
Industry/TSTF Standard Technical Specification Change Traveler

Elimination of Hydrogen Recombiners and Change to Hydrogen and Oxygen MonitorsNUREGs Affected: 1430 1431 1432 1433 1434

Classification 1) Technical Change

Recommended for CLIIP?: Yes

Priority 1)High

Simple or Complex Change: Complex

Correction or Improvement: Improvement

Industry Contact: Infanger, Paul

(352) 563-4796

Paul.Infanger@pgnmail.com

See attached.

Revision History

OG Revision 0**Revision Status: Closed**

Revision Proposed by: BWOG

Revision Description:
Original Issue

Owners Group Review Information

Date Originated by OG: 05-Dec-02

Owners Group Comments

Revisions Made In Response to Comments received during OG review:

- The BWR/4 CAD System is be retained. The CAD System is not a post-accident inerting system of the type being eliminated from 10 CFR 50.44. The justification was revised to eliminate discussion of elimination of the CAD System and related discussion of post-accident inerting.

- The justification was revised to specifically address each of the proposed changes.

- The justification was revised to state that the hydrogen recombiner specification is relocated to the TRM (or equivalent) and the hydrogen monitors are relocated to the licensee-controlled program for Post Accident Monitors that are not in Technical Specifications.

- Revised 5.6.7, Post Accident Monitoring Report, in all NUREGs to correct reference from Condition G to Condition F.

- Various editorial changes were made.

Owners Group Resolution: Approved Date: 08-Dec-02

TSTF Review Information

TSTF Received Date: 05-Dec-02 Date Distributed for Review 05-Dec-02

OG Review Completed: BWOG WOG CEOG BWROG

TSTF Comments:

02-May-03

OG Revision 0**Revision Status: Closed**

(No Comments)

TSTF Resolution: Approved Date: 08-Dec-02

NRC Review Information

NRC Received Date: 11-Dec-02

NRC Comments:

Discussion of Modifications Needed for TSTF-447 from NRC's April 1, 2003 letter:

1. TS 5.5.2 Primary Coolant Sources Outside Containment

TSTF-447 proposes to revise TS 5.5.2 from all NUREGs to remove the reference to Hydrogen Recombiner as a system outside of containment that could contain highly radioactive fluids during a serious transient or accident. The purpose of the program is to minimize leakage from these systems to levels as low as practicable. The hydrogen recombiner appears in a bracketed list of systems for this program. The staff believes that the program as described in the STS should remain unchanged since the hydrogen recombiner is in brackets and since portions of the hydrogen recombiner system could meet the threshold as a portion of systems outside of containment that could contain highly radioactive fluids.

2. Bases 3.6.3.1 Drywell Cooling System Fans (renumbered as proposed)

TSTF-447 proposes to revise the wording in the Bases of Drywell Cooling System Fans in NUREG-1433. Specifically, the TSTF-447 removes the last sentence of Action A.1 which states "... and the availability of the Primary Containment Hydrogen Recombiner System and the Containment Atmosphere Dilution System." The proposed rule change to 50.44 and the associated model safety evaluation does not address any changes to the Containment Atmosphere Dilution System. Therefore, the discussion about the Containment Atmosphere Dilution System should not be deleted from section A.1 of the Bases in NUREG-1433.

3. Bases 3.6.3.2 Primary Containment Oxygen Concentration (renumbered as proposed)

TSTF-447 proposes to revise the Bases of 3.6.3.2 to state that the Specification meets 10 CFR 50.36(c)(2)(ii) Criterion 4, instead of Criterion 2. This change was also documented in the staff's version of the draft technical specification changes and model safety evaluation for public comment. However, this change was incorrect. The primary containment oxygen concentration Specification meets Criterion 2 since the UFSAR Chapter 6 calculations assume that the primary containment is inerted, that is, oxygen concentration < 4.0 volume percent, when a design basis LOCA occurs. Therefore, primary containment oxygen concentration is a process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. Please revise TSTF-447 to show the retention of Criterion 2 as the basis for specification 3.6.3.2, primary containment oxygen concentration.

Final Resolution: Superceded by Revision

Final Resolution Date: 01-Apr-03

TSTF Revision 1**Revision Status: Active****Next Action: TSTF**

Revision Proposed by: NRC

Revision Description:

In response to the NRC's April 1, 2003 letter providing comments on TSTF-447, the following changes are made.

02-May-03

TSTF Revision 1	Revision Status: Active	Next Action: TSTF
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1. TS 5.5.2 Primary Coolant Sources Outside Containment

Changes to TS 5.5.2, Primary Coolant Sources Outside Containment, are eliminated from the Traveler. The Proposed Change section of the justification is modified to state that licensees that plan to remove the hydrogen recombiner from the plant should evaluate whether the list of equipment in TS 5.5.2 should be revised.

2. Bases 3.6.3.1 Drywell Cooling System Fans (renumbered as proposed)

The Bases of NUREG-1433, 3.6.3.1 Drywell Cooling System Fans is revised to retain the reference to the Containment Atmosphere Dilution (CAD) System.

Based on the 50.44 Rulemaking, the TSTF believes that CAD system no longer meets the 10 CFR 50.36(c)(2)(ii) criteria for retention in the Technical Specifications. However, in order to not delay the processing of TSTF-447, the TSTF will submit a separate Traveler to make this portion of the ISTS consistent with the revised regulations.

3. Bases 3.6.3.2 Primary Containment Oxygen Concentration (renumbered as proposed)

The Bases of NUREG-1433, 3.6.3.2 Primary Containment Oxygen Concentration, is revised to eliminate the change in 10 CFR 50.36(c)(2)(ii) criteria. The applicable criteria will remain Criteria 2.

Changes to the justification to eliminate discussion of removed items and to add the discussion of possible effects on TS 5.5.2 are marked with revision bars.

TSTF Review Information

TSTF Received Date: 02-May-03 Date Distributed for Review 02-May-03

OG Review Completed: BWOG WOG CEOG BWROG

TSTF Comments:

(No Comments)

TSTF Resolution: Date:

Affected Technical Specifications

5.6.7	Post Accident Monitoring Report	
3.6.8	Hydrogen Recombiners	NUREG(s)- 1430 1431 1432 Only
	Change Description: Deleted	
3.6.8 Bases	Hydrogen Recombiners	NUREG(s)- 1430 1431 1432 Only
	Change Description: Deleted	
LCO 3.3.17	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Table 3.3.17-1	
LCO 3.3.17 Bases	PAM Instrumentation	NUREG(s)- 1430 Only
Action 3.3.17.C	PAM Instrumentation	NUREG(s)- 1430 Only

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Action 3.3.17.C	Bases PAM Instrumentation	NUREG(s)- 1430 Only
Action 3.3.17.D	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Deleted	
Action 3.3.17.D Bases	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Deleted	
Action 3.3.17.E	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed D	
Action 3.3.17.E Bases	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed D	
Action 3.3.17.F	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed E	
Action 3.3.17.F Bases	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed E	
Action 3.3.17.G	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed G	
Action 3.3.17.G Bases	PAM Instrumentation	NUREG(s)- 1430 Only
	Change Description: Renamed G	
LCO 3.3.3	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Table 3.3.3-1	
LCO 3.3.3 Bases	PAM Instrumentation	NUREG(s)- 1431 Only
Action 3.3.3.C	PAM Instrumentation	NUREG(s)- 1431 Only
Action 3.3.3.C Bases	PAM Instrumentation	NUREG(s)- 1431 Only
Action 3.3.3.D	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Deleted	
Action 3.3.3.D Bases	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Deleted	
Action 3.3.3.E	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed D	
Action 3.3.3.E Bases	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed D	
Action 3.3.3.F	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed E	
Action 3.3.3.F Bases	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed E	
Action 3.3.3.G	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed F	

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Action 3.3.3.G Bases	PAM Instrumentation	NUREG(s)- 1431 Only
	Change Description: Renamed F	
Action 3.6.9.A Bases	HMS	NUREG(s)- 1431 Only
S/A 3.6.9.B Bases	HMS	NUREG(s)- 1431 Only
Action 3.6.9.B Bases	HMS	NUREG(s)- 1431 Only
3.6.19	Shield Building (Dual and Ice Condenser)	NUREG(s)- 1431 Only
	Change Description: Renumbered 3.6.8	
3.6.19 Bases	Shield Building (Dual and Ice Condenser)	NUREG(s)- 1431 Only
	Change Description: Renumbered 3.6.8	
LCO 3.3.11	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Table 3.3.11-1	
LCO 3.3.11	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
	Change Description: Table 3.3.11-1	
LCO 3.3.11 Bases	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Table 3.3.11-1	
LCO 3.3.11 Bases	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
Action 3.3.11.C	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
Action 3.3.11.C	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
Action 3.3.11.C Bases	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
Action 3.3.11.C Bases	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
Action 3.3.11.D	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Deleted	
Action 3.3.11.D	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
	Change Description: Deleted	
Action 3.3.11.D Bases	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Deleted	
Action 3.3.11.D Bases	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
	Change Description: Deleted	
Action 3.3.11.E	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Renamed D	
Action 3.3.11.E	PAM Instrumentation (Digital)	NUREG(s)- 1432 Only
	Change Description: Renamed D	
Action 3.3.11.E Bases	PAM Instrumentation (Analog)	NUREG(s)- 1432 Only
	Change Description: Renamed D	

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Action 3.3.11.E Bases	PAM Instrumentation (Digital) Change Description: Renamed D	NUREG(s)- 1432 Only
Action 3.3.11.F	PAM Instrumentation (Analog) Change Description: Renamed E	NUREG(s)- 1432 Only
Action 3.3.11.F	PAM Instrumentation (Digital) Change Description: Renamed E	NUREG(s)- 1432 Only
Action 3.3.11.F Bases	PAM Instrumentation (Analog) Change Description: Renamed E	NUREG(s)- 1432 Only
Action 3.3.11.F Bases	PAM Instrumentation (Digital) Change Description: Renamed E	NUREG(s)- 1432 Only
Action 3.3.11.G	PAM Instrumentation (Analog) Change Description: Renamed F	NUREG(s)- 1432 Only
Action 3.3.11.G	PAM Instrumentation (Digital) Change Description: Renamed F	NUREG(s)- 1432 Only
Action 3.3.11.G Bases	PAM Instrumentation (Analog) Change Description: Renamed F	NUREG(s)- 1432 Only
Action 3.3.11.G Bases	PAM Instrumentation (Digital) Change Description: Renamed F	NUREG(s)- 1432 Only
Action 3.6.9.A Bases	HMS	NUREG(s)- 1432 Only
Action 3.6.9.B Bases	HMS	NUREG(s)- 1432 Only
Bkgnd 3.6.11 Bases	Shield Building	NUREG(s)- 1432 Only
3.6.13	SBEACS Change Description: Renumber 3.6.8	NUREG(s)- 1432 Only
3.6.13 Bases	SBEACS Change Description: Renumber 3.6.8	NUREG(s)- 1432 Only
LCO 3.3.3.1	PAM Instrumentation Change Description: Table 3.3.3.1-1	NUREG(s)- 1433 1434 Only
LCO 3.3.3.1 Bases	PAM Instrumentation	NUREG(s)- 1433 1434 Only
Action 3.3.3.1.C	PAM Instrumentation	NUREG(s)- 1433 1434 Only
Action 3.3.3.1.C Bases	PAM Instrumentation	NUREG(s)- 1433 1434 Only
Action 3.3.3.1.D	PAM Instrumentation Change Description: Deleted	NUREG(s)- 1433 1434 Only
Action 3.3.3.1.D Bases	PAM Instrumentation Change Description: Deleted	NUREG(s)- 1433 1434 Only

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Action 3.3.3.1.E	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed D	
Action 3.3.3.1.E Bases	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed D	
Action 3.3.3.1.F	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed E	
Action 3.3.3.1.F Bases	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed E	
Action 3.3.3.1.G	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed F	
Action 3.3.3.1.G Bases	PAM Instrumentation	NUREG(s)- 1433 1434 Only
	Change Description: Renamed F	
3.6.3.1	Primary Containment Hydrogen Recombiners	NUREG(s)- 1433 1434 Only
	Change Description: Deleted	
3.6.3.1 Bases	Primary Containment Hydrogen Recombiners	NUREG(s)- 1433 1434 Only
	Change Description: Deleted	
3.6.3.2	[Drywell Cooling System Fans]	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.1	
3.6.3.2 Bases	[Drywell Cooling System Fans]	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.1	
3.6.3.3	Primary Containment Oxygen Concentration	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.2	
3.6.3.3 Bases	Primary Containment Oxygen Concentration	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.2	
Bkgnd 3.6.3.3 Bases	Primary Containment Oxygen Concentration	NUREG(s)- 1433 Only
S/A 3.6.3.3 Bases	Primary Containment Oxygen Concentration	NUREG(s)- 1433 Only
Action 3.6.3.3.A Bases	Primary Containment Oxygen Concentration	NUREG(s)- 1433 Only
3.6.3.4	CAD System	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.3	
3.6.3.4 Bases	CAD System	NUREG(s)- 1433 Only
	Change Description: Renumbered 3.6.3.3	
3.6.3.2	Primary Containment and Drywell Hydrogen Ignitors	NUREG(s)- 1434 Only
	Change Description: Renumbered 3.6.3.1	
3.6.3.2 Bases	Primary Containment and Drywell Hydrogen Ignitors	NUREG(s)- 1434 Only
	Change Description: Renumbered 3.6.3.1	
Action 3.6.3.2.B Bases	Primary Containment and Drywell Hydrogen Ignitors	NUREG(s)- 1434 Only

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3.6.3.3	Drywell Purge System	NUREG(s)- 1434 Only
	Change Description: Renumbered 3.6.3.2	
3.6.3.3 Bases	Drywell Purge System	NUREG(s)- 1434 Only
	Change Description: Renumbered 3.6.3.2	
Bkgnd 3.6.3.3 Bases	Drywell Purge System	NUREG(s)- 1434 Only

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1.0 Description

The Nuclear Regulatory Commission (NRC) has proposed a revision to 10 CFR 50.44 to amend its standards for combustible gas control in light-water-cooled power reactors. The amended rule eliminates the requirements for hydrogen recombiners and relaxes the requirements for hydrogen and oxygen monitoring. This proposed change to the Improved Standard Technical Specifications (ISTS) reflects the proposed rule change.

2.0 Proposed Change

The ISTS are revised to delete the Technical Specification on Hydrogen Recombiners. Subsequent specifications are renumbered or reordered to restore consecutive numbering in the ISTS.

Hydrogen monitors are eliminated from the Post Accident Monitoring (PAM) Instrumentation specification. The hydrogen monitors are relocated to the plant-specific controls for PAM instruments which are not in the Technical Specifications. This elimination results in several changes to the PAM Specification.

The “Post Accident Monitoring Report” is revised to reflect the revised ACTION numbering in the PAM Specification.

The Bases are revised to eliminate references to hydrogen recombiners, incorporate the renumbering or reordering, and other changes are made as necessary to reflect the proposed rule.

Licensees that intend to remove the hydrogen recombiners from the plant should determine if Specification 5.5.2, “Primary Coolant Sources Outside Containment” needs to be revised to eliminate any reference to the hydrogen recombiners.

3.0 Background

The Nuclear Regulatory Commission (NRC) has proposed a revision to 10 CFR 50.44. In the revised rule, the Commission retained requirements for ensuring a mixed atmosphere, inerting Mark I and II containments, and providing hydrogen control systems capable of accommodating an amount of hydrogen generated from a metal-water reaction involving 75 percent of the fuel cladding surrounding the active fuel region in Mark III and ice condenser containments. The Commission eliminated the design-basis LOCA hydrogen release from 50.44 and consolidated the requirements for hydrogen and oxygen monitoring to 50.44, while relaxing safety classifications and licensee commitments to certain design and qualification criteria. The Commission also relocated without change the hydrogen control requirements in 50.34(f) to 50.44 and the high point vent requirements from 50.44 to 50.46a, and eliminated the design option for post-accident containment inerting.

4.0 Technical Analysis

Hydrogen Recombiners: The revised 50.44 no longer defines a design-basis LOCA hydrogen release, and eliminates the requirements for hydrogen control systems to mitigate such a release. The installation of hydrogen recombiners and/or vent and purge systems required by 50.44(b)(3) was intended to address the limited quantity and rate of hydrogen generation that was postulated from a design-basis LOCA. The Commission has found that this hydrogen release is not risk-significant because the design-basis LOCA hydrogen release does not contribute to the conditional probability of a large release up to approximately 24 hours after the onset of core damage. In addition, these systems were ineffective at mitigating hydrogen releases from risk-significant accident sequences that could threaten containment integrity. The ISTS states that hydrogen recombiners meet 10 CFR 50.36(c)(2)(ii) Criterion 3 (accident mitigation). As stated in the rule change, since hydrogen recombiners are no longer required to respond to a LOCA, the hydrogen recombiners no longer meet Criterion 3 or any of the other criteria for retention in the Technical Specifications. Therefore, the proposed rule states that the requirements related to hydrogen recombiners currently in the ISTS no longer meet the criteria of 10 CFR 50.36(c)(2)(ii) for retention in the Technical Specifications and may be eliminated.

Hydrogen Monitoring Equipment: 50.44(b)(1) and the ISTS currently contain requirements for monitoring hydrogen. Licensees have also made commitments to design and qualification criteria for hydrogen monitors in NUREG-0737, Item II.F.1, Attachment 6 and RG 1.97. The hydrogen monitors are used to assess the degree of core damage and confirm that random or deliberate ignition has taken place and that containment integrity is not threatened by an explosive mixture. If an explosive mixture that could threaten containment integrity exists during a beyond design-basis accident, then other severe accident management strategies, such as purging and/or venting, would need to be considered. With the elimination of the design-basis LOCA hydrogen release, hydrogen monitors are no longer required to mitigate design-basis accidents and, therefore, the hydrogen monitors do not meet the definition of a safety-related component as defined in 10 CFR 50.2. RG 1.97 Category 1, is intended for key variables that most directly indicate the accomplishment of a safety function for design-basis accident events. The hydrogen monitors no longer meet the definition of Category 1 in RG 1.97. As part of the rulemaking to revise 50.44 the Commission found that Category 3, as defined in RG 1.97, is an appropriate categorization for the hydrogen monitors because the monitors are required to diagnose the course of beyond design-basis accidents. Hydrogen monitoring is not the primary means of indicating a significant abnormal degradation of the reactor coolant pressure boundary. Section 4 of Attachment 2 to SECY-00-0198 found that hydrogen monitoring was not risk-significant. Therefore, the rule making stated that the staff finds that hydrogen monitoring equipment requirements no longer meet the criteria of 50.36(c)(2)(ii) for retention in Technical Specifications and, therefore, may be removed from the Technical Specifications. The CLIIP for elimination of Post-Accident Sampling System requirements for Westinghouse and Combustion Engineering designs indicated that during the early phases of an accident, safety-grade hydrogen monitors provide an adequate capability for monitoring containment hydrogen concentration. The staff subsequently concluded that Category 3 hydrogen monitors also provide an adequate capability for monitoring containment hydrogen concentration during the early phases of an accident. Because the monitors are required to diagnose the course of beyond design basis accidents, each licensee

should verify that it has, and make a regulatory commitment to maintain, a hydrogen monitoring system capable of diagnosing the course of beyond design-basis accidents.

Oxygen Monitoring Equipment: The ISTS for BWR/4 plants currently contains requirements for monitoring oxygen. The oxygen monitors are required to verify the status of the inert containment. Combustible gases produced by beyond design-basis accidents involving both fuel-cladding oxidation and core-concrete interaction would be risk-significant for plants with Mark I and II containments if not for the inerted containment atmospheres. If an inerted containment was to become de-inerted during a beyond design-basis accident, then other severe accident management strategies, such as purging and venting, would need to be considered. The oxygen monitors are needed to implement these severe accident management strategies. Oxygen concentration also appears extensively in the emergency procedure guidelines/severe accident guidelines of plants with inerted containment atmospheres. With the elimination of the design-basis LOCA hydrogen release, the oxygen monitors are no longer required to mitigate design-basis accidents and, therefore, the oxygen monitors do not meet the definition of a safety-related component as defined in 50.2. RG 1.97 recommends that, for inerted containment plants, the oxygen monitors be Category 1 which is intended for key variables that most directly indicate the accomplishment of a safety function for design-basis accident events. The oxygen monitors no longer meet the definition of Category 1 in RG 1.97. As part of the rulemaking to revise 50.44 the Commission found that Category 2, as defined in RG 1.97, is an appropriate categorization for the oxygen monitors, because the monitors are required to verify the status of the inert containment. Oxygen monitoring is not the primary means of indicating a significant abnormal degradation of the reactor coolant pressure boundary. Oxygen monitors have not been shown by a probabilistic risk assessment to be risk significant. Therefore, the oxygen monitoring equipment requirements no longer meet the criteria of 50.36(c)(2)(ii) for retention in Technical Specifications and, therefore, may be removed from the Technical Specifications. However, for plant designs with an inerted containment, because the monitors are required to verify the status of the inert containment, each licensee should verify that it has, and make a regulatory commitment to maintain, an oxygen monitoring system capable of verifying the status of the inert containment. For plant designs with an inerted containment, the requirement for primary containment oxygen concentration will be retained in Technical Specifications.

Verifications and Commitments: If adopting these proposed changes to the ISTS in plant-specific Technical Specifications, the licensee must make a regulatory commitment to maintain a hydrogen monitoring system capable of diagnosing the course of beyond design basis accidents. The licensee has committed to maintain the hydrogen monitors within the requirements of its specified document or program. For plant designs with an inerted containment, the licensee must make a regulatory commitment to maintain an oxygen monitoring system capable of verifying the status of the inert containment.

