Ameren MISSOURI

Callaway Plant

March 12, 2015

ULNRC-06085

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 50.90

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSING DOCUMENT CHANGE NOTICE (LDCN) 14-0003
APPLICATION TO REVISE TECHNICAL SPECIFICATIONS TO ADOPT TSTF-523, "GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION," USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS (CLIIP)

Pursuant to 10 CFR 50.90, "Application for amendment of license or construction permit," Ameren Missouri (Union Electric Company) herewith transmits an application for amendment to Facility Operating License Number NPF-30 for the Callaway Plant. The proposed amendment would modify Technical Specification requirements in order to address NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," as described in TSTF-523-A, Revision 2, "Generic Letter 2008-01, Managing Gas Accumulation." This license amendment request is required in order to complete the response to NRC Generic Letter 2008-01, a 10 CFR 50.54(f) letter. As such, this is not a voluntary request to change the Callaway Plant licensing basis. Ameren Missouri first committed to submit this proposed change in letter ULNRC-05551 dated October 13, 2008.

Notice of Availability for adopting TSTF-523 under the Consolidated Line Item Improvement Process (CLIIP) was provided in 79 FR 2700. The enclosure to this letter uses the Model Application approved for use in adopting TSTF-523-A and provides a description and assessment of the proposed change. Attachments 1 through 4 to the Enclosure provide the Technical Specification Page Markups, Technical Specification Bases Page Markups, Retyped Technical Specification Pages, and Proposed FSAR Changes, respectively, in support of this amendment request. Attachments 2 and 4 are provided for information only. Final TS Bases changes will be processed under the program for updates per TS 5.5.14, "Technical Specifications Bases Control Program," at the time this amendment is implemented. Final FSAR changes will be processed under the process for FSAR updates pursuant to 10 CFR 50.71(e).

It should be noted that Ameren Missouri proposes to adopt TSTF-523-A Revision 2 with one minor surveillance numbering difference. Specifically, Ameren Missouri is proposing to adopt the new Containment Spray System Surveillance Requirement (SR) as SR 3.6.6.9 vice the SR 3.6.6.4 number found for the surveillance in TSTF-523-A. This difference is administrative in nature and would avoid unnecessary renumbering of existing SRs in the Callaway Technical Specifications.

In accordance with TSTF-523-A Revision 2, Ameren Missouri proposes to control all surveillances added or modified by this amendment application under the Surveillance Frequency Control Program established for Callaway. Under this program, the baseline frequency for each of the new surveillances proposed per this license amendment request would be the frequency proposed in TSTF-523-A Revision 2.

It is requested that approval of this amendment request be granted within a timeframe commensurate with previous industry-NRC agreements for amendments following the CLIIP process. Ameren Missouri further requests that the license amendment be made effective upon NRC issuance, to be implemented within 90 days from the date of issuance.

It has been determined that this amendment application does not involve a significant hazards consideration as determined per 10 CFR 50.92, "Issuance of amendment." Pursuant to 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," Section (b), no environmental impact statement or environmental assessment should need to be prepared in connection with the issuance of this amendment.

The Callaway Onsite Review Committee has reviewed and approved the proposed changes and has approved the submittal of this amendment application. In addition, in accordance with 10 CFR 50.91 "Notice for public comment; State consultation," Section (b)(1), a copy of this amendment application is being provided to the designated Missouri State official.

This amendment request does not contain new commitments. If there are any questions regarding this submittal, please contact Mr. Tom Elwood at 314-225-1905.

I declare under penalty of perjury that the foregoing is true and correct.

