACKGROUND** The insertion limits of the shutdown and control rods are initial assumptions in the safety analyses which assume rod insertion upon reactor trip. The insertion limits directly affect core power and fuel burnup distributions and assumptions of available ejected rod worth SDM and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Control System Redundancy and Protection," GDC 28, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

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**BASES**

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**BACKGROUND (continued)**

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SAFETY  
ANALYSES**

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The acceptance criteria for addressing shutdown and control rod bank insertion limits and inoperability or misalignment is that:

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  1. specified acceptable fuel design limits, or,
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**BASES**

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**APPLICABLE SAFETY ANALYSES (continued)**

As such, the shutdown bank insertion limits affect safety analysis involving core reactivity and SDM (Ref. 3).

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**LCO**

The shutdown banks must be within their insertion limits any time the reactor is critical or approaching criticality. This in conjunction with LCO 3.1.6, "Control Bank Insertion Limits," and 3.2.5.d, Online Power Distribution Monitoring System (OPDMS) Monitored Parameters, "SDM," ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip.

The shutdown bank insertion limits are defined in the COLR.

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**APPLICABILITY**

The shutdown banks must be within their insertion limits with the reactor in MODE 1 and MODE 2. The shutdown banks do not have to be within their insertion limits in MODE 3, unless an approach to criticality is being made. In MODE 3, 4, 5, or 6 the shutdown banks are fully inserted in the Core and contribute to the SDM. Refer to LCO 3.1.1 for SDM requirements in MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration" ensures adequate SDM in MODE 6.

The Applicability requirements have been modified by a Note indicating that the LCO requirement is suspended during SR 3.1.4.2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

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**ACTIONS**A.1.1, A.1.2, and A.2

When one or more shutdown banks is not within insertion limits, 2 hours are allowed to restore the shutdown banks to within the insertion limits. This is necessary because the available SDM may be significantly reduced with one or more of the shutdown banks not within their insertion limits. Also, verification of SDM or initiation of boration within 1 hour is required, since the SDM in MODES 1 and 2 is ensured by the continuous monitoring of SDM by the OPDMS (see LCO 3.2.5) and adhering to the

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**BASES**

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**ACTIONS (continued)**

control and shutdown bank insertion limits (see LCO 3.1.1). If shutdown banks are not within their insertion limits, then SDM will be verified by the OPDMS or by performing a reactivity balance calculation, considering the effects listed in the BASES for SR 3.1.1.1.

The allowed Completion Time of 2 hours provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

**B.1**

If the shutdown banks cannot be restored to within their insertion limits within 2 hours, the unit must be brought to a MODE where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

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**SURVEILLANCE  
REQUIREMENTS****SR 3.1.5.1**

Verification that the shutdown banks are within their insertion limits prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown banks will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown banks are withdrawn before the control banks are withdrawn during a unit startup.

Since the shutdown banks are positioned manually by the main control room operator, a verification of shutdown bank position at a Frequency of 12 hours, after the reactor is taken critical, is adequate to ensure that they are within their insertion limits. Also, the 12 hours Frequency takes into account other information available in the main control room for the purpose of monitoring the status of shutdown rods.

**BASES**

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- REFERENCES
1. 10 CFR 50, Appendix A, GDC 10, GDC 26, and GDC 28.
  2. 10 CFR 50.46.
  3. Chapter 15, "Accident Analysis."
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