5.0 Regulatory Analysis

5.1 No Significant Hazards Consideration

The TSTF has evaluated whether or not a significant hazards consideration is involved with the proposed generic change by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The revised 50.44 no longer defines a design-basis LOCA hydrogen release and eliminates requirements for hydrogen control systems to mitigate such a release. The installation of hydrogen recombiners and/or vent and purge systems required by 50.44(b)(3) was intended to address the limited quantity and rate of hydrogen generation that was postulated from a design-basis LOCA. The Commission has found that this hydrogen release is not risk-significant because the design-basis LOCA hydrogen release does not contribute to the conditional probability of a large release up to approximately 24 hours after the onset of core damage. In addition, these systems were ineffective at mitigating hydrogen releases from risk-significant accident sequences that could threaten containment integrity.

With the elimination of the design-basis LOCA hydrogen release, hydrogen and oxygen monitors are no longer required to mitigate design-basis accidents and, therefore, the hydrogen monitors do not meet the definition of a safety-related component as defined in 50.2. RG 1.97 Category 1, is intended for key variables that most directly indicate the accomplishment of a safety function for design-basis accident events. The hydrogen and oxygen monitors no longer meet the definition of Category 1 in RG 1.97. As part of the rulemaking to revise 50.44 the Commission found that Category 3, as defined in RG 1.97, is an appropriate categorization for the hydrogen monitors because the monitors are required to diagnose the course of beyond design-basis accidents. Also as part of the rulemaking to revise 50.44 the Commission found that Category 2, as defined in RG 1.97, is an appropriate categorization for the oxygen monitors, because the monitors are required to verify the status of the inert containment.

The regulatory requirements for the hydrogen and oxygen monitors can be relaxed without degrading the plant emergency response. The emergency response, in this sense, refers to the methodologies used in ascertaining the condition of the reactor core, mitigating the consequences of an accident, assessing and projecting offsite releases of radioactivity, and establishing protective action recommendations to be communicated to offsite authorities. Classification of the hydrogen monitors as Category 3, classification of the oxygen monitors as Category 2 and removal of the hydrogen and oxygen monitors from Technical Specifications (TS) will not prevent an accident management strategy through the use of the Severe Accident Management Guidelines (SAMGs), the emergency plan (EP), the emergency operating procedures (EOP), and site survey monitoring that support modification of emergency plan protective action recommendations (PARs).

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The elimination of the hydrogen recombiner requirements and relaxation of the hydrogen and oxygen monitor requirements, including removal of these requirements from TS, will not result in any failure mode not previously analyzed. The hydrogen recombiner and hydrogen and oxygen monitor equipment was intended to mitigate a design-basis hydrogen release. The hydrogen recombiner and hydrogen and oxygen monitor equipment are not considered accident precursors, nor does their existence or elimination have any adverse impact on the pre-accident state of the reactor core or post accident confinement of radionuclides within the containment building.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The elimination of the hydrogen recombiner requirements and relaxation of the hydrogen and oxygen monitor requirements, including removal of these requirements from TS, in light of existing plant equipment, instrumentation, procedures, and programs that provide effective mitigation of and recovery from reactor accidents, results in a neutral impact to the margin of safety.

The installation of hydrogen recombiners and/or vent and purge systems required by 50.44(b)(3) was intended to address the limited quantity and rate of hydrogen generation that was postulated from a design-basis LOCA. The Commission has found that this hydrogen release is not risk-significant because the design-basis LOCA hydrogen release does not contribute to the conditional probability of a large release up to approximately 24 hours after the onset of core damage. In addition, these systems were ineffective at mitigating hydrogen releases from risk-significant accident sequences that could threaten containment integrity.

Category 3 hydrogen monitors are adequate to provide rapid assessment of current reactor core conditions and the direction of degradation while effectively responding to the event in order to mitigate the consequences of the accident. The intent of the requirements established as a result of the Three Mile Island Unit 2 accident can be adequately met without reliance on safety-related hydrogen monitors. Regulatory Guide 1.97 Category 2 oxygen monitors are adequate to verify the status of an inerted containment.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, the TSTF concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

5.2 Applicable Regulatory Requirements/Criteria

The proposed changes revise the ISTS to reflect changes in the applicable regulatory requirements and criteria in 10 CFR 50.44.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the approval of the proposed change will not be inimical to the common defense and security or to the health and safety of the public.

6.0 Environmental Consideration

A review has determined that the proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

7.0 References

Notice of Proposed Rulemaking, Federal Register: August 2, 2002 (Volume 67, Number 149), Proposed Rules, Page 50374-50383, Combustible Gas Control in Containment.

3.3 INSTRUMENTATION

3.3.17 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.17 The PAM instrumentation for each Function in Table 3.3.17-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

- NOTES -

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C. One or more Functions with two required channels inoperable.	C.1 Restore one channel to OPERABLE status.	7 days
D. Two required hydrogen monitor channels inoperable.	D.1 Restore one required hydrogen monitor channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition C or D not met. <input checked="" type="checkbox"/> D	E.1 <input checked="" type="checkbox"/> D Enter the Condition referenced in Table 3.3.17-1 for the channel.	Immediately
F. As required by Required Action E.1 and referenced in Table 3.3.17-1. <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> D	F.1 <input checked="" type="checkbox"/> E AND <input checked="" type="checkbox"/> F F.2 Be in MODE 3. Be in MODE 4.	6 hours 12 hours
G. As required by Required Action E.1 and referenced in Table 3.3.17-1. <input checked="" type="checkbox"/> F <input checked="" type="checkbox"/> D	G.1 <input checked="" type="checkbox"/> F Initiate action in accordance with Specification 5.6.7.	Immediately

SURVEILLANCE REQUIREMENTS

- NOTE -

These SRs apply to each PAM instrumentation Function in Table 3.3.17-1.

	SURVEILLANCE	FREQUENCY
SR 3.3.17.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.17.2	<p>- NOTE -</p> <p>Neutron detectors are excluded from CHANNEL CALIBRATION.</p> <p>-----</p> <p>Perform CHANNEL CALIBRATION.</p>	[18] months

Table 3.3.17-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITIONS REFERENCED FROM REQUIRED ACTION C.4	D.1
1. Wide Range Neutron Flux	2	F E	
2. RCS Hot Leg Temperature	2 per loop	F E	
3. RCS Cold Leg Temperature	2 per loop	F E	
4. RCS Pressure (Wide Range)	2	F E	
5. Reactor Vessel Water Level	2	G F	
6. Containment Sump Water Level (Wide Range)	2	F E	
7. Containment Pressure (Wide Range)	2	F E	
8. Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path ^{(a)(b)}	F E	
9. Containment Area Radiation (High Range)	2	G F	
10. Containment Hydrogen Concentration	2	F	
10. 11. Pressurizer Level	2	F E	
11. 12. Steam Generator Water Level	2 per SG	F E	
12. 13. Condensate Storage Tank Level	2	F E	
13. 14. Core Exit Temperature	2 independent sets of 5 ^(c)	F E	
14. 15. Emergency Feedwater Flow	2	F E	

- REVIEWER'S NOTE -

Table 3.3.17-1 shall be amended for each unit as necessary to list all U.S. NRC Regulatory Guide 1.97, Type A instruments and all U.S. NRC Regulatory Guide 1.97, Category I, non-Type A instruments in accordance with the unit's U.S. NRC Regulatory Guide 1.97, Safety Evaluation Report.

- (a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.
- (b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.
- (c) The subcooling margin monitor takes the average of the five highest CETs for each of the ICCM trains.

Hydrogen Recombiners
3.6.8

3.6 CONTAINMENT SYSTEMS

3.6.8 Hydrogen Recombiners (if permanently installed)

LCO 3.6.8 Two hydrogen recombiners shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One hydrogen recombinder inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore hydrogen recombinder to OPERABLE status.</p>	30 days
B. [Two hydrogen recombiners inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one hydrogen recombinder to OPERABLE status.</p>	1 hour <u>AND</u> Every 12 hours thereafter 7 days]
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

Hydrogen Recombiners
3.6.8

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.8.1	Perform a system functional test for each hydrogen recombinder.	[18] months
SR 3.6.8.2	Visually examine each hydrogen recombinder enclosure and verify there is no evidence of abnormal conditions.	[18] months
SR 3.6.8.3	Perform a resistance to ground test for each heater phase.	[18] months

5.6 Reporting Requirements

5.6.6 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (continued)

- REVIEWER'S NOTE -

The methodology for the calculation of the P-T limits for NRC approval should include the following provisions:

1. The methodology shall describe how the neutron fluence is calculated (reference new Regulatory Guide when issued).
 2. The Reactor Vessel Material Surveillance Program shall comply with Appendix H to 10 CFR 50. The reactor vessel material irradiation surveillance specimen removal schedule shall be provided, along with how the specimen examinations shall be used to update the PTLR curves.
 3. Low Temperature Overpressure Protection (LTOP) System lift setting limits for the Power Operated Relief Valves (PORVs), developed using NRC-approved methodologies may be included in the PTLR.
 4. The adjusted reference temperature (ART) for each reactor beltline material shall be calculated, accounting for radiation embrittlement, in accordance with Regulatory Guide 1.99, Revision 2.
 5. The limiting ART shall be incorporated into the calculation of the pressure and temperature limit curves in accordance with NUREG-0800 Standard Review Plan 5.3.2, Pressure-Temperature Limits.
 6. The minimum temperature requirements of Appendix G to 10 CFR Part 50 shall be incorporated into the pressure and temperature limit curves.
 7. Licensees who have removed two or more capsules should compare for each surveillance material the measured increase in reference temperature (RT_{NDT}) to the predicted increase in RT_{NDT} ; where the predicted increase in RT_{NDT} is based on the mean shift in RT_{NDT} plus the two standard deviation value ($2\sigma_\Delta$) specified in Regulatory Guide 1.99, Revision 2. If the measured value exceeds the predicted value (increase in $RT_{NDT} + 2\sigma_\Delta$), the licensee should provide a supplement to the PTLR to demonstrate how the results affect the approved methodology.
-

5.6.7 Post Accident Monitoring Report

F

When a report is required by Condition B or G of LCO 3.3.[17], "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of

BASES

LCO (continued)

8. Containment Isolation Valve Position

PCIV position is provided for verification of containment integrity. In the case of PCIV position, the important information is the isolation status of the containment penetration. The LCO requires one channel of valve position indication in the control room to be OPERABLE for each active PCIV in a containment penetration flow path, i.e., two total channels of PCIV position indication for a penetration flow path with two active valves. For containment penetrations with only one active PCIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration flow path is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required to be OPERABLE. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

[For this plant, the PCIV position PAM instrumentation consists of the following:]

9. Containment Area Radiation (High Range)

Containment Area Radiation (High Range) instrumentation is provided to monitor the potential for significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans. [For this unit, the Containment Area Radiation instrumentation consists of the following:]

10. Containment Hydrogen Concentration

Containment Hydrogen Concentration instrumentation is provided to detect high hydrogen concentration conditions that represent a potential for containment breach. This variable is also important in verifying the adequacy of mitigating actions. [For this unit, the Containment Hydrogen Concentration instrumentation consists of the following:]

BASES

LCO (continued)

10. 41. Pressurizer Level

Pressurizer Level instrumentation is used to determine whether to terminate safety injection (SI), if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the unit conditions necessary to establish natural circulation in the RCS and to verify that the unit is maintained in a safe shutdown condition. [For this unit, the Pressurizer Level instrumentation consists of the following:]

11. 42. Steam Generator Water Level

Steam Generator Water Level instrumentation is provided to monitor operation of decay heat removal via the SG. The indication of SG level is the extended startup range level instrumentation, covering a span of 6 inches to 394 inches above the lower tubesheet. The measured differential pressure is displayed in inches of water at 68°F. Temperature compensation for this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation. The uncompensated level signal is input to the unit computer, a control room indicator, and the Emergency Feedwater (EFW) Control System.

SG level indication is used by the operator to manually raise and control SG level to establish boiler condenser heat transfer. Operator action is initiated on a loss of subcooled margin. Feedwater flow is increased until the indicated extended startup range level reaches the boiler condenser setpoint.

12. 43. Condensate Storage Tank (CST) Level

CST Level instrumentation is provided to ensure a water supply for EFW. The CST provides the assured, safety grade water supply for the EFW System. The CST consists of two identical tanks connected by a common outlet header. Inventory is monitored by a 0 inch to 144 inch level indication for each tank. CST Level is displayed on a control room indicator, strip chart recorder, and unit computer. In addition, a control room annunciator alarms on low level.

CST Level is the primary indication used by the operator to identify loss of CST volume and replenish the CST or align suction to the EFW pumps from the hotwell.

BASES

LCO (continued)

13. 14. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling. An evaluation was made of the minimum number of valid core exit thermocouples (CETs) necessary for inadequate core cooling detection. The evaluation determined the reduced complement of CETs necessary to detect initial core recovery and to trend the ensuing core heatup. The evaluations account for core nonuniformities and cold leg injection. Based on these evaluations, adequate or inadequate core cooling detection is ensured with two sets of five valid CETs.

The subcooling margin monitor takes the average of the five highest CETs for each of the ICCM trains. Two channels ensure that a single failure will not disable the ability to determine the representative core exit temperature.

14. 15. Emergency Feedwater Flow

EFW Flow instrumentation is provided to monitor operation of decay heat removal via the SGs. The EFW Flow to each SG is determined from a differential pressure measurement calibrated to a span of 0 gpm to 1200 gpm. Redundant monitoring capability is provided by two independent trains of instrumentation for each SG. Each differential pressure transmitter provides an input to a control room indicator and the unit computer.

EFW Flow is the primary indication used by the operator to determine the need to throttle flow during an SLB accident to prevent the EFW pumps from operating in runout conditions. EFW Flow is also used by the operator to verify that the EFW System is delivering the correct flow to each SG. However, the primary indication used by the operator to ensure an adequate inventory is SG level.

RCS pressure is used by the operator to monitor the cooldown of the RCS following an SG tube rupture or small break LOCA. In addition, HPI flow is throttled based on RCS pressure and subcooled margin. The indication is also used to identify an LPI pump operating at system pressures above its shutoff head. If this condition exists, the operator is instructed to verify this condition exists, to verify HPI flow, and to terminate LPI flow prior to exceeding 30 minutes of LPI pump operation against a deadhead pressure. RCS pressure, in

BASES

ACTIONS (continued)

B.1

Required Action B.1 specifies initiation of action described in Specification 5.6.7, that requires a written report to be submitted to the NRC. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative actions. This action is appropriate in lieu of a shutdown requirement since alternative actions are identified before loss of functional capability and given the likelihood of unit conditions that would require information provided by this instrumentation. The Completion Time of "Immediately" for Required Action B.1 ensures the requirements of Specification 5.6.7 are initiated.

C.1

When one or more Functions have two required channels inoperable (i.e., two channels inoperable in the same Function), one channel in the Function should be restored to OPERABLE status within 7 days. ~~This Condition does not apply to the hydrogen monitor channels.~~ The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrumentation action operation and the availability of alternative means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance of qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

~~D.1~~

~~When two required hydrogen monitor channels are inoperable, Required Action D.1 requires one channel to be restored to OPERABLE status. This action restores the monitoring capability of the hydrogen monitor. The 72 hour Completion Time is based on the relatively low probability of an event requiring hydrogen monitoring and the availability of alternative means to obtain the required information. Continuous operation with two required channels inoperable is not acceptable because alternate indications are not available.~~

~~D.1 → E.1~~

~~Required Action E.1 directs entry into the appropriate Condition referenced in Table 3.3.17-1. The applicable Condition referenced in the~~

BASES

ACTIONS (continued)

the Table is Function dependent. Each time an inoperable channel has not met any Required Action of Condition C or D, as applicable, and the associated Completion Time has expired, Condition E is entered for that channel and provides for transfer to the appropriate subsequent Condition. D

E.1 F.1

If the Required Action and associated Completion Time of Conditions C or D are not met and Table 3.3.17-1 directs entry into Condition E, the unit must be brought to a MODE in which the requirements of this LCO do not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

F.1 G.1

At this unit, alternative means of monitoring Containment Area Radiation have been developed and tested. These alternative means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allowed time.

If these alternative means are used, the Required Action is not to shut the unit down, but rather to follow the directions of Specification 5.6.7, in the Administrative Controls section of the Technical Specifications. The report provided to the NRC should discuss the alternative means used, describe the degree to which the alternative means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

In the case of reactor vessel level, Reference 4 determined that the appropriate Required Action was not to shut the unit down, but rather to follow the directions of Specification 5.6.8.

[At this unit, the alternative monitoring provisions consist of the following:]

B 3.6 CONTAINMENT SYSTEMS

B 3.6.8 Hydrogen Recombiners

BASES

BACKGROUND

Permanently installed hydrogen recombiners are required to reduce the hydrogen concentration in the containment following a loss of coolant accident (LOCA) or steam line break (SLB). The recombiners accomplish this by recombining hydrogen and oxygen to form water vapor. The vapor is returned to the containment thus eliminating any discharge to the environment. The hydrogen recombiners are manually initiated since flammability limits would not be reached until several days after a Design Basis Accident (DBA).

Two 100% capacity independent hydrogen recombiners are provided. Each consists of controls located in the control room, a power supply, and a recombiner located external to containment. The recombiners have no moving parts. Recombination is accomplished by heating a hydrogen air mixture above 1150°F. The resulting water vapor and discharge gases are cooled prior to discharge from the recombiner. Air flows through the unit at approximately 3000 cfm at a maximum supply temperature of 120°F. A single recombiner is capable of maintaining the hydrogen concentration in containment below the 4.1 volume percent (v/o) flammability limit. Two recombiners are provided to meet the requirement for redundancy and independence. Each recombiner is powered from a separate Engineered Safety Features bus and is provided with a separate power panel and control panel.

APPLICABLE
SAFETY
ANALYSES

The hydrogen recombiners provide for the capability of controlling the bulk hydrogen concentration in containment to less than a concentration of 4.1 v/o following a DBA. This control would prevent a hydrogen burn inside containment, thus ensuring the pressure and temperature assumed in the accident analysis are not exceeded. The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate within containment following a LOCA as a result of:

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant,
 - b. Radiolytic decomposition of water in the Reactor Coolant System (RCS) and the containment sump,
-

BASES

APPLICABLE SAFETY ANALYSES (continued)

- c. Hydrogen in the RCS at the time of the LOCA (i.e., hydrogen dissolved in the reactor coolant and hydrogen gas in the pressurizer vapor space), or
- d. Corrosion of metals exposed to Containment Spray System and Emergency Core Cooling Systems solutions.

To evaluate the potential for hydrogen accumulation in containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended by Reference 1 are used to maximize the amount of hydrogen calculated. These evaluations demonstrate approximately 10 days are needed for hydrogen concentration to increase to 4.1 v/o post LOCA.

The hydrogen recombiners satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two hydrogen recombiners must be OPERABLE. This ensures operation of at least one hydrogen recombiner in the event of a worst-case single active failure.

Operation with at least one hydrogen recombiner ensures that the post LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

APPLICABILITY

In MODES 1 and 2, two hydrogen recombiners are required to control the hydrogen concentration within containment below its flammability limit of 4.1 v/o following a LOCA, assuming a worst-case single failure.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the hydrogen recombiners is low. Therefore, the hydrogen recombiners are not required in MODE 3 or 4.

In MODES 5 and 6, the probability and consequences of a LOCA are low, due to the pressure and temperature limitations. Therefore, hydrogen recombiners are not required in these MODES.

BASES

ACTIONS

A.1

With one hydrogen recombiner inoperable, the inoperable recombiner must be restored to OPERABLE status within 30 days. In this condition, the remaining OPERABLE recombiner is adequate to perform the hydrogen control function. However, the overall reliability is reduced because a single failure in the OPERABLE recombiner could result in a reduced hydrogen control capability. The 30 day Completion Time is based on the availability of the other hydrogen recombiner, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

Required Action A.1 has been modified by a Note stating that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one hydrogen recombiner is inoperable. This allowance is based on the availability of the other hydrogen recombiner, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [the containment Hydrogen Purge System/hydrogen recombiner/Hydrogen Ignitor System/Hydrogen Mixing System/Containment Air Dilution System/Containment Inerting System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

~~BASES~~

~~ACTIONS (continued)~~

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified every 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check, by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If the inoperable hydrogen recombiner(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

~~SURVEILLANCE
REQUIREMENTS~~

SR 3.6.8.1

Performance of a system functional test for each hydrogen recombinder ensures that the recombiners are operational and can obtain and sustain the temperature necessary for hydrogen recombination. In particular, this SR requires verification that the minimum heater sheath temperature increases to $\geq 700^{\circ}\text{F}$ in ≤ 90 minutes. After reaching 700°F , the power is increased to maximum for approximately 2 minutes and power verified to be ≥ 60 kW. Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.8.2

This SR ensures that there are no physical problems that could affect recombiner operation. Since the recombiners are mechanically passive, they are not subject to mechanical failure. The only credible failures involve loss of power, blockage of the internal flow path, missile impact, etc. A visual inspection is sufficient to determine abnormal conditions that could cause such failures. The [18] month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

SR 3.6.8.3

This SR requires performance of a resistance to ground test for each heater phase to ensure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq 10,000$ ohms. The [18] month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

REFERENCES

1. Regulatory Guide 1.7, Revision [1].
-

3.3 INSTRUMENTATION

3.3.3 Post Accident Monitoring (PAM) Instrumentation

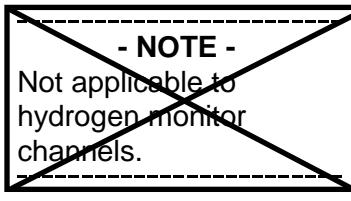
LCO 3.3.3 The PAM instrumentation for each Function in Table 3.3.3-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

- NOTES -

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C.  - NOTE - Not applicable to hydrogen monitor channels. One or more Functions with two required channels inoperable.	C.1 Restore one channel to OPERABLE status.	7 days
D. Two hydrogen monitor channels inoperable.	D.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. E. Required Action and associated Completion Time of Condition C or D not met.	E.1 D. Enter the Condition referenced in Table 3.3.3-1 for the channel.	Immediately
E. F. As required by Required Action E.1 and D.1 referenced in Table 3.3.3-1.	F.1 E. <u>AND</u> F.2 Be in MODE 3. Be in MODE 4.	6 hours 12 hours
F. G. As required by Required Action E.1 and D.1 referenced in Table 3.3.3-1.	G.1 F. Initiate action in accordance with Specification 5.6.7.	Immediately

SURVEILLANCE REQUIREMENTS

- NOTE -

SR 3.3.3.1 and SR 3.3.3.2 apply to each PAM instrumentation Function in Table 3.3.3-1.

	SURVEILLANCE	FREQUENCY
SR 3.3.3.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.3.2	<p>- NOTE -</p> <p>Neutron detectors are excluded from CHANNEL CALIBRATION.</p> <p>-----</p> <p>Perform CHANNEL CALIBRATION.</p>	[18] months

Table 3.3.3-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITION REFERENCED FROM REQUIRED ACTION E.1
1. Power Range Neutron Flux	2	F E D.1
2. Source Range Neutron Flux	2	F E
3. Reactor Coolant System (RCS) Hot Leg Temperature	2 per loop	F E
4. RCS Cold Leg Temperature	2 per loop	F E
5. RCS Pressure (Wide Range)	2	F E
6. Reactor Vessel Water Level	2	G F
7. Containment Sump Water Level (Wide Range)	2	F E
8. Containment Pressure (Wide Range)	2	F E
9. Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path ^{(a)(b)}	F E
10. Containment Area Radiation (High Range)	2	G F
11. Hydrogen Monitors	2	F
11. 12. Pressurizer Level	2	F E
12. 13. Steam Generator Water Level (Wide Range)	2 per steam generator	F E
13. 14. Condensate Storage Tank Level	2	F E
14. 15. Core Exit Temperature - Quadrant [1]	2 ^(c)	F E
15. 16. Core Exit Temperature - Quadrant [2]	2 ^(c)	F E
16. 17. Core Exit Temperature - Quadrant [3]	2 ^(c)	F E
17. 18. Core Exit Temperature - Quadrant [4]	2 ^(c)	F E
18. 19. Auxiliary Feedwater Flow	2	F E

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) A channel consists of two core exit thermocouples (CETs).

- REVIEWER'S NOTE -

Table 3.3.3-1 shall be amended for each unit as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category I, non-Type A instruments in accordance with the unit's Regulatory Guide 1.97, Safety Evaluation Report.

Hydrogen Recombiners (Atmospheric, Subatmospheric, Ice Condenser, and Dual)

3.6.8

3.6 CONTAINMENT SYSTEMS

3.6.8 Hydrogen Recombiners (Atmospheric, Subatmospheric, Ice Condenser, and Dual) (if permanently installed)

LCO 3.6.8 Two hydrogen recombines shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One hydrogen recombiner inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore hydrogen recombiner to OPERABLE status.</p>	30 days
B. [Two hydrogen recombines inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one hydrogen recombiner to OPERABLE status.</p>	<p>1 hour <u>AND</u> Once per 12 hours thereafter</p> <p>7 days]</p>
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

WOG STS

3.6.8 - 1

Rev. 2, 04/30/01

Hydrogen Recombiners (Atmospheric, Subatmospheric, Ice Condenser, and Dual)

3.6.8

SURVEILLANCE REQUIREMENTS

SURVEILLANCE

FREQUENCY

SR 3.6.8.1	Perform a system functional test for each hydrogen recombinder.	[18] months
SR 3.6.8.2	Visually examine each hydrogen recombinder enclosure and verify there is no evidence of abnormal conditions.	[18] months
SR 3.6.8.3	Perform a resistance to ground test for each heater phase.	[18] months

3.6 CONTAINMENT SYSTEMS

3.6.19 Shield Building (Dual and Ice Condenser)

3.6.8

LCO 3.6.19 The shield building shall be OPERABLE.
3.6.8

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Shield building inoperable.	A.1 Restore shield building to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.19.1 3.6.8.1 [Verify annulus negative pressure is > [5] inches water gauge.]	12 hours]
SR 3.6.19.2 3.6.8.2 Verify one shield building access door in each access opening is closed.	31 days
SR 3.6.19.3 3.6.8.3 [Verify shield building structural integrity by performing a visual inspection of the exposed interior and exterior surfaces of the shield building.]	During shutdown for SR 3.6.1.1 Type A tests

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.6.19.4 3.6.8.4 Verify the shield building can be maintained at a pressure equal to or more negative than [-0.5] inch water gauge in the annulus by one Shield Building Air Cleanup System train with final flow \leq [] cfm within [22] seconds after a start signal.	[18] months on a STAGGERED TEST BASIS for each Shield Building Air Cleanup System Train

5.6 Reporting Requirements

5.6.7 Post Accident Monitoring Report

F

When a report is required by Condition B or G of LCO 3.3.[3], "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

5.6.8 [Tendon Surveillance Report]

Any abnormal degradation of the containment structure detected during the tests required by the Pre-stressed Concrete Containment Tendon Surveillance Program shall be reported to the NRC within 30 days. The report shall include a description of the tendon condition, the condition of the concrete (especially at tendon anchorages), the inspection procedures, the tolerances on cracking, and the corrective action taken.]

5.6.9 [Steam Generator Tube Inspection Report]

- REVIEWER'S NOTES -

1. Reports required by the Licensee's current licensing basis regarding steam generator tube surveillance requirements shall be included here. An appropriate administrative controls format should be used.
 2. These reports may be required covering inspection, test, and maintenance activities. These reports are determined on an individual basis for each unit and their preparation and submittal are designated in the Technical Specifications.
-

REVISION HISTORY

REVISION	TSTF	DESCRIPTION	APPROVED
2.1	TSTF-419	Revise PTLR Definition and References in ISTS 5.6.6, RCS PTLR	03/21/02

BASES

LCO (continued)

for use by operators in determining the need to invoke site emergency plans. Containment radiation level is used to determine if a high energy line break (HELB) has occurred, and whether the event is inside or outside of containment.

~~11. Hydrogen Monitors~~

~~Hydrogen Monitors are provided to detect high hydrogen concentration conditions that represent a potential for containment breach from a hydrogen explosion. This variable is also important in verifying the adequacy of mitigating actions.~~

~~11. 12. Pressurizer Level~~

Pressurizer Level is used to determine whether to terminate SI, if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the unit conditions necessary to establish natural circulation in the RCS and to verify that the unit is maintained in a safe shutdown condition.

~~12. 13. Steam Generator Water Level (Wide Range)~~

SG Water Level is provided to monitor operation of decay heat removal via the SGs. The Category I indication of SG level is the extended startup range level instrumentation. The extended startup range level covers a span of \geq 6 inches to \leq 394 inches above the lower tubesheet. The measured differential pressure is displayed in inches of water at 68°F.

Temperature compensation of this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation. The uncompensated level signal is input to the unit computer, a control room indicator, and the Emergency Feedwater Control System.

SG Water Level (Wide Range) is used to:

- identify the faulted SG following a tube rupture,
- verify that the intact SGs are an adequate heat sink for the reactor,

BASES

LCO (continued)

- determine the nature of the accident in progress (e.g., verify an SGTR), and
- verify unit conditions for termination of SI during secondary unit HELBs outside containment.

At some units, operator action is based on the control room indication of SG level. The RCS response during a design basis small break LOCA depends on the break size. For a certain range of break sizes, the boiler condenser mode of heat transfer is necessary to remove decay heat. Extended startup range level is a Type A variable because the operator must manually raise and control SG level to establish boiler condenser heat transfer. Operator action is initiated on a loss of subcooled margin. Feedwater flow is increased until the indicated extended startup range level reaches the boiler condenser setpoint.

13. 44. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for auxiliary feedwater (AFW). The CST provides the ensured safety grade water supply for the AFW System. The CST consists of two identical tanks connected by a common outlet header. Inventory is monitored by a 0 inch to 144 inch level indication for each tank. CST Level is displayed on a control room indicator, strip chart recorder, and unit computer. In addition, a control room annunciator alarms on low level.

At some units, CST Level is considered a Type A variable because the control room meter and annunciator are considered the primary indication used by the operator.

The DBAs that require AFW are the loss of electric power, steam line break (SLB), and small break LOCA.

The CST is the initial source of water for the AFW System. However, as the CST is depleted, manual operator action is necessary to replenish the CST or align suction to the AFW pumps from the hotwell.

BASES

LCO (continued)

14, 15, 16, 17. ~~15, 16, 17, 18.~~ Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

An evaluation was made of the minimum number of valid core exit thermocouples (CET) necessary for measuring core cooling. The evaluation determined the reduced complement of CETs necessary to detect initial core recovery and trend the ensuing core heatup. The evaluations account for core nonuniformities, including incore effects of the radial decay power distribution, excore effects of condensate runback in the hot legs, and nonuniform inlet temperatures. Based on these evaluations, adequate core cooling is ensured with two valid Core Exit Temperature channels per quadrant with two CETs per required channel. The CET pair are oriented radially to permit evaluation of core radial decay power distribution. Core Exit Temperature is used to determine whether to terminate SI, if still in progress, or to reinitiate SI if it has been stopped. Core Exit Temperature is also used for unit stabilization and cooldown control.

Two OPERABLE channels of Core Exit Temperature are required in each quadrant to provide indication of radial distribution of the coolant temperature rise across representative regions of the core. Power distribution symmetry was considered in determining the specific number and locations provided for diagnosis of local core problems. Therefore, two randomly selected thermocouples are not sufficient to meet the two thermocouples per channel requirement in any quadrant. The two thermocouples in each channel must meet the additional requirement that one is located near the center of the core and the other near the core perimeter, such that the pair of Core Exit Temperatures indicate the radial temperature gradient across their core quadrant. Unit specific evaluations in response to Item II.F.2 of NUREG-0737 (Ref. 3) should have identified the thermocouple pairings that satisfy these requirements. Two sets of two thermocouples ensure a single failure will not disable the ability to determine the radial temperature gradient.

18. ~~49.~~ Auxiliary Feedwater Flow

AWF Flow is provided to monitor operation of decay heat removal via the SGs.

BASES

ACTIONS (continued)

applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur. Condition C is modified by a Note that excludes hydrogen monitor channels.

D.1

-REVIEWER'S NOTE-

Implementation of WCAP-14986, Rev 1, "Post Accident Sampling System Requirements: A Technical Basis," and the associated NRC Safety Evaluation dated June 14, 2000, allows other core damage assessment capabilities in lieu of the Post Accident Sampling System.

Condition D applies when two hydrogen monitor channels are inoperable. Required Action D.1 requires restoring one hydrogen monitor channel to OPERABLE status within 72 hours. The 72 hour Completion Time is reasonable based on [the backup capability of the Post Accident Sampling System to monitor the hydrogen concentration for evaluation of core damage or other core damage assessment capabilities available and] to provide information for operator decisions. Also, it is unlikely that a LOCA (which would cause core damage) would occur during this time.

D.1 E.1

D

is

Condition E applies when the Required Action and associated Completion Time of Condition C or D are not met. Required Action E.1 requires entering the appropriate Condition referenced in Table 3.3.3-1 for the channel immediately. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has not met any Required Action of Condition C or D, and the associated Completion Time has expired, Condition E is entered for that channel and provides for transfer to the appropriate subsequent Condition.

D

E.1 and E.2

F.1 and F.2

is If the Required Action and associated Completion Time of Conditions C or D are not met and Table 3.3.3-1 directs entry into Condition F, the unit must be brought to a MODE where the requirements of this LCO do not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and MODE 4 within 12 hours.

BASES

ACTIONS (continued)

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

F.1 G.1

At this unit, alternate means of monitoring Reactor Vessel Water Level and Containment Area Radiation have been developed and tested. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the unit but rather to follow the directions of Specification 5.6.7, in the Administrative Controls section of the TS. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

SURVEILLANCE REQUIREMENTS

A Note has been added to the SR Table to clarify that SR 3.3.3.1 and SR 3.3.3.3 apply to each PAM instrumentation Function in Table 3.3.3-1.

SR 3.3.3.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar unit instruments located throughout the unit.

Agreement criteria are determined by the unit staff, based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE.

B 3.6 CONTAINMENT SYSTEMS**B 3.6.8 Hydrogen Recombiners (Atmospheric, Subatmospheric, Ice Condenser, and Dual)
(if permanently installed)****BASES****BACKGROUND**

The function of the hydrogen recombines is to eliminate the potential breach of containment due to a hydrogen oxygen reaction.

Per 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1), and GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), hydrogen recombines are required to reduce the hydrogen concentration in the containment following a loss of coolant accident (LOCA) or steam line break (SLB). The recombines accomplish this by recombining hydrogen and oxygen to form water vapor. The vapor remains in containment, thus eliminating any discharge to the environment. The hydrogen recombines are manually initiated since flammable limits would not be reached until several days after a Design Basis Accident (DBA).

Two 100% capacity independent hydrogen recombination systems are provided. Each consists of controls located in the control room, a power supply and a recombiner. Recombination is accomplished by heating a hydrogen air mixture above 1150°F. The resulting water vapor and discharge gases are cooled prior to discharge from the recombiner. A single recombiner is capable of maintaining the hydrogen concentration in containment below the 4.1 volume percent (v/o) flammability limit. Two recombines are provided to meet the requirement for redundancy and independence. Each recombiner is powered from a separate Engineered Safety Features bus, and is provided with a separate power panel and control panel.

**APPLICABLE
SAFETY
ANALYSES**

The hydrogen recombines provide for the capability of controlling the bulk hydrogen concentration in containment to less than the lower flammable concentration of 4.1 v/o following a DBA. This control would prevent a containment wide hydrogen burn, thus ensuring the pressure and temperature assumed in the analyses are not exceeded. The limiting DBA relative to hydrogen generation is a LOCA. Hydrogen may accumulate in containment following a LOCA as a result of:

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant,

BASES**APPLICABLE SAFETY ANALYSES (continued)**

- b. Radiolytic decomposition of water in the Reactor Coolant System (RCS) and the containment sump,
- c. Hydrogen in the RCS at the time of the LOCA (i.e., hydrogen dissolved in the reactor coolant and hydrogen gas in the pressurizer vapor space), or
- d. Corrosion of metals exposed to containment spray and Emergency Core Cooling System solutions.

To evaluate the potential for hydrogen accumulation in containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended by Reference 3 are used to maximize the amount of hydrogen calculated.

Based on the conservative assumptions used to calculate the hydrogen concentration versus time after a LOCA, the hydrogen concentration in the primary containment would reach 3.5 v/o about 6 days after the LOCA and 4.0 v/o about 2 days later if no recombiner was functioning (Ref. 3). Initiating the hydrogen recombiners when the primary containment hydrogen concentration reaches 3.5 v/o will maintain the hydrogen concentration in the primary containment below flammability limits.

The hydrogen recombiners are designed such that, with the conservatively calculated hydrogen generation rates discussed above, a single recombiner is capable of limiting the peak hydrogen concentration in containment to less than 4.0 v/o (Ref. 4). The Hydrogen Purge System is similarly designed such that one of two redundant trains is an adequate backup to the redundant hydrogen recombiners.

The hydrogen recombiners satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two hydrogen recombiners must be OPERABLE. This ensures operation of at least one hydrogen recombiner in the event of a worst case single active failure.

Operation with at least one hydrogen recombiner ensures that the post LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

BASES

APPLICABILITY

In MODES 1 and 2, two hydrogen recombiners are required to control the hydrogen concentration within containment below its flammability limit of 4.1 v/o following a LOCA, assuming a worst case single failure.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the hydrogen recombiners is low. Therefore, the hydrogen recombiners are not required in MODE 3 or 4.

In MODES 5 and 6, the probability and consequences of a LOCA are low, due to the pressure and temperature limitations in these MODES. Therefore, hydrogen recombiners are not required in these MODES.

ACTIONS

A.1

With one containment hydrogen recombiner inoperable, the inoperable recombiner must be restored to OPERABLE status within 30 days. In this condition, the remaining OPERABLE hydrogen recombiner is adequate to perform the hydrogen control function. However, the overall reliability is reduced because a single failure in the OPERABLE recombiner could result in reduced hydrogen control capability. The 30 day Completion Time is based on the availability of the other hydrogen recombiner, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

Required Action A.1 has been modified by a Note that states the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one recombiner is inoperable. This allowance is based on the availability of the other hydrogen recombiner, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

~~BASES~~

ACTIONS (continued)

B.1 and B.2**- REVIEWER'S NOTE -**

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [the containment Hydrogen Purge System/ Hydrogen Recombiner/Hydrogen Ignitor System/ Hydrogen Mixing System/ Containment Air Dilution System/ Containment Inerting System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If the inoperable hydrogen recombiner(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The Completion Time of 6 hours is reasonable, based on operating

~~BASES~~~~ACTIONS (continued)~~

experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

~~SURVEILLANCE REQUIREMENTS~~SR 3.6.8.1

Performance of a system functional test for each hydrogen recombinder ensures the recombiners are operational and can attain and sustain the temperature necessary for hydrogen recombination. In particular, this SR verifies that the minimum heater sheath temperature increases to $\geq 700^{\circ}\text{F}$ in ≤ 90 minutes. After reaching 700°F , the power is increased to maximum power for approximately 2 minutes and power is verified to be ≥ 60 kW.

Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.8.2

This SR ensures there are no physical problems that could affect recombinder operation. Since the recombiners are mechanically passive, they are not subject to mechanical failure. The only credible failure involves loss of power, blockage of the internal flow, missile impact, etc.

A visual inspection is sufficient to determine abnormal conditions that could cause such failures. The [18] month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

SR 3.6.8.3

This SR requires performance of a resistance to ground test for each heater phase to ensure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq 10,000$ ohms.

The [18] month Frequency for this Surveillance was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

Hydrogen Recombiners (Atmospheric, Subatmospheric, Ice Condenser, and Dual)

B 3.6.8

BASES

REFERENCES

1. 10 CFR 50.44.
 2. 10 CFR 50, Appendix A, GDC 41.
 3. Regulatory Guide 1.7, Revision [1].
 4. FSAR Section 15.
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BASES

APPLICABILITY	<p>In MODES 1 and 2, the two HMS trains ensure the capability to prevent localized hydrogen concentrations above the flammability limit of 4.1 volume percent in containment assuming a worst case single active failure.</p> <p>In MODE 3 or 4, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the HMS is low. Therefore, the HMS is not required in MODE 3 or 4.</p> <p>In MODES 5 and 6, the probability and consequences of a LOCA or steam line break (SLB) are reduced due to the pressure and temperature limitations in these MODES. Therefore, the HMS is not required in these MODES.</p>
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ACTIONS	<p><u>A.1</u></p> <p>With one HMS train inoperable, the inoperable train must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE HMS train is adequate to perform the hydrogen mixing function. However, the overall reliability is reduced because a single failure in the OPERABLE train could result in reduced hydrogen mixing capability. The 30 day Completion Time is based on the availability of the other HMS train, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit, and the availability of the hydrogen recombiners, Containment Spray System, Hydrogen Purge System, and hydrogen monitors. and</p> <p>Required Action A.1 has been modified by a Note that states the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one HMS train is inoperable. This allowance is based on the availability of the other HMS train, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.</p>
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BASES

ACTIONS (continued)

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two HMS trains inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [the containment Hydrogen Purge System/ Hydrogen Recombiner/Hydrogen Ignitor System/ HMS/ Containment Air Dilution System/ Containment Inerting System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check, by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two HMS trains inoperable for up to 7 days. Seven days is a reasonable time to allow two HMS trains to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If an inoperable HMS train cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating

BASES

BACKGROUND (continued)

pockets of hydrogen at increased concentrations would burn before reaching a hydrogen concentration significantly higher than the lower flammability limit. Hydrogen ignition in the vicinity of the ignitors is assumed to occur when the local hydrogen concentration reaches [8.0] volume percent (v/o) and results in [85]% of the hydrogen present being consumed.

APPLICABLE SAFETY ANALYSES	<p>The HIS causes hydrogen in containment to burn in a controlled manner as it accumulates following a degraded core accident (Ref. 3). Burning occurs at the lower flammability concentration, where the resulting temperatures and pressures are relatively benign. Without the system, hydrogen could build up to higher concentrations that could result in a violent reaction if ignited by a random ignition source after such a buildup.</p> <p>The hydrogen ignitors are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners. The hydrogen ignitors, however, have been shown by probabilistic risk analysis to be a significant contributor to limiting the severity of accident sequences that are commonly found to dominate risk for units with ice condenser containments. The hydrogen ignitors satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).</p>
LCO	<p>Two HIS trains must be OPERABLE with power from two independent, safety related power supplies.</p> <p>For this unit, an OPERABLE HIS train consists of 32 of 33 ignitors energized on the train.</p> <p>Operation with at least one HIS train ensures that the hydrogen in containment can be burned in a controlled manner. Unavailability of both HIS trains could lead to hydrogen buildup to higher concentrations, which could result in a violent reaction if ignited. The reaction could take place fast enough to lead to high temperatures and overpressurization of containment and, as a result, breach containment or cause containment leakage rates above those assumed in the safety analyses. Damage to safety related equipment located in containment could also occur.</p>

B 3.6 CONTAINMENT SYSTEMS

B 3.6.19 Shield Building (Dual and Ice Condenser) 3.6.8

BASES

BACKGROUND	<p>The shield building is a concrete structure that surrounds the steel containment vessel. Between the containment vessel and the shield building inner wall is an annular space that collects containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the steel containment vessel.</p> <p>The Shield Building Air Cleanup System (SBACS) establishes a negative pressure in the annulus between the shield building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment. The shield building is required to be OPERABLE to ensure retention of containment leakage and proper operation of the SBACS.</p>
APPLICABLE SAFETY ANALYSES	<p>The design basis for shield building OPERABILITY is a LOCA. Maintaining shield building OPERABILITY ensures that the release of radioactive material from the containment atmosphere is restricted to those leakage paths and associated leakage rates assumed in the accident analyses.</p> <p>The shield building satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).</p>
LCO	<p>Shield building OPERABILITY must be maintained to ensure proper operation of the SBACS and to limit radioactive leakage from the containment to those paths and leakage rates assumed in the accident analyses.</p>
APPLICABILITY	<p>Maintaining shield building OPERABILITY prevents leakage of radioactive material from the shield building. Radioactive material may enter the shield building from the containment following a LOCA. Therefore, shield building OPERABILITY is required in MODES 1, 2, 3, and 4 when a steam line break, LOCA, or rod ejection accident could release radioactive material to the containment atmosphere.</p> <p>In MODES 5 and 6, the probability and consequences of these events are low due to the Reactor Coolant System temperature and pressure limitations in these MODES. Therefore, shield building OPERABILITY is not required in MODE 5 or 6.</p>

BASES

ACTIONS

A.1

In the event shield building OPERABILITY is not maintained, shield building OPERABILITY must be restored within 24 hours. Twenty-four hours is a reasonable Completion Time considering the limited leakage design of containment and the low probability of a Design Basis Accident occurring during this time period.

B.1 and B.2

If the shield building cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS[SR 3.6.19.1 3.6.8.1

Verifying that shield building annulus negative pressure is within limit ensures that operation remains within the limit assumed in the containment analysis. The 12 hour Frequency of this SR was developed considering operating experience related to shield building annulus pressure variations and pressure instrument drift during the applicable MODES.]

SR 3.6.19.2 3.6.8.2

Maintaining shield building OPERABILITY requires verifying one door in the access opening closed. [An access opening may contain one inner and one outer door, or in some cases, shield building access openings are shared such that a shield building barrier may have multiple inner or multiple outer doors. The intent is to not breach the shield building boundary at any time when the shield building boundary is required. This is achieved by maintaining the inner or outer portion of the barrier closed at all times.] However, all shield building access doors are normally kept closed, except when the access opening is being used for entry and exit or when maintenance is being performed on an access opening. The 31 day Frequency of this SR is based on engineering judgment and is considered adequate in view of the other indications of door status that are available to the operator.

BASES

SURVEILLANCE REQUIREMENTS (continued)

[SR 3.6.19.3 3.6.8.3

This SR would give advance indication of gross deterioration of the concrete structural integrity of the shield building. The Frequency of this SR is the same as that of SR 3.6.1.1. The verification is done during shutdown.]

SR 3.6.19.4 3.6.8.4

The Shield Building Air Cleanup System produces a negative pressure to prevent leakage from the building. SR 3.6.19.4 verifies that the shield building can be rapidly drawn down to [-0.5] inch water gauge in the annulus. This test is used to ensure shield building boundary integrity.

3.6.8.4

Establishment of this pressure is confirmed by SR 3.6.19.4, which demonstrates that the shield building can be drawn down to \leq [-0.5] inches of vacuum water gauge in the annulus \leq [22] seconds using one Shield Building Air Cleanup System train. The time limit ensures that no significant quantity of radioactive material leaks from the shield building prior to developing the negative pressure. Since this SR is a shield building boundary integrity test, it does not need to be performed with each Shield Building Air Cleanup System train. The Shield Building Air Cleanup System train used for this Surveillance is staggered to ensure that in addition to the requirements of LCO 3.6.19.4, either train will perform this test. The primary purpose of this SR is to ensure shield building integrity. The secondary purpose of this SR is to ensure that the Shield Building Air Cleanup System being tested functions as designed. The inoperability of the Shield Building Air Cleanup System train does not necessarily constitute a failure of this Surveillance relative to the shield building OPERABILITY. The 18 month Frequency is based on the need to perform this Surveillance under conditions that apply during a plant outage.

SR 3.6.8.4

REFERENCESNone.

3.3 INSTRUMENTATION

3.3.11 Post Accident Monitoring (PAM) Instrumentation (Analog)

LCO 3.3.11 The PAM instrumentation for each Function in Table 3.3.11-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

- NOTES -

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C. One or more Functions with two required channels inoperable.	C.1 Restore one channel to OPERABLE status.	7 days
D. Two hydrogen monitor channels inoperable.	D.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. E. Required Action and associated Completion Time of Condition C or D not met.	E.1 D. Enter the Condition referenced in Table 3.3.11-1 for the channel.	Immediately
E. F. As required by Required Action E.1 and D.1 referenced in Table 3.3.11-1.	F.1 E. <u>AND</u> F.2 Be in MODE 4.	6 hours 12 hours
F. G. [As required by Required Action E.1 and D.1 referenced in Table 3.3.11-1.	G.1 F. Initiate action in accordance with Specification 5.6.7.	Immediately]

SURVEILLANCE REQUIREMENTS

- NOTE -

These SRs apply to each PAM instrumentation Function in Table 3.3.11-1.

SURVEILLANCE		FREQUENCY
SR 3.3.11.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.11.2	<p>- NOTE -</p> <p>Neutron detectors are excluded from CHANNEL CALIBRATION.</p> <p>Perform CHANNEL CALIBRATION.</p>	[18] months

Table 3.3.11-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITIONS REFERENCED FROM REQUIRED ACTION E.1 D.1
1. [Logarithmic] Neutron Flux	2	F E
2. Reactor Coolant System Hot Leg Temperature	2 per loop	F E
3. Reactor Coolant System Cold Leg Temperature	2 per loop	F E
4. Reactor Coolant System Pressure (wide range)	2	F E
5. Reactor Vessel Water Level	2	[G] F
6. Containment Sump Water Level (wide range)	2	F E
7. Containment Pressure (wide range)	2	F E
8. Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path ^{(a)(b)}	F E
9. Containment Area Radiation (high range)	2	[G] F
10. Containment Hydrogen Monitors	2	F
10.44. Pressurizer Level	2	F E
11.42. Steam Generator Water Level (wide range)	2 per steam generator	F E
12.43. Condensate Storage Tank Level	2	F E
13.44. Core Exit Temperature - Quadrant [1]	2 ^(c)	F E
14.45. Core Exit Temperature - Quadrant [2]	2 ^(c)	F E
15.46. Core Exit Temperature - Quadrant [3]	2 ^(c)	F E
16.47. Core Exit Temperature - Quadrant [4]	2 ^(c)	F E
17.48. Auxiliary Feedwater Flow	2	F E

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) A channel consists of two or more core exit thermocouples.

- REVIEWER'S NOTE -

Table 3.3.11-1 shall be amended for each unit as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category I, non-Type A instruments specified in the unit's Regulatory Guide 1.97, Safety Evaluation Report.

3.3 INSTRUMENTATION

3.3.11 Post Accident Monitoring (PAM) Instrumentation (Digital)

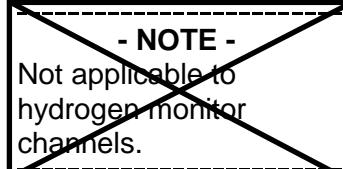
LCO 3.3.11 The PAM instrumentation for each Function in Table 3.3.11-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.
During movement of [recently] irradiated fuel assemblies.

ACTIONS

- NOTES -

1. LCO 3.0.4 not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C.  - NOTE - Not applicable to hydrogen monitor channels. One or more Functions with two required channels inoperable.	C.1 Restore one channel to OPERABLE status.	7 days
D. Two hydrogen monitor channels inoperable.	D.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. <u>E.</u> Required Action and associated Completion Time of Condition C or D not met.	E.1 D. Enter the Condition referenced in Table 3.3.11-1 for the channel.	Immediately
E. <u>F.</u> As required by Required Action E.1 and referenced in Table 3.3.11-1.	F.1 E. <u>AND</u> E. F.2 Be in MODE 3. Be in MODE 4.	6 hours 12 hours
F. <u>G.</u> [As required by Required Action E.1 and referenced in Table 3.3.11-1.	G.1 F. Initiate action in accordance with Specification 5.6.7.	Immediately]

SURVEILLANCE REQUIREMENTS

- NOTE -

These SRs apply to each PAM instrumentation Function in Table 3.3.11-1.

SURVEILLANCE		FREQUENCY
SR 3.3.11.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.11.2	<p>- NOTE -</p> <p>Neutron detectors are excluded from the CHANNEL CALIBRATION.</p> <p>Perform CHANNEL CALIBRATION.</p>	[18] months

Table 3.3.11-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITIONS REFERENCED FROM REQUIRED ACTION E.1	D.1
1. [Wide Range] Neutron Flux	2	F E	
2. Reactor Coolant System Hot Leg Temperature	2 per loop	F E	
3. Reactor Coolant System Cold Leg Temperature	2 per loop	F E	
4. Reactor Coolant System Pressure (wide range)	2	F E	
5. Reactor Vessel Water Level	2	[G] F	
6. Containment Sump Water Level (wide range)	2	F E	
7. Containment Pressure (wide range)	2	F E	
8. Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path ^{(a)(b)}	F E	
9. Containment Area Radiation (high range)	2	[G] F	
10. Containment Hydrogen Monitors	2	F	
10.41. Pressurizer Level	2	F E	
11.42. Steam Generator Water Level (wide range)	2 per steam generator	F E	
12. 43. Condensate Storage Tank Level	2	F E	
13. 44. Core Exit Temperature - Quadrant [1]	2 ^(c)	F E	
14. 45. Core Exit Temperature - Quadrant [2]	2 ^(c)	F E	
15. 46. Core Exit Temperature - Quadrant [3]	2 ^(c)	F E	
16. 47. Core Exit Temperature - Quadrant [4]	2 ^(c)	F E	
17. 48. Emergency Feedwater Flow	2	F E	

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) A channel consists of two or more core exit thermocouples.

- REVIEWER'S NOTE -

Table 3.3.11-1 shall be amended for each unit as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category I, non-Type A instruments specified in the unit's Regulatory Guide 1.97, Safety Evaluation Report.

Hydrogen Recombiners (Atmospheric and Dual)

3.6.8

3.6 CONTAINMENT SYSTEMS

3.6.8 Hydrogen Recombiners (Atmospheric and Dual) (if permanently installed)

LCO 3.6.8 [Two] hydrogen recombines shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One hydrogen recombiner inoperable.	<p>A.1 -----</p> <p style="text-align: center;">- NOTE -</p> <p>LCO 3.0.4 is not applicable.</p> <p>-----</p> <p>Restore hydrogen recombiner to OPERABLE status.</p>	30 days
B. [Two hydrogen recombines inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one hydrogen recombiner to OPERABLE status.</p>	<p>1 hour</p> <p><u>AND</u></p> <p>Once every 12 hours thereafter</p> <p>7 days</p>
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

Hydrogen Recombiners (Atmospheric and Dual)

3.6.8

~~SURVEILLANCE REQUIREMENTS~~~~SURVEILLANCE~~~~FREQUENCY~~

SR 3.6.8.1 Perform a system functional test for each hydrogen recombinder.

[18] months

SR 3.6.8.2 Visually examine each hydrogen recombinder enclosure and verify there is no evidence of abnormal conditions.

[18] months

SR 3.6.8.3 Perform a resistance to ground test for each heater phase.

[18] months

3.6 CONTAINMENT SYSTEMS

3.6.13 Shield Building Exhaust Air Cleanup System (SBEACS) (Dual)

3.6.8

LCO ~~3.6.13~~ Two SBEACS trains shall be OPERABLE.
3.6.8

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One SBEACS train inoperable.	A.1 Restore train to OPERABLE status.	7 days
B. Required Action and Associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.13.1 3.6.8.1	Operate each SBEACS train for [\geq 10 continuous hours with the heaters operating or (for systems without heaters) \geq 15 minutes].	31 days
SR 3.6.13.2 3.6.8.2	Perform required SBEACS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.6.13.3 3.6.8.3	Verify each SBEACS train actuates on an actual or simulated actuation signal.	[18] months
SR 3.6.13.4 3.6.8.4	[Verify each SBEACS filter bypass damper can be opened.	[18] months]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.6.13.5 3.6.8.5 Verify each SBEACS train flow rate is \geq [] cfm.	[18] months on a STAGGERED TEST BASIS

5.6 Reporting Requirements

5.6.6 RCS Pressure and Temperature Limits Report (continued)

- REVIEWER'S NOTE -

The methodology for the calculation of the P-T limits for NRC approval should include the following provisions:

1. The methodology shall describe how the neutron fluence is calculated (reference new Regulatory Guide when issued).
 2. The Reactor Vessel Material Surveillance Program shall comply with Appendix H to 10 CFR 50. The reactor vessel material irradiation surveillance specimen removal schedule shall be provided, along with how the specimen examinations shall be used to update the PTLR curves.
 3. Low Temperature Overpressure Protection (LTOP) System lift setting limits for the Power Operated Relief Valves (PORVs), developed using NRC-approved methodologies may be included in the PTLR.
 4. The adjusted reference temperature (ART) for each reactor beltline material shall be calculated, accounting for radiation embrittlement, in accordance with Regulatory Guide 1.99, Revision 2.
 5. The limiting ART shall be incorporated into the calculation of the pressure and temperature limit curves in accordance with NUREG-0800 Standard Review Plan 5.3.2, Pressure-Temperature Limits.
 6. The minimum temperature requirements of Appendix G to 10 CFR Part 50 shall be incorporated into the pressure and temperature limit curves.
 7. Licensees who have removed two or more capsules should compare for each surveillance material the measured increase in reference temperature (RT_{NDT}) to the predicted increase in RT_{NDT} ; where the predicted increase in RT_{NDT} is based on the mean shift in RT_{NDT} plus the two standard deviation value ($2\sigma_\Delta$) specified in Regulatory Guide 1.99, Revision 2. If the measured value exceeds the predicted value (increase in $RT_{NDT} + 2\sigma_\Delta$), the licensee should provide a supplement to the PTLR to demonstrate how the results affect the approved methodology.
-

5.6.7 Post Accident Monitoring Report

F

When a report is required by Condition B or G of LCO 3.3.[17], "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of

BASES

LCO (continued)

8. Containment Isolation Valve Position

Containment Isolation Valve Position is provided for verification of containment OPERABILITY.

PCIV position is provided for verification of containment integrity. In the case of PCIV position, the important information is the isolation status of the containment penetration. The LCO requires one channel of valve position indication in the control room to be OPERABLE for each active PCIV in a containment penetration flow path, i.e., two total channels of PCIV position indication for a penetration flow path with two active valves. For containment penetrations with only one active PCIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration flow path is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required to be OPERABLE. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

[For this unit, the PCIV position PAM instrumentation consists of the following:]

9. Containment Area Radiation (high range)

Containment Area Radiation is provided to monitor for the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans.

[For this unit, Containment Area Radiation instrumentation consists of the following:]

10. Containment Hydrogen Monitors

Containment Hydrogen Monitors are provided to detect high hydrogen concentration conditions that represent a potential for

BASES

LCO (continued)

~~containment breach. This variable is also important in verifying the adequacy of mitigating actions.~~

~~[For this unit, Containment Hydrogen instrumentation consists of the following:]~~

10. ~~11.~~ Pressurizer Level

Pressurizer Level is used to determine whether to terminate safety injection (SI), if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the plant conditions necessary to establish natural circulation in the RCS and to verify that the plant is maintained in a safe shutdown condition.

~~[For this unit, Pressurizer Level instrumentation consists of the following:]~~

11. ~~12.~~ Steam Generator Water Level

Steam Generator Water Level is provided to monitor operation of decay heat removal via the steam generators. The Category I indication of steam generator level is the extended startup range level instrumentation. The extended startup range level covers a span of 6 inches to 394 inches above the lower tubesheet. The measured differential pressure is displayed in inches of water at 68°F. Temperature compensation of this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation. The uncompensated level signal is input to the plant computer, a control room indicator, and the [Auxiliary Feedwater (AFW)] Control System.

At some plants, operator action is based on the control room indication of Steam Generator Water Level. The RCS response during a design basis small break LOCA is dependent on the break size. For a certain range of break sizes, the boiler condenser mode of heat transfer is necessary to remove decay heat. At these plants, extended startup range level is a Type A variable because the operator must manually raise and control the steam generator level to establish boiler condenser heat transfer. Operator action is initiated on a loss of subcooled margin. Feedwater flow is increased until the indicated extended startup range level reaches the boiler condenser setpoint.

BASES

LCO (continued)

12. 13. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for [AFW]. The CST provides the ensured safety grade water supply for the [AFW] System. The CST consists of two identical tanks connected by a common outlet header. Inventory is monitored by a 0 to 144 inch level indication for each tank. CST Level is displayed on a control room indicator, strip chart recorder, and plant computer. In addition, a control room annunciator alarms on low level.

At some plants, CST Level is considered a Type A variable because the control room meter and annunciator are considered the primary indication used by the operator. The DBAs that require [AFW] are the loss of electric power, steam line break (SLB), and small break LOCA. The CST is the initial source of water for the [AFW] System. However, as the CST is depleted, manual operator action is necessary to replenish the CST or align suction to the [AFW] pumps from the hotwell.

13, 14, 15, 16.

14, 15, 16, 17. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

An evaluation was made of the minimum number of valid core exit thermocouples necessary for inadequate core cooling detection. The evaluation determined the reduced complement of core exit thermocouples necessary to detect initial core uncover and trend the ensuing core heatup. The evaluations account for core nonuniformities including incore effects of the radial decay power distribution and excore effects of condensate runback in the hot legs and nonuniform inlet temperatures. Based on these evaluations, adequate or inadequate core cooling detection is ensured with two valid core exit thermocouples per quadrant.

The design of the Incore Instrumentation System includes a Type K (chromel alumel) thermocouple within each of the 56 incore instrument detector assemblies.

The junction of each thermocouple is located a few inches above the fuel assembly, inside a structure that supports and shields the incore instrument detector assembly string from flow forces in the outlet

BASES

LCO (continued)

plenum region. These core exit thermocouples monitor the temperature of the reactor coolant as it exits the fuel assemblies.

The core exit thermocouples have a usable temperature range from 32°F to 2300°F, although accuracy is reduced at temperatures above 1800°F.

17,

18. [Auxiliary Feedwater (AFW)] Flow

[AFW] Flow is provided to monitor operation of decay heat removal via the steam generators.

The [AFW] Flow to each steam generator is determined from a differential pressure measurement calibrated to a span of 0 gpm to 1200 gpm. Redundant monitoring capability is provided by two independent trains of instrumentation for each steam generator. Each differential pressure transmitter provides an input to a control room indicator and the plant computer. Since the primary indication used by the operator during an accident is the control room indicator, the PAM instrumentation Specification deals specifically with this portion of the instrument channel.

At some plants [AFW] Flow is a Type A variable because operator action is required to throttle flow during an SLB accident in order to prevent the [AFW] pumps from operating in runout conditions.

[AFW] Flow is also used by the operator to verify that the [AFW] System is delivering the correct flow to each steam generator.

However, the primary indication used by the operator to ensure an adequate inventory is steam generator level.

Two channels are required to be OPERABLE for all but one Function. Two OPERABLE channels ensure that no single failure, within either the PAM instrumentation or its auxiliary supporting features or power sources (concurrent with the failures that are a condition of or result from a specific accident), prevents the operators from being presented the information necessary for them to determine the safety status of the plant and to bring the plant to and maintain it in a safe condition following that accident.

In Table 3.3.11-1 the exception to the two channel requirement is Containment Isolation Valve Position.

BASES

ACTIONS (continued)

Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrumentation operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

D.1

~~When two required hydrogen monitor channels are inoperable, Required Action D.1 requires one channel to be restored to OPERABLE status. This Required Action restores the monitoring capability of the hydrogen monitor. The 72 hour Completion Time is based on the relatively low probability of an event requiring hydrogen monitoring and the availability of alternative means to obtain the required information. Continuous operation with two required channels inoperable is not acceptable because alternate indications are not available.~~

D.1 E.1

This Required Action directs entry into the appropriate Condition referenced in Table 3.3.11-1. The applicable Condition referenced in the Table is Function dependent. Each time Required Action C.1 or D.1 is not met, and the associated Completion Time has expired, Condition E is entered for that channel and provides for transfer to the appropriate subsequent Condition.

E.1 and E.2 F.1 and F.2

If the Required Action and associated Completion Time of Condition G is not met, and Table 3.3.11-1 directs entry into Condition F, the plant must be brought to a MODE in which the requirements of this LCO do not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

BASES

ACTIONS (continued)

F.1

G.4

[At this plant, alternate means of monitoring Reactor Vessel Water Level and Containment Area Radiation have been developed and tested. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the plant, but rather to follow the directions of Specification 5.6.7. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.]

SURVEILLANCE REQUIREMENTS

A Note at the beginning of the Surveillance Requirements specifies that the following SRs apply to each PAM instrumentation Function in Table 3.3.11-1.

SR 3.3.11.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction. Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.

BASES

LCO (continued)

PCIV position is provided for verification of containment integrity. In the case of PCIV position, the important information is the isolation status of the containment penetration. The LCO requires one channel of valve position indication in the control room to be OPERABLE for each active PCIV in a containment penetration flow path, i.e., two total channels of PCIV position indication for a penetration flow path with two active valves. For containment penetrations with only one active PCIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration flow path is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required to be OPERABLE. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate condition entry is allowed for each inoperable penetration flow path.

[For this unit, the PCIV position PAM instrumentation consists of the following:]

9. Containment Area Radiation (high range)

Containment Area Radiation is provided to monitor for the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans.

[For this unit, Containment Area Radiation instrumentation consists of the following:]

10. Containment Hydrogen Monitors

Containment Hydrogen Monitors are provided to detect high hydrogen concentration conditions that represent a potential for containment breach. This variable is also important in verifying the adequacy of mitigating actions.

[For this unit, Containment Hydrogen instrumentation consists of the following:]

BASES

LCO (continued)

10. 41. Pressurizer Level

Pressurizer Level is used to determine whether to terminate safety injection (SI), if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the plant conditions necessary to establish natural circulation in the RCS and to verify that the plant is maintained in a safe shutdown condition.

[For this unit, Pressurizer Level instrumentation consists of the following:]

11. 42. Steam Generator Water Level

Steam Generator Water Level is provided to monitor operation of decay heat removal via the steam generators. The Category I indication of steam generator level is the extended startup range level instrumentation. The extended startup range level covers a span of 6 inches to 394 inches above the lower tubesheet. The measured differential pressure is displayed in inches of water at 68°F. Temperature compensation of this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation. The uncompensated level signal is input to the plant computer, a control room indicator, and the Emergency Feedwater (EFW) Control System.

At some plants, operator action is based on the control room indication of Steam Generator Water Level. The RCS response during a design basis small break LOCA is dependent on the break size. For a certain range of break sizes, the boiler condenser mode of heat transfer is necessary to remove decay heat. At these plants, extended startup range level is a Type A variable because the operator must manually raise and control the steam generator level to establish boiler condenser heat transfer. Operator action is initiated on a loss of subcooled margin. Feedwater flow is increased until the indicated extended startup range level reaches the boiler condenser setpoint.

12. 43. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for EFW. The CST provides the ensured, safety grade water supply for the EFW System. The CST consists of two identical tanks connected by a

BASES

LCO (continued)

common outlet header. Inventory is monitored by a 0 to 144 inch level indication for each tank. CST Level is displayed on a control room indicator, strip chart recorder, and plant computer. In addition, a control room annunciator alarms on low level.

At some plants, CST Level is considered a Type A variable because the control room meter and annunciator are considered the primary indication used by the operator. The DBAs that require EFW are the loss of electric power, steam line break (SLB), and small break LOCA. The CST is the initial source of water for the EFW System. However, as the CST is depleted, manual operator action is necessary to replenish the CST or align suction to the EFW pumps from the hotwell.

13, 14, 15, 16.

14, 15, 16, 17. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

An evaluation was made of the minimum number of valid core exit thermocouples necessary for inadequate core cooling detection. The evaluation determined the reduced complement of core exit thermocouples necessary to detect initial core recovery and trend the ensuing core heatup. The evaluations account for core nonuniformities including incore effects of the radial decay power distribution and excore effects of condensate runback in the hot legs and nonuniform inlet temperatures. Based on these evaluations, adequate or inadequate core cooling detection is ensured with two valid core exit thermocouples per quadrant.

The design of the Incore Instrumentation System includes a Type K (chromel alumel) thermocouple within each of the 56 incore instrument detector assemblies. The junction of each thermocouple is located a few inches above the fuel assembly, inside a structure that supports and shields the incore instrument detector assembly string from flow forces in the outlet plenum region. These core exit thermocouples monitor the temperature of the reactor coolant as it exits the fuel assemblies.

The core exit thermocouples have a usable temperature range from 32°F to 2300°F, although accuracy is reduced at temperatures above 1800°F.

BASES

LCO (continued)

17. 18. Emergency Feedwater (EFW) Flow

EFW Flow is provided to monitor operation of decay heat removal via the steam generators.

EFW Flow to each steam generator is determined from a differential pressure measurement calibrated to a span of 0 gpm to 1200 gpm. Redundant monitoring capability is provided by two independent trains of instrumentation for each steam generator. Each differential pressure transmitter provides an input to a control room indicator and the plant computer. Since the primary indication used by the operator during an accident is the control room indicator, the PAM instrumentation Specification deals specifically with this portion of the instrument channel.

At some plants EFW Flow is a Type A variable because operator action is required to throttle flow during an SLB accident in order to prevent the EFW pumps from operating in runout conditions. EFW Flow is also used by the operator to verify that the EFW System is delivering the correct flow to each steam generator. However, the primary indication used by the operator to ensure an adequate inventory is steam generator level. Two channels are required to be OPERABLE for all but one Function. Two OPERABLE channels ensure that no single failure within the PAM instrumentation or its auxiliary supporting features or power sources, concurrent with failures that are a condition of or result from a specific accident, prevents the operators from being presented the information necessary for them to determine the safety status of the plant and to bring the plant to and maintain it in a safe condition following that accident.

In Table 3.3.11-1 the exception to the two channel requirement is Containment Isolation Valve Position.

Two OPERABLE channels of core exit thermocouples are required for each channel in each quadrant to provide indication of radial distribution of the coolant temperature rise across representative regions of the core. Power distribution symmetry was considered in determining the specific number and locations provided for diagnosis of local core problems. Therefore, two randomly selected thermocouples may not be sufficient to meet the two thermocouples per channel requirement in any quadrant. The two thermocouples in each channel must meet the additional requirement that one be located near the center of the core and the other

BASES

ACTIONS (continued)

limits the risk that the PAM Function will be in a degraded condition should an accident occur.

D.1

When two required hydrogen monitor channels are inoperable, Required Action D.1 requires one channel to be restored to OPERABLE status. This Required Action restores the monitoring capability of the hydrogen monitor. The 72 hour Completion Time is based on the relatively low probability of an event requiring hydrogen monitoring and the availability of alternative means to obtain the required information. Continuous operation with two required channels inoperable is not acceptable because alternate indications are not available.

D.1

E.1

This Required Action directs entry into the appropriate Condition referenced in Table 3.3.11-1. The applicable Condition referenced in the Table is Function dependent. Each time Required Action C.1 or D.4 is not met, and the associated Completion Time has expired, Condition E is entered for that channel and provides for transfer to the appropriate subsequent Condition.

E.1 and E.2

F.1 and F.2

If the Required Action and associated Completion Time of Condition C are not met and Table 3.3.11-1 directs entry into Condition E, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

F.1

G.1

At this plant, alternate means of monitoring Reactor Vessel Water Level and Containment Area Radiation have been developed and tested. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the plant, but rather to follow the directions of Specification 5.6.7. The report provided to the NRC should discuss whether the alternate

B 3.6. CONTAINMENT SYSTEMS

B 3.6.8 Hydrogen Recombiners (Atmospheric and Dual)(If permanently installed)

BASES

BACKGROUND

The function of the hydrogen recombiners is to eliminate the potential breach of containment due to a hydrogen oxygen reaction. Per 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1), and 10 CFR 50, GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), hydrogen recombiners are required to reduce the hydrogen concentration in the containment following a loss of coolant accident (LOCA) or main steam line break (MSLB). The recombiners accomplish this by recombining hydrogen and oxygen to form water vapor. The vapor remains in containment, thus eliminating any discharge to the environment. The hydrogen recombiners are manually initiated since flammability limits would not be reached until several days after a Design Basis Accident (DBA).

Two 100% capacity independent hydrogen recombiners are provided. Each consists of controls located in the control room, a power supply, and a recombiner located in containment. The recombiners have no moving parts. Recombination is accomplished by heating a hydrogen air mixture above 1150°F. The resulting water vapor and discharge gases are cooled prior to discharge from the recombiner. Air flows through the unit at 100 cfm with natural circulation in the unit providing the motive force. A single recombiner is capable of maintaining the hydrogen concentration in containment below the 4.1 volume percent (v/o) flammability limit. Two recombiners are provided to meet the requirement for redundancy and independence. Each recombiner is powered from a separate Engineered Safety Features bus and is provided with a separate power panel and control panel.

APPLICABLE
SAFETY
ANALYSES

The hydrogen recombiners provide for controlling the bulk hydrogen concentration in containment to less than the lower flammable concentration of 4.1 v/o following a DBA. This control would prevent a containmentwide hydrogen burn, thus ensuring the pressure and temperature assumed in the analysis are not exceeded and minimizing damage to safety related equipment located in containment. The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate within containment following a LOCA as a result of:

~~BASES~~

APPLICABLE SAFETY ANALYSES (continued)

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant,
- b. Radiolytic decomposition of water in the Reactor Coolant System (RCS) and the containment sump,
- c. Hydrogen in the RCS at the time of the LOCA (i.e., hydrogen dissolved in the reactor coolant and hydrogen gas in the pressurizer vapor space), or
- d. Corrosion of metals exposed to Containment Spray System and Emergency Core Cooling Systems solutions.

To evaluate the potential for hydrogen accumulation in containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended in Reference 3 are used to maximize the amount of hydrogen calculated.

The hydrogen recombiners satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

~~LCO~~

Two hydrogen recombiners must be OPERABLE. This ensures operation of at least one hydrogen recombiner in the event of a worst case single active failure.

Operation with at least one hydrogen recombiner ensures that the post LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

~~APPLICABILITY~~

In MODES 1 and 2, two hydrogen recombiners are required to control the post LOCA hydrogen concentration within containment below its flammability limit of 4.1 v/o, assuming a worst case single failure.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the hydrogen recombiners is low. Therefore, the hydrogen recombiners are not required in MODE 3 or 4.

In MODES 5 and 6, the probability and consequences of a LOCA are low, due to the pressure and temperature limitations. Therefore, hydrogen recombiners are not required in these MODES.

BASES

ACTIONS

A.1

With one containment hydrogen recombinder inoperable, the inoperable recombinder must be restored to OPERABLE status within 30 days. In this condition, the remaining OPERABLE hydrogen recombinder is adequate to perform the hydrogen control function. The 30 day Completion Time is based on the availability of the other hydrogen recombinder, the small probability of a LOCA or MSLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or MSLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

Required Action A.1 has been modified by a Note stating that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one hydrogen recombinder is inoperable. This allowance is based on the availability of the other hydrogen recombinder, the small probability of a LOCA or MSLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or MSLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [the containment Hydrogen Purge System/hydrogen recombinder/Hydrogen Ignitor System/Hydrogen Mixing System/Containment Air Dilution System/Containment Inerting System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified every 12 hours thereafter to ensure its continued availability.

BASES

ACTIONS (continued)

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check, by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit.

C.1

If the inoperable hydrogen recombination(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.8.1

Performance of a system functional test for each hydrogen recombination ensures that the recombiners are operational and can attain and sustain the temperature necessary for hydrogen recombination. In particular, this SR requires verification that the minimum heater sheath temperature increases to $\geq 700^{\circ}\text{F}$ in ≤ 90 minutes. After reaching 700°F , the power is increased to maximum for approximately 2 minutes and verified to be ≥ 60 kW. Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.8.2

This SR ensures that there are no physical problems that could affect recombination operation. Since the recombiners are mechanically passive, they are not subject to mechanical failure. The only credible failures involve loss of power, blockage of the internal flow path, missile impact, etc. A visual inspection is sufficient to determine abnormal conditions

BASES**SURVEILLANCE REQUIREMENTS (continued)**

that could cause such failures. The [18] month Frequency for this SR was developed considering that the incidence of hydrogen recombiners failing the SR in the past is low.

SR 3.6.8.3

This SR requires performance of a resistance to ground test for each heater phase to ensure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq 10,000$ ohms. The [18] month Frequency for this SR was developed considering that the incidence of hydrogen recombiners failing the SR in the past is low.

REFERENCES

1. 10 CFR 50.44.
2. 10 CFR 50, Appendix A, GDC 41.
3. Regulatory Guide 1.7, Revision [1].

BASES

ACTIONS

A.1

With one HMS train inoperable, the inoperable train must be restored to OPERABLE status within 30 days. The 30 day Completion Time is based on the availability of the other HMS train, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit, and the availability of the ~~hydrogen recombiners, Containment Spray System, Hydrogen Purge System, and hydrogen monitors.~~ and

Required Action A.1 has been modified by a Note that states the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one HMS train is inoperable. This allowance is based on the availability of the other HMS train, the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit), and the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two HMS inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [the containment Hydrogen Purge System/~~hydrogen recombiner/Hydrogen Ignitor System/HMS/Containment Air Dilution System/Containment Inerting System~~]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition. In addition, the alternate hydrogen control system capability must be verified every 12 hours thereafter to ensure its continued availability.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.11 Shield Building (Dual)

BASES

BACKGROUND	<p>The shield building is a concrete structure that surrounds the steel containment vessel. Between the containment vessel and the shield building inner wall is an annular space that collects any containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the steel containment vessel.</p> <p>Following a LOCA, the Shield Building Exhaust Air Cleanup System (SBEACS) establishes a negative pressure in the annulus between the shield building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment.</p> <p>3.6.8 A description of the SBEACS is provided in the Bases for Specification 3.6.13, "Shield Building Exhaust Air Cleanup System (SBEACS)." Shield building OPERABILITY is required to ensure retention of primary containment leakage and proper operation of the SBEACS.</p>
APPLICABLE SAFETY ANALYSES	<p>The design basis for shield building OPERABILITY is a large break LOCA. Maintaining shield building OPERABILITY ensures that the release of radioactive material from the primary containment atmosphere is restricted to those leakage paths and associated leakage rates assumed in the accident analysis.</p> <p>The shield building satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).</p>
LCO	<p>Shield building OPERABILITY must be maintained to ensure proper operation of the SBEACS and to limit radioactive leakage from the containment to those paths and leakage rates assumed in the accident analysis.</p>
APPLICABILITY	<p>Maintaining shield building OPERABILITY prevents leakage of radioactive material from the shield building. Radioactive material may enter the shield building from the primary containment following a LOCA. Therefore, shield building OPERABILITY is required in MODES 1, 2, 3, and 4 when a main steam line break, LOCA, or control element assembly ejection accident could release radioactive material to the primary containment atmosphere.</p>

B 3.6 CONTAINMENT SYSTEMS

B 3.6.13 Shield Building Exhaust Air Cleanup System (SBEACS) (Dual) 3.6.8

BASES

BACKGROUND The SBEACS is required by 10 CFR 50, Appendix A, GDC 41, "Containment Atmosphere Cleanup" (Ref. 1), to ensure that radioactive material leaking from the primary containment of a dual containment into the shield building (secondary containment) following a Design Basis Accident are filtered and adsorbed prior to exhausting to the environment.

The containment has a secondary containment, the shield building, which is a concrete structure that surrounds the steel primary containment vessel. Between the containment vessel and the shield building inner wall is an annular space that collects any containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the steel containment vessel.

Following a LOCA, the SBEACS establishes a negative pressure in the annulus between the shield building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment. Shield building OPERABILITY is required to ensure retention of primary containment leakage and proper operation of the SBEACS.

The SBEACS consists of two separate and redundant trains. Each train includes a heater, cooling coils, a prefilter, a moisture separator, a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of radioiodines, and a fan. Ductwork, valves and/or dampers, and instrumentation also form part of the system. The moisture separators function to reduce the moisture content of the airstream. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case of failure of the main HEPA filter bank. Only the upstream HEPA filter and the charcoal adsorber section are credited in the analysis. The system initiates and maintains a negative air pressure in the shield building by means of filtered exhaust ventilation of the shield building following receipt of a safety injection actuation signal (SIAS). The system is described in Reference 2.

The prefilters remove any large particles in the air, and the moisture separators remove any entrained water droplets present, to prevent excessive loading of the HEPA filters and charcoal adsorbers. Heaters may be included to reduce the relative humidity of the airstream on systems operating in high humidity. Continuous operation of each train

BASES

BACKGROUND (continued)

for at least 10 hours per month with heaters on reduces moisture buildup on the HEPA filters and adsorbers. [The cooling coils cool the air to keep the charcoal beds from becoming too hot due to absorption of fission products.]

During normal operation, the Shield Building Cooling System is aligned to bypass the SBEACS HEPA filters and charcoal adsorbers. For SBEACS operation following a DBA, however, the bypass dampers automatically reposition to draw the air through the filters and adsorbers.

The SBEACS reduces the radioactive content in the shield building atmosphere following a DBA. Loss of the SBEACS could cause site boundary doses, in the event of a DBA, to exceed the values given in the licensing basis.

APPLICABLE
SAFETY
ANALYSES

The SBEACS design basis is established by the consequences of the limiting DBA, which is a LOCA. The accident analysis (Ref. 3) assumes that only one train of the SBEACS is functional due to a single failure that disables the other train. The accident analysis accounts for the reduction in airborne radioactive material provided by the remaining one train of this filtration system. The amount of fission products available for release from containment is determined for a LOCA.

The modeled SBEACS actuation in the safety analysis is based on a worst case response time associated with exceeding an SIAS. The total response time from exceeding the signal setpoint to attaining the negative pressure of [≥ 0.25] inch water gauge in the shield building is [1 minute]. This response time is composed of signal delay, diesel generator startup and sequencing time, system startup time, and time for the system to attain the required pressure after starting.

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

LCO

In the event of a DBA, one SBEACS train is required to provide the minimum particulate iodine removal assumed in the safety analysis. Two trains of the SBEACS must be OPERABLE to ensure that at least one train will operate, assuming that the other train is disabled by a single active failure.

BASES

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could lead to fission product release to containment that leaks to the shield building. The large break LOCA, on which this system's design is based, is a full power event. Less severe LOCAs and leakage still require the system to be OPERABLE throughout these MODES. The probability and severity of a LOCA decrease as core power and Reactor Coolant System pressure decrease. With the reactor shut down, the probability of release of radioactivity resulting from such an accident is low.

In MODES 5 and 6, the probability and consequences of a DBA are low due to the pressure and temperature limitations in these MODES. Under these conditions, the Filtration System is not required to be OPERABLE.

ACTIONS A.1
With one SBEACS train inoperable, the inoperable train must be restored to OPERABLE status within 7 days. The components in this degraded condition are capable of providing 100% of the iodine removal needs after a DBA. The 7 day Completion Time is based on consideration of such factors as the availability of the OPERABLE redundant SBEACS train and the low probability of a DBA occurring during this period.

B.1 and B.2

If the SBEACS train cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS SR 3.6.13.1 3.6.8.1
Operating each SBEACS train for \geq 15 minutes ensures that all trains are OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, fan or motor failure, or excessive vibration can be detected for corrective action. For systems with heaters, operation with the heaters on (automatic heater cycling to maintain temperature) for \geq 10 continuous hours eliminates moisture on the adsorbers and HEPA filters. Experience from filter testing at operating units indicates that the 10 hour period is adequate for moisture elimination on the adsorbers and HEPA filters. The 31 day Frequency

BASES

SURVEILLANCE REQUIREMENTS (continued)

was developed considering the known reliability of fan motors and controls, the two train redundancy available, and the iodine removal capability of the Containment Spray System.

SR 3.6.13.2 3.6.8.2

This SR verifies that the required SBEACS filter testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The VFTP includes testing of HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.6.13.3 3.6.8.3

The automatic startup ensures that each SBEACS train responds properly. The [18] month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint. Furthermore, the SR interval was developed considering that the SBEACS equipment OPERABILITY is demonstrated at a 31 day Frequency by SR 3.6.13.1. 3.6.8.1

[SR 3.6.13.4 3.6.8.4

The filter bypass dampers are tested to verify OPERABILITY. The dampers are in the bypass position during normal operation and must reposition for accident operation to draw air through the filters. The [18] month Frequency is considered to be acceptable based on the damper reliability and design, the mild environmental conditions in the vicinity of the dampers, and the fact that operating experience has shown that the dampers usually pass the Surveillance when performed at the [18] month Frequency.]

SR 3.6.13.5 3.6.8.5

The SBEACS train flow rate is verified \geq [] cfm to ensure that the flow rate is adequate to "pull down" the shield building pressure as required. This test also will verify the proper functioning of the fans, dampers,

BASES

SURVEILLANCE REQUIREMENTS (continued)

filters, absorbers, etc., when this SR is performed in conjunction with SR 3.6.11.4.

The [18] month on a STAGGERED TEST BASIS Frequency is consistent with the Regulatory Guide 1.52 (Ref. 4) guidance.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 41.
 2. FSAR, Section [].
 3. FSAR, Section [].
 4. Regulatory Guide 1.52, Revision [2].
-
-

3.3 INSTRUMENTATION

3.3.3.1 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.3.1 The PAM instrumentation for each Function in Table 3.3.3.1-1 shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

- NOTES -

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C. One or more Functions with two required channels inoperable.	C.1 Restore one required channel to OPERABLE status.	7 days
D. Two [required hydrogen monitor] channels inoperable.	D.1 Restore one [required hydrogen monitor] channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. <u>E.</u> Required Action and associated Completion Time of Condition C or D not met.	E.1 D. Enter the Condition referenced in Table 3.3.3.1-1 for the channel.	Immediately
E. <u>F.</u> As required by Required Action E.1 and referenced in D.1 Table 3.3.3.1-1.	F.1 E. Be in MODE 3.	12 hours
F. <u>G.</u> [As required by Required Action E.1 and referenced in D.1 Table 3.3.3.1-1.	G.1 F. Initiate action in accordance with Specification 5.6.7.	Immediately]

SURVEILLANCE REQUIREMENTS

- NOTE -

These SRs apply to each Function in Table 3.3.3.1-1.

SURVEILLANCE	FREQUENCY
SR 3.3.3.1.1 Perform CHANNEL CHECK.	31 days
SR 3.3.3.1.2 Perform CHANNEL CALIBRATION.	[18] months

Table 3.3.3.1-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITIONS REFERENCED FROM REQUIRED ACTION E.1	D.1
1. Reactor Steam Dome Pressure	2	F E	
2. Reactor Vessel Water Level	2	F E	
3. Suppression Pool Water Level	2	F E	
4. Drywell Pressure	2	F E	
5. Primary Containment Area Radiation	2	[G] F	
[6. Drywell Sump Level	2	F] E	
[7. Drywell Drain Sump Level	2	F] E	
8. Penetration Flow Path PCIV Position	2 per penetration flow path ^{(a)(b)}	F E	
9. Wide Range Neutron Flux	2	F E	
10. Drywell H₂ & O₂ Analyzer	2	F	
11. Containment H₂ & O₂ Analyzer	2	F	
10. 12. Primary Containment Pressure	2	F E	
11. 13. [Relief Valve Discharge Location] Suppression Pool Water Temperature	2 ^(c)	F E	

(a) Not required for isolation valves whose associated penetration flow path is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) Monitoring each [relief valve discharge location].

- REVIEWER'S NOTE -

Table 3.3.3.1-1 shall be amended for each plant as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category 1, non-Type A instruments specified in the plant's Regulatory Guide 1.97, Safety Evaluation Report.

Primary Containment Hydrogen Recombiners
3.6.3.1

3.6 CONTAINMENT SYSTEMS

3.6.3.1 Primary Containment Hydrogen Recombiners (if permanently installed)

LCO 3.6.3.1 Two primary containment hydrogen recombiners shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One primary containment hydrogen recombiner inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable -----</p> <p>Restore primary containment hydrogen recombiner to OPERABLE status.</p>	30 days
B. [Two primary containment hydrogen recombiners inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one primary containment hydrogen recombiner to OPERABLE status.</p>	1 hour AND Once per 12 hours thereafter 7 days]
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

Primary Containment Hydrogen Recombiners
3.6.3.1

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.3.1.1	Perform a system functional test for each primary containment hydrogen recombiner.	[18] months
SR 3.6.3.1.2	Visually examine each primary containment hydrogen recombiner enclosure and verify there is no evidence of abnormal conditions.	[18] months
SR 3.6.3.1.3	Perform a resistance to ground test for each heater phase.	[18] months

3.6 CONTAINMENT SYSTEMS

3.6.3.2 [Drywell Cooling System Fans]

3.6.3.1

LCO 3.6.3.2 Two [drywell cooling system fans] shall be OPERABLE.
3.6.3.1

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One [required] [drywell cooling system fan] inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore [required] [drywell cooling system fan] to OPERABLE status.</p>	30 days
B. Two [required] [drywell cooling system fans] inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one [required] [drywell cooling system fan] to OPERABLE status.</p>	<p>1 hour <u>AND</u> Once per 12 hours thereafter</p> <p>7 days</p>
C. Required Action and Associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.3.2.1 3.6.3.1.1	Operate each [required] [drywell cooling system fan] for \geq [15] minutes.	92 days
SR 3.6.3.2.2 3.6.3.1.2	[Verify each [required] [drywell cooling system fan] flow rate is \geq [500] scfm.	[18] months]

Primary Containment Oxygen Concentration

~~3.6.3.3~~

3.6.3.2

3.6 CONTAINMENT SYSTEMS

3.6.3.3 Primary Containment Oxygen Concentration

3.6.3.2

LCO ~~3.6.3.3~~ The primary containment oxygen concentration shall be < 4.0 volume percent.

APPLICABILITY: MODE 1 during the time period:

- a. From [24] hours after THERMAL POWER is > [15]% RTP following startup, to
- b. [24] hours prior to reducing THERMAL POWER to < [15]% RTP prior to the next scheduled reactor shutdown.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Primary containment oxygen concentration not within limit.	A.1 Restore oxygen concentration to within limit.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Reduce THERMAL POWER to \leq [15]% RTP.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.3.3.1 3.6.3.2.1 Verify primary containment oxygen concentration is within limits.	7 days

3.6 CONTAINMENT SYSTEMS

3.6.3.4 Containment Atmosphere Dilution (CAD) System

3.6.3.3

LCO 3.6.3.4 Two CAD subsystems shall be OPERABLE.

3.6.3.3

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CAD subsystem inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore CAD subsystem to OPERABLE status.</p>	30 days
B. [Two CAD subsystems inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one CAD subsystem to OPERABLE status.</p>	<p>1 hour <u>AND</u> Once per 12 hours thereafter</p> <p>7 days]</p>
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.3.4.1 3.6.3.3.1	Verify \geq [4350] gal of liquid nitrogen are contained in the CAD System.	31 days
SR 3.6.3.4.2 3.6.3.3.2	Verify each CAD subsystem manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position or can be aligned to the correct position.	31 days

5.6 Reporting Requirements

5.6.6 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (continued)

- REVIEWER'S NOTE -

The methodology for the calculation of the P-T limits for NRC approval should include the following provisions:

1. The methodology shall describe how the neutron fluence is calculated (reference new Regulatory Guide when issued).
 2. The Reactor Vessel Material Surveillance Program shall comply with Appendix H to 10 CFR 50. The reactor vessel material irradiation surveillance specimen removal schedule shall be provided, along with how the specimen examinations shall be used to update the PTLR curves.
 3. Low Temperature Overpressure Protection (LTOP) System lift setting limits for the Power Operated Relief Valves (PORVs), developed using NRC-approved methodologies may be included in the PTLR.
 4. The adjusted reference temperature (ART) for each reactor beltline material shall be calculated, accounting for radiation embrittlement, in accordance with Regulatory Guide 1.99, Revision 2.
 5. The limiting ART shall be incorporated into the calculation of the pressure and temperature limit curves in accordance with NUREG-0800 Standard Review Plan 5.3.2, Pressure-Temperature Limits.
 6. The minimum temperature requirements of Appendix G to 10 CFR Part 50 shall be incorporated into the pressure and temperature limit curves.
 7. Licensees who have removed two or more capsules should compare for each surveillance material the measured increase in reference temperature (RT_{NDT}) to the predicted increase in RT_{NDT} ; where the predicted increase in RT_{NDT} is based on the mean shift in RT_{NDT} plus the two standard deviation value ($2\sigma_\Delta$) specified in Regulatory Guide 1.99, Revision 2. If the measured value exceeds the predicted value (increase $RT_{NDT} + 2\sigma_\Delta$), the licensee should provide a supplement to the PTLR to demonstrate how the results affect the approved methodology.
-

5.6.7

Post Accident Monitoring Report

F

When a report is required by Condition B or G of LCO 3.3.[3.1], "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of

BASES

LCO (continued)

indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration flow path is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required to be OPERABLE. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

[For this plant, the PCIV position PAM instrumentation consists of the following:]

9. Wide Range Neutron Flux

Wide range neutron flux is a Category I variable provided to verify reactor shutdown. [For this plant, the wide range neutron flux PAM instrumentation consists of the following:]

10, 11. Drywell and Containment Hydrogen and Oxygen Analyzers

Drywell and containment hydrogen and oxygen analyzers are Category I instruments provided to detect high hydrogen or oxygen concentration conditions that represent a potential for containment breach. This variable is also important in verifying the adequacy of mitigating actions. [For this plant, the drywell and containment hydrogen and oxygen analyzers PAM instrumentation consists of the following:]

10. 12. Primary Containment Pressure

Primary containment pressure is a Category I variable provided to verify RCS and containment integrity and to verify the effectiveness of ECCS actions taken to prevent containment breach. Two wide range primary containment pressure signals are transmitted from separate pressure transmitters and are continuously recorded and displayed on two control room recorders. These recorders are the primary indication used by the operator during an accident. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

BASES

LCO (continued)

11. 43. Suppression Pool Water Temperature

Suppression pool water temperature is a Category I variable provided to detect a condition that could potentially lead to containment breach and to verify the effectiveness of ECCS actions taken to prevent containment breach. The suppression pool water temperature instrumentation allows operators to detect trends in suppression pool water temperature in sufficient time to take action to prevent steam quenching vibrations in the suppression pool. Twenty-four temperature sensors are arranged in six groups of four independent and redundant channels, located such that there is a group of sensors within a 30 ft line of sight of each relief valve discharge location.

Thus, six groups of sensors are sufficient to monitor each relief valve discharge location. Each group of four sensors includes two sensors for normal suppression pool temperature monitoring and two sensors for PAM. The outputs for the PAM sensors are recorded on four independent recorders in the control room (channels A and C are redundant to channels B and D, respectively). All four of these recorders must be OPERABLE to furnish two channels of PAM indication for each of the relief valve discharge locations. These recorders are the primary indication used by the operator during an accident. Therefore, the PAM Specification deals specifically with this portion of the instrument channels. Each suppression pool water temperature [relief valve discharge location] is treated separately and each [relief valve discharge location] is considered to be a separate function. Therefore, separate Condition entry is allowed for each inoperable [relief valve discharge location.]

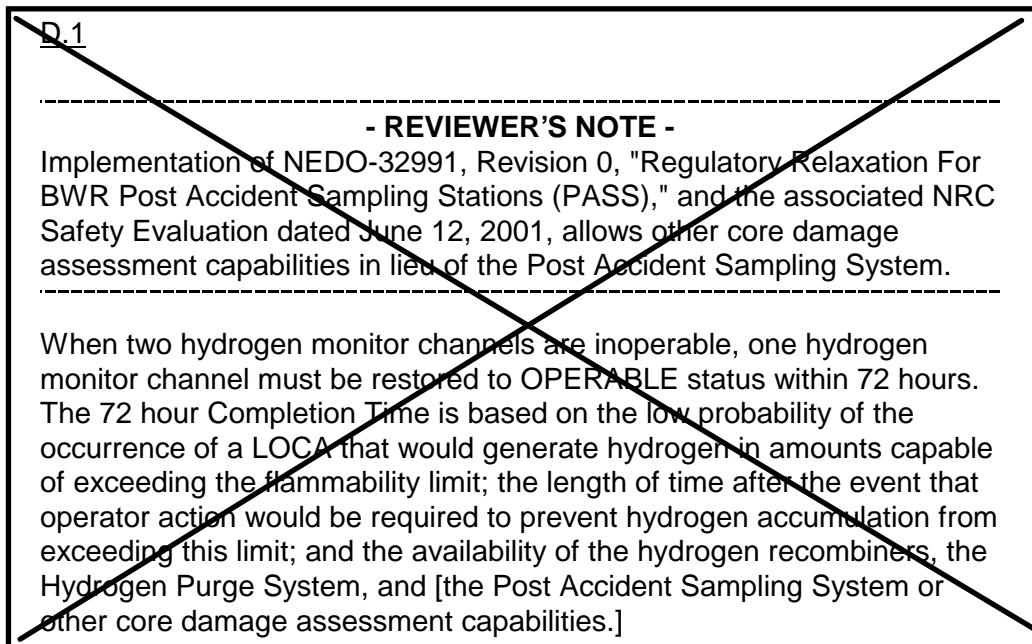
APPLICABILITY	The PAM instrumentation LCO is applicable in MODES 1 and 2. These variables are related to the diagnosis and preplanned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in MODES 1 and 2. In MODES 3, 4, and 5, plant conditions are such that the likelihood of an event that would require PAM instrumentation is extremely low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.
ACTIONS	Note 1 has been added to the ACTIONS to exclude the MODE change restriction of LCO 3.0.4. This exception allows entry into the applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require plant shutdown. This exception is acceptable due to the passive function of the instruments, the operator's ability to diagnose

BASES

ACTIONS (continued)

C.1

When one or more Functions have two required channels that are inoperable (i.e., two channels inoperable in the same Function), one channel in the Function should be restored to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur. Condition C is modified by a Note that excludes hydrogen monitor channels. Condition D provides appropriate Required Actions for two inoperable hydrogen monitor channels.



E.1 E.1

This Required Action directs entry into the appropriate Condition referenced in Table 3.3.3.1-1. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has not met any Required Action of Condition C or D, as applicable, and the

the

BASES

ACTIONS (continued)

D

associated Completion Time has expired, Condition E is entered for that channel and provides for transfer to the appropriate subsequent Condition.

E.1 F.1

the

For the majority of Functions in Table 3.3.3.1-1, if any Required Action and associated Completion Time of Condition C or D are not met, the plant must be brought to a MODE in which the LCO not apply. To achieve this status, the plant must be brought to at least MODE 3 within does 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

F.1 G.1

Since alternate means of monitoring primary containment area radiation have been developed and tested, the Required Action is not to shut down the plant, but rather to follow the directions of Specification 5.6.7. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

SURVEILLANCE REQUIREMENTS

The following SRs apply to each PAM instrumentation Functionin Table 3.3.3.1-1.

SR 3.3.3.1.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel against a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.1 Primary Containment Hydrogen Recombiners

BASES

BACKGROUND

The primary containment hydrogen recombiner eliminates the potential breach of primary containment due to a hydrogen oxygen reaction and is part of combustible gas control required by 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1), and GDC 41, "Containment Atmosphere Cleanup" (Ref. 2). The primary containment hydrogen recombiner is required to reduce the hydrogen concentration in the primary containment following a loss of coolant accident (LOCA). The primary containment hydrogen recombiner accomplishes this by recombining hydrogen and oxygen to form water vapor. The vapor remains in the primary containment, thus eliminating any discharge to the environment. The primary containment hydrogen recombiner is manually initiated since flammability limits would not be reached until several days after a Design Basis Accident (DBA).

The primary containment hydrogen recombiner functions to maintain the hydrogen gas concentration within the containment at or below the flammability limit of 4.0 volume percent (v/o) following a postulated LOCA. It is fully redundant and consists of two 100% capacity subsystems. Each primary containment hydrogen recombiner consists of an enclosed blower assembly, heater section, reaction chamber, direct contact water spray gas cooler, water separator, and associated piping, valves, and instruments. The primary containment hydrogen recombiner will be manually initiated from the main control room when the hydrogen gas concentration in the primary containment reaches [3.3] v/o. When the primary containment is inerted (oxygen concentration < 4.0 v/o), the primary containment hydrogen recombiner will only function until the oxygen is used up (2.0 v/o hydrogen combines with 1.0 v/o oxygen). Two recombiners are provided to meet the requirement for redundancy and independence. Each recombiner is powered from a separate Engineered Safety Feature bus and is provided with separate power panel and control panel.

The process gas circulating through the heater, the reaction chamber, and the cooler is automatically regulated to [150] scfm by the use of an orifice plate installed in the cooler. The process gas is heated to [1200]°F. The hydrogen and oxygen gases are recombined into water vapor, which is then condensed in the water spray gas cooler by the associated residual heat removal subsystem and discharged with some of the effluent process gas to the suppression chamber. The majority of

~~BASES~~

~~BACKGROUND (continued)~~

the cooled, effluent process gas is mixed with the incoming process gas to dilute the incoming gas prior to the mixture entering the heater section.

~~APPLICABLE
SAFETY
ANALYSES~~

The primary containment hydrogen recombiner provides the capability of controlling the bulk hydrogen concentration in primary containment to less than the lower flammable concentration of 4.0 v/o following a DBA. This control would prevent a primary containment wide hydrogen burn, thus ensuring that pressure and temperature conditions assumed in the analysis are not exceeded. The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate in primary containment following a LOCA as a result of either:

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant or
- b. Radiolytic decomposition of water in the Reactor Coolant System.

To evaluate the potential for hydrogen accumulation in primary containment following a LOCA, the hydrogen generation is calculated as a function of time following the initiation of the accident. Assumptions recommended by Reference 3 are used to maximize the amount of hydrogen calculated.

The calculation confirms that when the mitigating systems are actuated in accordance with emergency procedures, the peak hydrogen concentration in the primary containment is < 4.0 v/o (Ref. 4).

The primary containment hydrogen recombiners satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

~~LCO~~

Two primary containment hydrogen recombiners must be OPERABLE. This ensures operation of at least one primary containment hydrogen recombiner subsystem in the event of a worst case single active failure.

Operation with at least one primary containment hydrogen recombiner subsystem ensures that the post-LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

Primary Containment Hydrogen Recombiners
B 3.6.3.1

BASES

APPLICABILITY

In MODES 1 and 2, the two primary containment hydrogen recombiners are required to control the hydrogen concentration within primary containment below its flammability limit of 4.0 v/o following a LOCA, assuming a worst case single failure.

In MODE 3, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in this MODE, the probability of an accident requiring the primary containment hydrogen recombiner is low. Therefore, the primary containment hydrogen recombiner is not required in MODE 3.

In MODES 4 and 5, the probability and consequences of a LOCA are low due to the pressure and temperature limitations in these MODES. Therefore, the primary containment hydrogen recombiner is not required in these MODES.

ACTIONS

A.1

With one primary containment hydrogen recombiner inoperable, the inoperable recombiner must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE recombiner is adequate to perform the hydrogen control function. However, the overall reliability is reduced because a single failure in the OPERABLE recombiner could result in reduced hydrogen control capability. The 30 day Completion Time is based on the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the amount of time available after the event for operator action to prevent exceeding this limit, and the low probability of failure of the OPERABLE primary containment hydrogen recombiner.

Required Action A.1 has been modified by a Note indicating that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one recombiner is inoperable. This allowance is provided because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the low probability of the failure of the OPERABLE subsystem, and the amount of time available after a postulated LOCA for operator action to prevent exceeding the flammability limit.

BASES

ACTIONS (continued)

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two primary containment hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by the [Primary Containment Inerting System or one subsystem of the Containment Atmosphere Dilution System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non- Technical Specification alternate hydrogen control function is used to justify this Condition. In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit.

C.1

If any Required Action and associated Completion Time cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable,

~~BASES~~

ACTIONS (continued)

based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

~~SURVEILLANCE REQUIREMENTS~~

SR 3.6.3.1.1

Performance of a system functional test for each primary containment hydrogen recombiner ensures that the recombiners are OPERABLE and can attain and sustain the temperature necessary for hydrogen recombination. In particular, this SR verifies that the minimum heater sheath temperature increases to $\geq [1200]^\circ\text{F}$ in $\leq [1.5]$ hours and that it is maintained $> [1150]^\circ\text{F}$ and $< [1300]^\circ\text{F}$ for $\geq [4]$ hours thereafter to check the ability of the recombiner to function properly (and to make sure that significant heater elements are not burned out). Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.3.1.2

This SR ensures there are no physical problems that could affect recombiner operation. Since the recombiners are mechanically passive, except for the blower assemblies, they are subject to only minimal mechanical failure. The only credible failures involve loss of power or blower function, blockage of the internal flow path, missile impact, etc.

A visual inspection is sufficient to determine abnormal conditions that could cause such failures. Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.3.1.3

This SR requires performance of a resistance to ground test of each heater phase to make sure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq [10,000]$ ohms.

Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

Primary Containment Hydrogen Recombiners

B 3.6.3.1

BASES

REFERENCES

1. 10 CFR 50.44.
 2. 10 CFR 50, Appendix A, GDC 41.
 3. Regulatory Guide 1.7, Revision [1].
 4. FSAR, Section [6.2.5].
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.2 [Drywell Cooling System Fans]

3.6.3.1

BASES

BACKGROUND The [Drywell Cooling System fans] ensure a uniformly mixed post accident primary containment atmosphere, thereby minimizing the potential for local hydrogen burns due to a pocket of hydrogen above the flammable concentration.

The [Drywell Cooling System fans] are an Engineered Safety Feature and are designed to withstand a loss of coolant accident (LOCA) in post accident environments without loss of function. The system has two independent subsystems consisting of fans, fan coil units, motors, controls, and ducting. Each subsystem is sized to circulate [500] scfm. The [Drywell Cooling System fans] employ both forced circulation and natural circulation to ensure the proper mixing of hydrogen in primary containment. The recirculation fans provide the forced circulation to mix hydrogen while the fan coils provide the natural circulation by increasing the density through the cooling of the hot gases at the top of the drywell causing the cooled gases to gravitate to the bottom of the drywell. The two subsystems are initiated manually since flammability limits would not be reached until several days after a LOCA. Each subsystem is powered from a separate emergency power supply. Since each subsystem can provide 100% of the mixing requirements, the system will provide its design function with a worst case single active failure.

The [Drywell Cooling System fans] use the Drywell Cooling System recirculating fans to mix the drywell atmosphere. The fan coil units and recirculation fans are automatically disengaged during a LOCA but may be restored to service manually by the operator. In the event of a loss of offsite power, all fan coil units, recirculating fans, and primary containment water chillers are transferred to the emergency diesels. The fan coil units and recirculating fans are started automatically from diesel power upon loss of offsite power.

**APPLICABLE
SAFETY
ANALYSES**

The [Drywell Cooling System fans] provide the capability for reducing the local hydrogen concentration to approximately the bulk average concentration following a Design Basis Accident (DBA). The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate in primary containment following a LOCA as a result of either:

BASES**APPLICABLE SAFETY ANALYSES (continued)**

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant or
- b. Radiolytic decomposition of water in the Reactor Coolant System.

To evaluate the potential for hydrogen accumulation in primary containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended by Reference 1 are used to maximize the amount of hydrogen calculated.

The Reference 2 calculations show that hydrogen assumed to be released to the drywell within 2 minutes following a DBA LOCA raises drywell hydrogen concentration to over 2.5 volume percent (v/o). Natural circulation phenomena result in a gradient concentration difference of less than 0.5 v/o in the drywell and less than 0.1 v/o in the suppression chamber. Even though this gradient is acceptably small and no credit for mechanical mixing was assumed in the analysis, two [Drywell Cooling System fans] are [required] to be OPERABLE (typically four to six fans are required to keep the drywell cool during operation in MODE 1 or 2) by this LCO.

The [Drywell Cooling System fans] satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two [Drywell Cooling System fans] must be OPERABLE to ensure operation of at least one fan in the event of a worst case single active failure. Each of these fans must be powered from an independent safety related bus.

Operation with at least one fan provides the capability of controlling the bulk hydrogen concentration in primary containment without exceeding the flammability limit.

APPLICABILITY

In MODES 1 and 2, the two [Drywell Cooling System fans] ensure the capability to prevent localized hydrogen concentrations above the flammability limit of 4.0 v/o in drywell, assuming a worst case single active failure.

In MODE 3, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in this MODE, the probability of

BASES

APPLICABILITY (continued)

an accident requiring the [Drywell Cooling System fans] is low. Therefore, the [Drywell Cooling System fans] are not required in MODE 3.

In MODES 4 and 5, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations in these MODES. Therefore, the [Drywell Cooling System fans] are not required in these MODES.

ACTIONS

A.1

With one [required] [Drywell Cooling System fan] inoperable, the inoperable fan must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE fan is adequate to perform the hydrogen mixing function. However, the overall reliability is reduced because a single failure in the OPERABLE fan could result in reduced hydrogen mixing capability. The 30 day Completion Time is based on the availability of the second fan, the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the amount of time available after the event for operator action to prevent exceeding this limit, and the availability of the ~~Primary Containment Hydrogen Recombiner System and the~~ Containment Atmosphere Dilution System.

Required Action A.1 has been modified by a Note indicating that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one [Drywell Cooling System fan] is inoperable. This allowance is provided because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the low probability of the failure of the OPERABLE fan, and the amount of time available after a postulated LOCA for operator action to prevent exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two [Drywell Cooling System fans] inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control

BASES

ACTIONS (continued)

capabilities are provided by the [Primary Containment Inerting System or one subsystem of the Containment Atmosphere Dilution System]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two [Drywell Cooling System fans] inoperable for up to 7 days. Seven days is a reasonable time to allow two [Drywell Cooling System fans] to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit.

C.1

If any Required Action and associated Completion Time cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS**SR 3.6.3.2.1 3.6.3.1.1**

Operating each [required] [Drywell Cooling System fan] for \geq 15 minutes ensures that each subsystem is OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, fan or motor failure, or excessive vibration can be detected for corrective action. The 92 day Frequency is consistent with the Inservice Testing Program Frequencies, operating experience, the known reliability of the fan motors and controls, and the two redundant fans available.

BASES

SURVEILLANCE REQUIREMENTS (continued)[SR 3.6.3.2.2 3.6.3.1.2

Verifying that each [required] [Drywell Cooling System fan] flow rate is \geq [500] scfm ensures that each fan is capable of maintaining localized hydrogen concentrations below the flammability limit. The [18] month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.]

REFERENCES

1. Regulatory Guide 1.7, Revision [1].
 2. FSAR, Section [6.2.5].
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-

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.3 Primary Containment Oxygen Concentration

3.6.3.2

BASES

BACKGROUND

All nuclear reactors must be designed to withstand events that generate hydrogen either due to the zirconium metal water reaction in the core or due to radiolysis. The primary method to control hydrogen is to inert the primary containment. With the primary containment inert, that is, oxygen concentration < 4.0 volume percent (v/o), a combustible mixture cannot be present in the primary containment for any hydrogen concentration. ~~The capability to inert the primary containment and maintain oxygen < 4.0 v/o works together with the Hydrogen Recombiner System (LCO 3.6.3.1, "Primary Containment Hydrogen Recombinators") and the [Drywell Cooling System fans] (LCO 3.6.3.2, "[Drywell Cooling System Fans]") to provide redundant and diverse methods to mitigate events that produce hydrogen. For example, an event that rapidly generates hydrogen from zirconium metal water reaction will result in excessive hydrogen in primary containment, but oxygen concentration will remain < 4.0 v/o and no combustion can occur. Long term generation of both hydrogen and oxygen from radiolytic decomposition of water may eventually result in a combustible mixture in primary containment, except that the hydrogen recombiners remove hydrogen and oxygen gases faster than they can be produced from radiolysis and again no combustion can occur.~~ An LCO ensures that oxygen concentration does not exceed 4.0 v/o during operation in the applicable conditions.

APPLICABLE SAFETY ANALYSES

The Reference 1 calculations assume that the primary containment is inerted when a Design Basis Accident loss of coolant accident occurs. Thus, the hydrogen assumed to be released to the primary containment as a result of metal water reaction in the reactor core will not produce combustible gas mixtures in the primary containment. Oxygen, which is subsequently generated by radiolytic decomposition of water, is recombined by the hydrogen recombiners (LCO 3.6.3.1) more rapidly than it is produced.

Primary containment oxygen concentration satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The primary containment oxygen concentration is maintained < 4.0 v/o to ensure that an event that produces any amount of hydrogen does not result in a combustible mixture inside primary containment.

BASES

APPLICABILITY

The primary containment oxygen concentration must be within the specified limit when primary containment is inerted, except as allowed by the relaxations during startup and shutdown addressed below. The primary containment must be inert in MODE 1, since this is the condition with the highest probability of an event that could produce hydrogen.

Inerting the primary containment is an operational problem because it prevents containment access without an appropriate breathing apparatus. Therefore, the primary containment is inerted as late as possible in the plant startup and de-inerted as soon as possible in the plant shutdown. As long as reactor power is < 15% RTP, the potential for an event that generates significant hydrogen is low and the primary containment need not be inert. Furthermore, the probability of an event that generates hydrogen occurring within the first [24] hours of a startup, or within the last [24] hours before a shutdown, is low enough that these "windows," when the primary containment is not inerted, are also justified. The [24] hour time period is a reasonable amount of time to allow plant personnel to perform inerting or de-inerting.

ACTIONS

A.1

If oxygen concentration is $\geq 4.0\text{ v/o}$ at any time while operating in MODE 1, with the exception of the relaxations allowed during startup and shutdown, oxygen concentration must be restored to $< 4.0\text{ v/o}$ within 24 hours. The 24 hour Completion Time is allowed when oxygen concentration is $\geq 4.0\text{ v/o}$ because of the availability of other hydrogen mitigating systems (e.g., hydrogen recombiners) and the low probability and long duration of an event that would generate significant amounts of hydrogen occurring during this period.

B.1

If oxygen concentration cannot be restored to within limits within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, power must be reduced to $\leq [15]\%$ RTP within 8 hours. The 8 hour Completion Time is reasonable, based on operating experience, to reduce reactor power from full power conditions in an orderly manner and without challenging plant systems.

BASES**SURVEILLANCE
REQUIREMENTS****SR 3.6.3.3.1 3.6.3.2.1**

The primary containment must be determined to be inert by verifying that oxygen concentration is < 4.0 v/o. The 7 day Frequency is based on the slow rate at which oxygen concentration can change and on other indications of abnormal conditions (which would lead to more frequent checking by operators in accordance with plant procedures). Also, this Frequency has been shown to be acceptable through operating experience.

REFERENCES

1. FSAR, Section [6.2.5].

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.4 Containment Atmosphere Dilution (CAD) System

3.6.3.3

BASES

BACKGROUND	<p>The CAD System functions to maintain combustible gas concentrations within the primary containment at or below the flammability limits following a postulated loss of coolant accident (LOCA) by diluting hydrogen and oxygen with nitrogen. To ensure that a combustible gas mixture does not occur, oxygen concentration is kept < [5.0] volume percent (v/o), or hydrogen concentration is kept < 4.0 v/o.</p> <p>The CAD System is manually initiated and consists of two independent, 100% capacity subsystems. Each subsystem includes a liquid nitrogen supply tank, ambient vaporizer, electric heater, and connected piping to supply the drywell and suppression chamber volumes. The nitrogen storage tanks each contain \geq [4350] gal, which is adequate for [7] days of CAD subsystem operation.</p> <p>The CAD System operates in conjunction with emergency operating procedures that are used to reduce primary containment pressure periodically during CAD System operation. This combination results in a feed and bleed approach to maintaining hydrogen and oxygen concentrations below combustible levels.</p>
APPLICABLE SAFETY ANALYSES	<p>To evaluate the potential for hydrogen and oxygen accumulation in primary containment following a LOCA, hydrogen and oxygen generation is calculated (as a function of time following the initiation of the accident). The assumptions stated in Reference 1 are used to maximize the amount of hydrogen and oxygen generated. The calculation confirms that when the mitigating systems are actuated in accordance with emergency operating procedures, the peak oxygen concentration in primary containment is < [5.0] v/o (Ref. 2).</p> <p>Hydrogen and oxygen may accumulate within primary containment following a LOCA as a result of either:</p> <ol style="list-style-type: none">A metal water reaction between the zirconium fuel rod cladding and the reactor coolant orRadiolytic decomposition of water in the Reactor Coolant System. <p>The CAD System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).</p>

BASES

LCO	<p>Two CAD subsystems must be OPERABLE. This ensures operation of at least one CAD subsystem in the event of a worst case single active failure. Operation of at least one CAD subsystem is designed to maintain primary containment post-LOCA oxygen concentration < 5.0 v/o for 7 days.</p>
APPLICABILITY	<p>In MODES 1 and 2, the CAD System is required to maintain the oxygen concentration within primary containment below the flammability limit of 5.0 v/o following a LOCA. This ensures that the relative leak tightness of primary containment is adequate and prevents damage to safety related equipment and instruments located within primary containment.</p> <p>In MODE 3, both the hydrogen and oxygen production rates and the total amounts produced after a LOCA would be less than those calculated for the Design Basis Accident LOCA. Thus, if the analysis were to be performed starting with a LOCA in MODE 3, the time to reach a flammable concentration would be extended beyond the time conservatively calculated for MODES 1 and 2. The extended time would allow hydrogen removal from the primary containment atmosphere by other means and also allow repair of an inoperable CAD subsystem, if CAD were not available. Therefore, the CAD System is not required to be OPERABLE in MODE 3.</p> <p>In MODES 4 and 5, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these MODES. Therefore, the CAD System is not required to be OPERABLE in MODES 4 and 5.</p>
ACTIONS	<p>A.1</p> <p>If one CAD subsystem is inoperable, it must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE CAD subsystem is adequate to perform the oxygen control function. However, the overall reliability is reduced because a single failure in the OPERABLE subsystem could result in reduced oxygen control capability. The 30 day Completion Time is based on the low probability of the occurrence of a LOCA that would generate hydrogen and oxygen in amounts capable of exceeding the flammability limit, the amount of time available after the event for operator action to prevent exceeding this limit, and the availability of the OPERABLE CAD subsystem and other hydrogen mitigating systems.</p> <p>Required Action A.1 has been modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change</p>

BASES

ACTIONS (continued)

is allowed when one CAD subsystem is inoperable. This allowance is provided because of the low probability of the occurrence of a LOCA that would generate hydrogen and oxygen in amounts capable of exceeding the flammability limit, the low probability of the failure of the OPERABLE subsystem, the amount of time available after a postulated LOCA for operator action to prevent exceeding the flammability limit, and the availability of other hydrogen mitigating systems.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for plants with an alternate hydrogen control system acceptable to the technical staff.

With two CAD subsystems inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by the [Primary Containment Inerting System or one hydrogen recombiner and one Drywell Cooling System fan]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two CAD subsystems inoperable for up to 7 days. Seven days is a reasonable time to allow two CAD subsystems to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit.

BASES

ACTIONS (continued)

With two CAD subsystems inoperable, one CAD subsystem must be restored to OPERABLE status within 7 days. The 7 day Completion Time is based on the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit, the amount of time available after the event for operator action to prevent exceeding this limit, and the availability of other hydrogen mitigating systems.

C.1

If any Required Action cannot be met within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.3.4.1 3.6.3.3.1

Verifying that there is \geq [4350] gal of liquid nitrogen supply in the CAD System will ensure at least [7] days of post-LOCA CAD operation. This minimum volume of liquid nitrogen allows sufficient time after an accident to replenish the nitrogen supply for long term inerting. This is verified every 31 days to ensure that the system is capable of performing its intended function when required. The 31 day Frequency is based on operating experience, which has shown 31 days to be an acceptable period to verify the liquid nitrogen supply and on the availability of other hydrogen mitigating systems.

SR 3.6.3.4.2 3.6.3.3.2

Verifying the correct alignment for manual, power operated, and automatic valves in each of the CAD subsystem flow paths provides assurance that the proper flow paths exist for system operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing.

A valve is also allowed to be in the nonaccident position provided it can be aligned to the accident position within the time assumed in the accident analysis. This is acceptable because the CAD System is manually initiated. This SR does not apply to valves that cannot be

BASES

SURVEILLANCE REQUIREMENTS (continued)

inadvertently misaligned, such as check valves. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The 31 day Frequency is appropriate because the valves are operated under procedural control, improper valve position would only affect a single subsystem, the probability of an event requiring initiation of the system is low, and the system is a manually initiated system.

REFERENCES

1. Regulatory Guide 1.7, Revision [2].
 2. FSAR, Section [].
-
-

3.3 INSTRUMENTATION

3.3.3.1 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.3.1 The PAM instrumentation for each Function in Table 3.3.3.1-1 shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

- NOTES -

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.7.	Immediately
C. One or more Functions with two required channels inoperable.	C.1 Restore one required channel to OPERABLE status.	7 days
D. Two [required hydrogen monitor] channels inoperable.	D.1 Restore one [required hydrogen monitor] channel to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. <u>E.</u> Required Action and associated Completion Time of Condition C or D not met.	E.1 D. Enter the Condition referenced in Table 3.3.3.1-1 for the channel.	Immediately
E. <u>F.</u> As required by Required Action E.1 and referenced in D.1 Table 3.3.3.1-1.	F.1 E. Be in MODE 3.	12 hours
F. <u>G.</u> [As required by Required Action E.1 and D.1 referenced in Table 3.3.3.1-1.	G.1 F. Initiate action in accordance with Specification 5.6.7.	Immediately]

SURVEILLANCE REQUIREMENTS

- NOTE -

These SRs apply to each Function in Table 3.3.3.1-1.

SURVEILLANCE	FREQUENCY
SR 3.3.3.1.1 Perform CHANNEL CHECK.	31 days
SR 3.3.3.1.2 Perform CHANNEL CALIBRATION.	[18] months

Table 3.3.3.1-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	CONDITIONS REFERENCED FROM REQUIRED ACTION E.1	D.1
1. Reactor Steam Dome Pressure	2	F E	
2. Reactor Vessel Water Level	2	F E	
3. Suppression Pool Water Level	2	F E	
4. Drywell Pressure	2	F E	
5. Primary Containment Area Radiation	2	[G] F	
6. Drywell Sump Level	2	F] E	
7. Drywell Drain Sump Level	2	F] E	
8. Penetration Flow Path PCIV Position	2 per penetration flow path ^{(a) (c)}	F E	
9. Wide Range Neutron Flux	2	F E	
10. Drywell H ₂ & O ₂ Analyzer	2	F	
11. Containment H ₂ & O ₂ Analyzer	2	F	
10.42. Primary Containment Pressure	2	F E	
11.43. [Relief Valve Discharge Location] Suppression Pool Water Temperature	2 ^(c)	F E	

- (a) Not required for isolation valves whose associated penetration flow path is isolated by at least one closed and de-activated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.
- (b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.
- (c) Monitoring each [relief valve discharge location].

- REVIEWER'S NOTE -

Table 3.3.3.1-1 shall be amended for each plant as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category 1, non-Type A instruments specified in the plant's Regulatory Guide 1.97, Safety Evaluation Report.

Primary Containment Hydrogen Recombiners
3.6.3.1

3.6 CONTAINMENT SYSTEMS

3.6.3.1 Primary Containment Hydrogen Recombiners (if permanently installed)

LCO 3.6.3.1 Two primary containment hydrogen recombiners shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One primary containment hydrogen recombinder inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore primary containment hydrogen recombinder to OPERABLE status.</p>	30 days
B. [Two primary containment hydrogen recombiners inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one primary containment hydrogen recombinder to OPERABLE status.</p>	1 hour AND One per 12 hours thereafter 7 days]
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

Primary Containment Hydrogen Recombiners
3.6.3.1

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.3.1.1	Perform a system functional test for each primary containment hydrogen recombiner.	[18] months
SR 3.6.3.1.2	Visually examine each primary containment hydrogen recombiner enclosure and verify there is no evidence of abnormal conditions.	[18] months
SR 3.6.3.1.3	Perform a resistance to ground test for each heater phase.	[18] months

Primary Containment and Drywell Hydrogen Ignitors

~~3.6.3.2~~

3.6.3.1

3.6 CONTAINMENT SYSTEMS

3.6.3.2 Primary Containment and Drywell Hydrogen Ignitors

3.6.3.1

- LCO 3.6.3.2 Two divisions of primary containment and drywell hydrogen ignitors shall
 3.6.3.1 be OPERABLE, each with > 90% of the associated ignitor assemblies
 OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One primary containment and drywell hydrogen ignitor division inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore primary containment and drywell hydrogen ignitor division to OPERABLE status.</p>	30 days
B. Two primary containment and drywell hydrogen ignitor divisions inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one primary containment and drywell hydrogen ignitor division to OPERABLE status.</p>	1 hour <u>AND</u> Once per 12 hours thereafter 7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

Primary Containment and Drywell Hydrogen Ignitors

3.6.3.2

3.6.3.1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.3.2.1 3.6.3.1.1	Energize each primary containment and drywell hydrogen ignitor division and perform current versus voltage measurements to verify required ignitors in service.	184 days
SR 3.6.3.2.2 3.6.3.1.2	<p style="text-align: center;">- NOTE -</p> <p>Not required to be performed until 92 days after discovery of four or more ignitors in the division inoperable.</p> <p>Energize each primary containment and drywell hydrogen ignitor division and perform current versus voltage measurements to verify required ignitors in service.</p>	92 days
SR 3.6.3.2.3 3.6.3.1.3	Verify each required ignitor in inaccessible areas develops sufficient current draw for a $\geq [1700]^\circ\text{F}$ surface temperature.	[18] months
SR 3.6.3.2.4 3.6.3.1.4	Verify each required ignitor in accessible areas develops a surface temperature of $\geq [1700]^\circ\text{F}$.	[18] months

3.6 CONTAINMENT SYSTEMS

3.6.3.3 [Drywell Purge System]

3.6.3.2

LCO 3.6.3.3 Two [drywell purge] subsystems shall be OPERABLE.
 3.6.3.2

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One [drywell purge] subsystem inoperable.	<p>A.1 ----- - NOTE - LCO 3.0.4 is not applicable. -----</p> <p>Restore [drywell purge] subsystem to OPERABLE status.</p>	30 days
B. Two [drywell purge] subsystems inoperable.	<p>B.1 Verify by administrative means that the hydrogen control function is maintained.</p> <p><u>AND</u></p> <p>B.2 Restore one [drywell purge] subsystem to OPERABLE status.</p>	<p>1 hour <u>AND</u> Once per 12 hours thereafter</p> <p>7 days</p>
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.3.3.1 3.6.3.2.1	Operate each [drywell purge] subsystem for ≥ [15] minutes.	92 days
SR 3.6.3.3.2 3.6.3.2.2	[Verify each [drywell purge] subsystem flow rate is ≥ [500] scfm.]	[18] months]

5.6 Reporting Requirements

5.6.6 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (continued)

- REVIEWER'S NOTE -

The methodology for the calculation of the P-T limits for NRC approval should include the following provisions:

1. The methodology shall describe how the neutron fluence is calculated (reference new Regulatory Guide when issued).
 2. The Reactor Vessel Material Surveillance Program shall comply with Appendix H to 10 CFR 50. The reactor vessel material irradiation surveillance specimen removal schedule shall be provided, along with how the specimen examinations shall be used to update the PTLR curves.
 3. Low Temperature Overpressure Protection (LTOP) System lift setting limits for the Power Operated Relief Valves (PORVs), developed using NRC-approved methodologies may be included in the PTLR.
 4. The adjusted reference temperature (ART) for each reactor beltline material shall be calculated, accounting for radiation embrittlement, in accordance with Regulatory Guide 1.99, Revision 2.
 5. The limiting ART shall be incorporated into the calculation of the pressure and temperature limit curves in accordance with NUREG-0800 Standard Review Plan 5.3.2, Pressure-Temperature Limits.
 6. The minimum temperature requirements of Appendix G to 10 CFR Part 50 shall be incorporated into the pressure and temperature limit curves.
 7. Licensees who have removed two or more capsules should compare for each surveillance material the measured increase in reference temperature (RT_{NDT}) to the predicted increase in RT_{NDT} ; where the predicted increase in RT_{NDT} is based on the mean shift in RT_{NDT} plus the two standard deviation value ($2\sigma_\Delta$) specified in Regulatory Guide 1.99, Revision 2. If the measured value exceeds the predicted value (increase in $RT_{NDT} + 2\sigma_\Delta$), the licensee should provide a supplement to the PTLR to demonstrate how the results affect the approved methodology.
-

5.6.7

Post Accident Monitoring Report

F

When a Special Report is required by Condition B or G of LCO 3.3.[3.1], "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method

BASES

LCO (continued)

position indication in the control room to be OPERABLE for each active PCIV in a containment penetration flow path, i.e., two total channels of PCIV position indication for a penetration flow path with two active valves. For containment penetrations with only one active PCIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to verify redundantly the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration is not required to be OPERABLE. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

[For this plant, the PCIV position PAM instrumentation consists of the following:]

9. Wide Range Neutron Flux

Wide range neutron flux is a Category I variable provided to verify reactor shutdown.

[For this plant, wide range neutron flux PAM instrumentation consists of the following:]

10, 11. Drywell and Containment Hydrogen and Oxygen Analyzer

Drywell and containment hydrogen and oxygen analyzers are Category I instruments provided to detect high hydrogen or oxygen concentration conditions that represent a potential for containment breach. This variable is also important in verifying the adequacy of mitigating actions.

[For this plant, the drywell and containment hydrogen and oxygen analyzers PAM instrumentation consists of the following:]

10. 12. Primary Containment Pressure

Primary containment pressure is a Category I variable provided to verify RCS and containment integrity and to verify the effectiveness of ECCS actions taken to prevent containment breach. Two wide range primary containment pressure signals are transmitted from separate pressure

BASES

LCO (continued)

transmitters and are continuously recorded and displayed on two control room recorders. These recorders are the primary indication used by the operator during an accident. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

11. 43. Suppression Pool Water Temperature

Suppression pool water temperature is a Category I variable provided to detect a condition that could potentially lead to containment breach, and to verify the effectiveness of ECCS actions taken to prevent containment breach. The suppression pool water temperature instrumentation allows operators to detect trends in suppression pool water temperature in sufficient time to take action to prevent steam quenching vibrations in the suppression pool. Twenty-four temperature sensors are arranged in six groups of four independent and redundant channels, located such that there is a group of sensors within a 30 ft line of sight of each relief valve discharge location.

Thus, six groups of sensors are sufficient to monitor each relief valve discharge location. Each group of four sensors includes two sensors for normal suppression pool temperature monitoring and two sensors for PAM. The outputs for the PAM sensors are recorded on four independent recorders in the control room. (Channels A and C are redundant to channels B and D, respectively.) All four of these recorders must be OPERABLE to furnish two channels of PAM indication for each of the relief valve discharge locations. These recorders are the primary indication used by the operator during an accident. Therefore, the PAM Specification deals specifically with this portion of the instrument channels. Each suppression pool water temperature [relief valve discharge location] is treated separately and each [relief valve discharge location] is considered to be a separate function. Therefore, separate Condition entry is allowed for each inoperable [relief valve discharge location].

APPLICABILITY

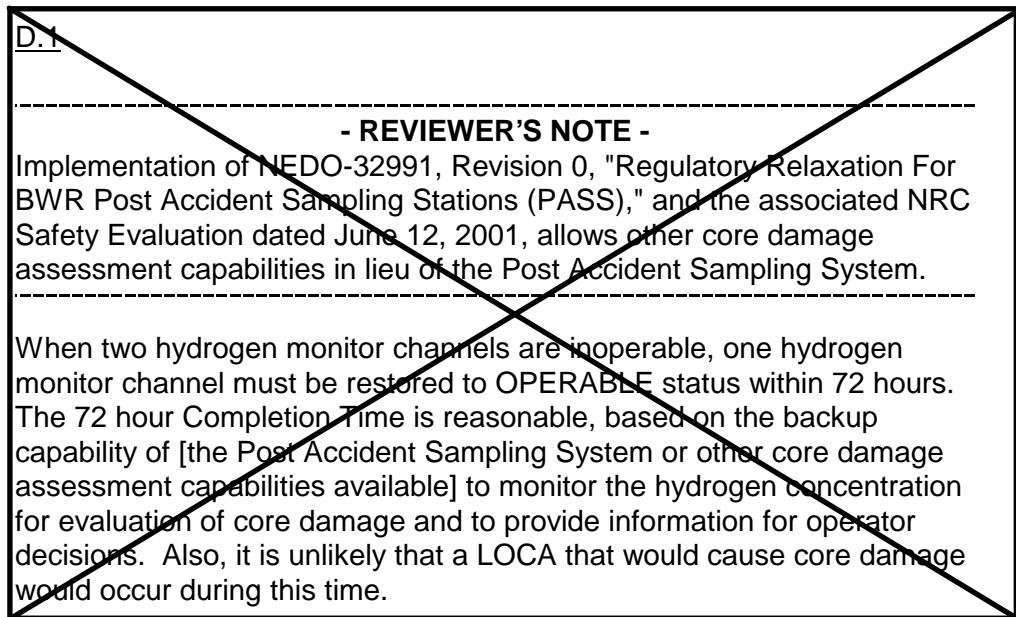
The PAM instrumentation LCO is applicable in MODES 1 and 2. These variables are related to the diagnosis and preplanned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in MODES 1 and 2. In MODES 3, 4, and 5, plant conditions are such that the likelihood of an event that would require PAM instrumentation is extremely low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.

BASES

ACTIONS (continued)

C.1

When one or more Functions have two required channels that are inoperable (i.e., two channels inoperable in the same Function), one channel in the Function should be restored to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur. Condition C is modified by a Note that excludes hydrogen monitor channels. Condition D provides appropriate Required Actions for two inoperable hydrogen monitor channels.



D.1 E.1

This Required Action directs entry into the appropriate Condition referenced in Table 3.3.3.1-1. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has the ~~not met any~~ Required Action of Condition C or D, as applicable, and the associated Completion Time has expired, Condition E is entered for that

D

BASES

ACTIONS (continued)

channel and provides for transfer to the appropriate subsequent Condition.

E.1 F.1

the

For the majority of Functions in Table 3.3.3.1-1, if ~~any~~ Required Action and associated Completion Time of Condition C or D is not met, the plant must be placed in a MODE in which the LCO does not apply. This is done by placing the plant in at least MODE 3 within 12 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant condition from full power conditions in an orderly manner and without challenging plant systems.

F.1 G.1

Since alternate means of monitoring primary containment area radiation have been developed and tested, the Required Action is not to shut down the plant but rather to follow the directions of Specification 5.6.7. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

SURVEILLANCE REQUIREMENTS	The following SRs apply to each PAM instrumentation Function in Table 3.3.3.1-1.
---------------------------	--

SR 3.3.3.1.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar plant instruments located throughout the plant.

B 3.6. CONTAINMENT SYSTEMS

B 3.6.3.1 Primary Containment Hydrogen Recombiners

BASES

BACKGROUND

The primary containment hydrogen recombinder eliminates the potential breach of primary containment due to a hydrogen oxygen reaction and is part of combustible gas control required by 10 CFR 50.44, "Standards for Combustible Gas Control in Light-Water-Cooled Reactors" (Ref. 1), and GDC 41, "Containment Atmosphere Cleanup" (Ref. 2). The primary containment hydrogen recombinder is required to reduce the hydrogen concentration in the primary containment following a loss of coolant accident (LOCA). The primary containment hydrogen recombinder accomplishes this by recombining hydrogen and oxygen to form water vapor. The vapor remains in the primary containment, thus eliminating any discharge to the environment. The primary containment hydrogen recombinder is manually initiated, since flammability limits would not be reached until several days after a Design Basis Accident (DBA).

Two 100% capacity independent primary containment hydrogen recombinder subsystems are provided. Each consists of controls located in the control room, a power supply, and a recombinder located in primary containment. The recombiners have no moving parts. Recombination is accomplished by heating a hydrogen air mixture to > [1150]°F. The resulting water vapor and discharge gases are cooled prior to discharge from the unit. Air flows through the unit at [100] cfm, with natural circulation in the unit providing the motive force. A single recombinder is capable of maintaining the hydrogen concentration in primary containment below the 4.0 volume percent (v/o) flammability limit. Two recombiners are provided to meet the requirement for redundancy and independence. Each recombinder is powered from a separate Engineered Safety Feature bus and is provided with separate power panel and control panel.

Emergency operating procedures direct that the hydrogen concentration in primary containment be monitored following a DBA and that the primary containment hydrogen recombinder be manually activated to prevent the primary containment atmosphere from reaching a bulk hydrogen concentration of 4.0 v/o.

Primary Containment Hydrogen Recombiners
B 3.6.3.1

BASES

APPLICABLE SAFETY ANALYSES

The primary containment hydrogen recombiner provides the capability of controlling the bulk hydrogen concentration in primary containment to less than the lower flammable concentration of 4.0 v/o following a DBA. This control would prevent a primary containment wide hydrogen burn, thus ensuring that pressure and temperature conditions assumed in the analysis are not exceeded. The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate in primary containment following a LOCA as a result of either:

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant or
- b. Radiolytic decomposition of water in the Reactor Coolant System.

To evaluate the potential for hydrogen accumulation in primary containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Assumptions recommended by Reference 3 are used to maximize the amount of hydrogen calculated.

The calculation confirms that when the mitigating systems are actuated in accordance with plant procedures, the peak hydrogen concentration in the primary containment remains < 4 v/o (Ref. 4).

The primary containment hydrogen recombiners satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two primary containment hydrogen recombiners must be OPERABLE. This ensures operation of at least one primary containment hydrogen recombiner in the event of a worst case single active failure.

Operation with at least one primary containment hydrogen recombiner subsystem ensures that the post LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

APPLICABILITY

In MODES 1 and 2, the two primary containment hydrogen recombiners are required to control the hydrogen concentration within primary containment below its flammability limit of 4.0 v/o following a LOCA, assuming a worst case single failure.

In MODE 3, both the hydrogen production rate and the total hydrogen production after a LOCA would be less than that calculated for the DBA

BASES

APPLICABILITY (continued)

LOCA. Also, because of the limited time in this MODE, the probability of an accident requiring the primary containment hydrogen recombiner is low. Therefore, the primary containment hydrogen recombiner is not required in MODE 3.

In MODES 4 and 5, the probability and consequences of a LOCA are low due to the pressure and temperature limitations in these MODES. Therefore, the primary containment hydrogen recombiner is not required in these MODES.

ACTIONS

A.1

With one primary containment hydrogen recombiner inoperable, the inoperable primary containment hydrogen recombiner must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE primary containment recombiner is adequate to perform the hydrogen control function. However, the overall reliability is reduced because a single failure in the OPERABLE recombiner could result in reduced hydrogen control capability. The 30 day Completion Time is based on the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the amount of time available after the event for operator action to prevent hydrogen accumulation exceeding this limit, and the low probability of failure of the OPERABLE primary containment hydrogen recombiner.

Required Action A.1 has been modified by a Note stating that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one recombiner is inoperable. This allowance is provided because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the low probability of the failure of the OPERABLE recombiner, and the amount of time available after a postulated LOCA for operator action to prevent exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

~~BASES~~

ACTIONS (continued)

With two primary containment hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [one division of the hydrogen ignitors]. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If any Required Action and required Completion Time cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

~~SURVEILLANCE REQUIREMENTS~~

SR 3.6.3.1.1

Performance of a system functional test for each primary containment hydrogen recombiner ensures that the recombiners are OPERABLE and can attain and sustain the temperature necessary for hydrogen recombination. In particular, this SR requires verification that the

BASES

SURVEILLANCE REQUIREMENTS (continued)

minimum heater sheath temperature increases to $\geq [1200]^\circ\text{F}$ in $\leq [5]$ hours and that it is maintained $> [1150]$ and $< [1300]^\circ\text{F}$ for $\geq [4]$ hours to check the capability of the recombiner to properly function (and that significant heater elements are not burned out)

Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.3.1.2

This SR ensures that there are no physical problems that could affect primary containment hydrogen recombiner operation. Since the recombiners are mechanically passive, they are not subject to mechanical failure. The only credible failures involve loss of power, blockage of the internal flow path, missile impact, etc. A visual inspection is sufficient to determine abnormal conditions that could cause such failures.

Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.3.1.3

This SR requires performance of a resistance to ground test of each heater phase to ensure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq [10,000]$ ohms.

Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. 10 CFR 50.44.
2. 10 CFR 50, Appendix A, GDC 41.
3. Regulatory Guide 1.7, Revision [1].

Primary Containment Hydrogen Recombiners
B 3.6.3.1

BASES

REFERENCES (continued)

4. FSAR, Section [8.2.5].

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.2 Primary Containment and Drywell Hydrogen Ignitors

3.6.3.1

BASES

BACKGROUND The primary containment and drywell hydrogen ignitors are a part of the combustible gas control required by 10 CFR 50.44 (Ref. 1) and GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), to reduce the hydrogen concentration in the primary containment following a degraded core accident. The hydrogen ignitors ensure the combustion of hydrogen in a manner such that containment overpressure failure is prevented as a result of a postulated degraded core accident.

10 CFR 50.44 (Ref. 1) requires boiling water reactor units with Mark III containments to install suitable hydrogen control systems. The hydrogen ignitors are installed to accommodate an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water. This requirement was placed on reactor units with Mark III containments because they were not designed for inerting and because of their low design pressure. Calculations indicate that if hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water were to collect in primary containment, the resulting hydrogen concentration would be far above the lower flammability limit such that, without the hydrogen ignitors, if the hydrogen were ignited from a random ignition source, the resulting hydrogen burn would seriously challenge the primary containment.

The hydrogen ignitors are based on the concept of controlled ignition using thermal ignitors designed to be capable of functioning in a post accident environment, seismically supported and capable of actuation from the control room. Ignitors are distributed throughout the [32] regions of the drywell and primary containment in which hydrogen could be released or to which it could flow in significant quantities. The hydrogen ignitors are arranged in two independent divisions such that each containment region has two ignitors, one from each division, controlled and powered redundantly so that ignition would occur in each region even if one division failed to energize.

When the hydrogen ignitors are energized they heat up to a surface temperature \geq [1700] $^{\circ}$ F. At this temperature, they ignite the hydrogen gas that is present in the airspace in the vicinity of the ignitor. The hydrogen ignitors depend on the dispersed location of the ignitors so that local pockets of hydrogen at increased concentrations would burn before reaching a hydrogen concentration significantly higher than the lower flammability limit. Hydrogen ignition in the vicinity of the ignitors is

BASES

BACKGROUND (continued)

assumed to occur when the local hydrogen concentration reaches [8.0] volume percent (v/o) and results in [85]% of the hydrogen present being consumed.

APPLICABLE SAFETY ANALYSES The hydrogen ignitors cause hydrogen in containment to burn in a controlled manner as it accumulates following a degraded core accident (Ref. 3). Burning occurs at the lower flammability concentration, where the resulting temperatures and pressures are relatively benign. Without the system, hydrogen could build up to higher concentrations that could result in a violent reaction if ignited by a random ignition source after such a buildup.

The hydrogen ignitors are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners. However, the hydrogen ignitors have been shown by probabilistic risk analysis to be a significant contributor to limiting the severity of accident sequences that are commonly found to dominate risk for units with Mark III containment.

The hydrogen ignitors satisfy Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO Two divisions of primary containment and drywell hydrogen ignitors must be OPERABLE, each with more than 90% of the ignitors OPERABLE.

This ensures operation of at least one ignitor division, with adequate coverage of the primary containment and drywell, in the event of a worst case single active failure. This will ensure that the hydrogen concentration remains near 4.0 v/o.

APPLICABILITY In MODES 1 and 2, the hydrogen ignitor is required to control hydrogen concentration to near the flammability limit of 4.0 v/o following a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding. The control of hydrogen concentration prevents overpressurization of the primary containment. The event that could generate hydrogen in quantities sufficiently high enough to exceed the flammability limit is limited to MODES 1 and 2.

BASES**APPLICABILITY (continued)**

In MODE 3, both the hydrogen production rate and the total hydrogen produced after a degraded core accident would be less than that calculated for the DBA LOCA. Also, because of the limited time in this MODE, the probability of an accident requiring the hydrogen ignitor is low. Therefore, the hydrogen ignitor is not required in MODE 3.

In MODES 4 and 5, the probability and consequences of a degraded core accident are reduced due to the pressure and temperature limitations. Therefore, the hydrogen ignitors are not required to be OPERABLE in MODES 4 and 5 to control hydrogen.

ACTIONS**A.1**

With one hydrogen ignitor division inoperable, the inoperable division must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE hydrogen ignitor division is adequate to perform the hydrogen burn function. However, the overall reliability is reduced because a single failure in the OPERABLE subsystem could result in reduced hydrogen control capability. The 30 day Completion Time is based on the low probability of the occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding, the amount of time available after the event for operator action to prevent hydrogen accumulation from exceeding the flammability limit, and the low probability of failure of the OPERABLE hydrogen ignitor division.

Required Action A.1 has been modified by a Note indicating the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one hydrogen ignitor division is inoperable or when one or more areas with adjacent ignitors are inoperable. The allowance is provided because of the low probability of the occurrence of an event that would generate hydrogen in amounts capable of exceeding the flammability limit, the low probability of the failure of both hydrogen ignitor divisions or adjacent ignitors, and the amount of time available after the event for operator action to prevent exceeding the flammability limit.

B.1 and B.2

With two primary containment and drywell ignitor divisions inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. ~~The alternate hydrogen control capabilities are provided by one hydrogen recombiner and one drywell purge subsystem.~~ The 1 hour Completion Time allows a

BASES

ACTIONS (continued)

reasonable period of time to verify that a loss of hydrogen control function does not exist. The verification may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control capabilities. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control capabilities. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two ignitor divisions inoperable for up to 7 days. Seven days is a reasonable time to allow two ignitor divisions to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If any Required Action and required Completion Time cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.3.2.1 and SR 3.6.3.2.2 SR 3.6.3.1.1 and SR 3.6.3.1.2

These SRs verify that there are no physical problems that could affect the ignitor operation. Since the ignitors are mechanically passive, they are not subject to mechanical failure. The only credible failures are loss of power or burnout. The verification that each required ignitor is energized is performed by circuit current versus voltage measurement.

The Frequency of 184 days has been shown to be acceptable through operating experience because of the low failure occurrence, and provides assurance that hydrogen burn capability exists between the more rigorous 18 month Surveillances. Operating experience has shown these components usually pass the Surveillance when performed at a 184 day Frequency. Additionally, these surveillances must be performed every 92 days if four or more ignitors in any division are inoperable. The 92 day Frequency was chosen, recognizing that the failure occurrence is higher than normal. Thus, decreasing the Frequency from 184 days to 92 days is a prudent measure, since only two more inoperable ignitors (for a total of six) will result in an inoperable ignitor division. SR 3.6.3.2.2 is modified by a Note that indicates that the Surveillance is not required to be



3.6.3.1.2

BASES**SURVEILLANCE REQUIREMENTS (continued)**

performed until 92 days after four or more ignitors in the division are discovered to be inoperable.

[SR 3.6.3.2.3 and SR 3.6.3.2.4 SR 3.6.3.1.3 and SR 3.6.3.1.4

These functional tests are performed every 18 months to verify system OPERABILITY. The current draw to develop a surface temperature of $\geq 1700^{\circ}\text{F}$ is verified for ignitors in inaccessible areas, e.g., in a high radiation area. Additionally, the surface temperature of each accessible ignitor is measured to be $\geq 1700^{\circ}\text{F}$ to demonstrate that a temperature sufficient for ignition is achieved. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.]

REFERENCES

1. 10 CFR 50.44.
2. 10 CFR 50, Appendix A, GDC 41.
3. FSAR, Section [6.2.5].

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.3 [Drywell Purge System]

3.6.3.2

BASES

BACKGROUND

The [Drywell Purge System] ensures a uniformly mixed post accident containment atmosphere, thereby minimizing the potential for local hydrogen burns due to a pocket of hydrogen above the flammable concentration.

The [Drywell Purge System] is an Engineered Safety Feature and is designed to operate following a loss of coolant accident (LOCA) in post accident environments without loss of function. The system has two independent subsystems, each consisting of a compressor and associated valves, controls, and piping. Each subsystem is sized to pump [500] scfm. Each subsystem is powered from a separate emergency power supply. Since each subsystem can provide 100% of the mixing requirements, the system will provide its design function with a worst case single active failure.

Following a LOCA, the drywell is immediately pressurized due to the release of steam into the drywell environment. This pressure is relieved by the lowering of the water level within the weir wall, clearing the drywell vents and allowing the mixture of steam and noncondensables to flow into the primary containment through the suppression pool, removing much of the heat from the steam. The remaining steam in the drywell begins to condense as steam flow from the reactor pressure vessel ceases, the drywell pressure falls rapidly. Both drywell purge compressors start automatically 30 seconds after a LOCA signal is received from the Emergency Core Cooling System instrumentation, but only when drywell pressure has decreased to within approximately [0.087] psi above primary containment pressure. This ensures the blowdown from the drywell to the primary containment is complete. The drywell purge compressors force air from the primary containment into the drywell. Drywell pressure increases until the water level between the weir wall and the drywell is forced down to the first row of suppression pool vents forcing drywell atmosphere back into containment and mixing with containment atmosphere to dilute the hydrogen. While drywell purge continues following the LOCA, hydrogen continues to be produced. Eventually, the 4.0 v/o limit is again approached and the hydrogen recombiners are manually placed in operation.

BASESAPPLICABLE
SAFETY
ANALYSES

The [Drywell Purge System] provides the capability for reducing the drywell hydrogen concentration to approximately the bulk average primary containment concentration following a Design Basis Accident (DBA). The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate in primary containment following a LOCA as a result of:

- a. A metal steam reaction between the zirconium fuel rod cladding and the reactor coolant and
- b. Radiolytic decomposition of water in the Reactor Coolant System and drywell sump.

To evaluate the potential for hydrogen accumulation in primary containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended by Reference 1 are used to maximize the amount of hydrogen calculated.

[Based on a conservative assumption used to calculate the hydrogen concentration versus time after a LOCA, the hydrogen concentration in the primary containment would reach [3.5 v/o about 6 days] after the LOCA and [4.0 v/o about 2 days] later if no hydrogen mixing and recombiner were functioning (Ref. 2).]

The [Drywell Purge System] satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two [drywell purge] subsystems must be OPERABLE to ensure operation of at least one primary containment [drywell purge] subsystem in the event of a worst case single active failure. Operation with at least one OPERABLE [drywell purge] subsystem provides the capability of controlling the hydrogen concentration in the drywell without exceeding the flammability limit.

APPLICABILITY

In MODES 1 and 2, the two [drywell purge] subsystems ensure the capability to prevent localized hydrogen concentrations above the flammability limit of 4.0 v/o in the drywell, assuming a worst case single active failure.

In MODE 3, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in this MODE, the probability of

BASES

APPLICABILITY (continued)

an accident requiring the [Drywell Purge System] is low. Therefore, the [Drywell Purge System] is not required in MODE 3.

In MODES 4 and 5, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations in these MODES. Therefore, the [Drywell Purge System] is not required in these MODES.

ACTIONS

A.1

With one [drywell purge] subsystem inoperable, the inoperable subsystem must be restored to OPERABLE status within 30 days. In this Condition, the remaining OPERABLE subsystem is adequate to perform the drywell purge function. However, the overall reliability is reduced because a single failure in the OPERABLE subsystem could result in reduced drywell purge capability. The 30 day Completion Time is based on the availability of the second subsystem, the low probability of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, and the amount of time available after the event for operator action to prevent hydrogen accumulation from exceeding this limit.

Required Action A.1 has been modified by a Note indicating the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one subsystem is inoperable. This allowance is provided because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit, the low probability of the failure of the OPERABLE subsystem, and the amount of time available after a postulated LOCA for operator action to prevent exceeding the flammability limit.

B.1 and B.2

- REVIEWER'S NOTE -

This Condition is only allowed for units with an alternate hydrogen control system acceptable to the technical staff.

With two [drywell purge] subsystems inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by [one division of the hydrogen ignitors]. The

BASES

ACTIONS (continued)

1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist.

- REVIEWER'S NOTE -

The following is to be used if a non-Technical Specification alternate hydrogen control function is used to justify this Condition: In addition, the alternate hydrogen control system capability must be verified once per 12 hours thereafter to ensure its continued availability.

[Both] the [initial] verification may [and all subsequent verifications] may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two [drywell purge] subsystems inoperable for up to 7 days. Seven days is a reasonable time to allow two [drywell purge] subsystems to be inoperable because the hydrogen control function is maintained and because of the low probability of the occurrence of a LOCA that would generate hydrogen in amounts capable of exceeding the flammability limit.

C.1

If any Required Action and the required Completion Time cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.3.3-1 3.6.3.2.1

Operating each [drywell purge] subsystem for \geq 15 minutes ensures that each subsystem is OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, compressor failure, or excessive vibration can be detected for corrective action. The 92 day Frequency is consistent with Inservice Testing Program Frequencies, operating experience, the known reliability of the compressor and controls, and the two redundant subsystems available.

BASES

SURVEILLANCE REQUIREMENTS (continued)[SR 3.6.3.3.2 3.6.3.2.2

Verifying that each [drywell purge] subsystem flow rate is \geq [500] scfm ensures that each subsystem is capable of maintaining drywell hydrogen concentrations below the flammability limit. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the [18] month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.]

REFERENCES

1. Regulatory Guide 1.7, Revision [1].
 2. FSAR, Section [6.2.5].
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