Very truly yours,

Executed on: 3/12/2015

Scott A. M

Scott A. Maglio
Manager, Regulatory Affairs

TAW/
Enclosure: Description and Assessment of the Proposed Change

Attachments to the Enclosure:

1 – Technical Specification Page Markups
2 – Technical Specification Bases Page Markups
3 – Retyped Technical Specification Pages
4 – Proposed FSAR Changes

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DESCRIPTION AND ASSESSMENT OF THE PROPOSED CHANGE

1.0 DESCRIPTION

The proposed change revises or adds Surveillance Requirements to verify that the system locations susceptible to gas accumulation are sufficiently filled with water and to provide allowances that permit performance of the verification. The changes are being made to address the concerns discussed in Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems."

The proposed amendment is consistent with TSTF-523-A, Revision 2, "Generic Letter 2008-01, Managing Gas Accumulation."

2.0 ASSESSMENT

2.1 Applicability of Published Safety Evaluation

Ameren Missouri has reviewed the model safety evaluation dated December 23, 2013 [Accession No. ML13255A169] as referenced in the Federal Register Notice of Availability of TSTF-523 (Rev. 2) (79 FR 2700 dated January 15, 2014). This review included review of the NRC staff's evaluation as well as the information provided in TSTF-523-A. As described further below, Ameren Missouri has concluded that the justifications presented in the TSTF-523-A proposal and the model safety evaluation prepared by the NRC staff are applicable to Callaway Plant and justify this proposed license amendment for incorporation of the applicable changes to the Callaway Plant Technical Specifications (TSs).

2.2 Optional Changes and Variations

Ameren Missouri is not proposing any variations or deviations from the TS changes described in the TSTF-523-A, Revision 2, or the applicable parts of the NRC staff's model safety evaluation dated December 23, 2013.

The proposed Callaway TSs will utilize different numbering than the Standard Technical Specifications upon which TSTF-523-A was based. Specifically, the new Surveillance Requirement (SR) being added for the Containment Spray System will be inserted as new SR 3.6.6.9 rather than SR 3.6.6.4 as found in TSTF-523-A. The traveler inserted new SR 3.6.6.4 in order to maintain the listing in order of decreasing frequency. In the Callaway TSs, the frequency of SRs such as those being added by this amendment request are listed as "in accordance with the Surveillance Frequency Control Program" per Callaway License Amendment 202. Therefore, listing the SRs for TS 3.6.6 in order of decreasing frequency in the Callaway TS is not needed. This difference is administrative and would avoid unnecessary renumbering of existing SRs under TS 3.6.6. It does not affect the applicability of TSTF-523-A to the Callaway TSs.

3.0 REGULATORY ANALYSIS

3.1 No Significant Hazards Consideration Determination

Ameren Missouri requests adoption of TSTF-523-A, Rev. 2, "Generic Letter 2008-01, Managing Gas Accumulation," which is an approved change to the Standard Technical Specifications (STS), into the Callaway Plant Technical Specifications. The proposed change revises or adds Surveillance Requirements to verify that the system locations susceptible to gas accumulation are sufficiently filled with water and to provide allowances that permit performance of the verification.

Ameren Missouri has evaluated whether or not a significant hazards consideration is involved with the proposed amendment 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 proposed change revises or adds Surveillance Requirements (SRs) that require verification that the Emergency Core Cooling System (ECCS), the Residual Heat Removal (RHR) System, and the Containment Spray (CS) System, are not rendered inoperable due to accumulated gas and to provide allowances that permit performance of the verification. Gas accumulation in the subject systems is not an initiator of any accident previously evaluated. As a result, the probability of any accident previously evaluated is not significantly increased. The proposed SRs ensure that the subject systems continue to be capable to perform their assumed safety function and are not rendered inoperable due to gas accumulation. Thus, the consequences of any accident previously evaluated are not significantly increased.

   Based on the above, 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 proposed change revises or adds SRs that require verification that the ECCS, the RHR System, and the CS System are not rendered inoperable due to accumulated gas and to provide allowances that permit performance of the revised verification. The proposed change does not involve a physical alteration of the plant (i.e., no new or different type of equipment will be installed) or a change in the methods governing normal plant operation. In addition, the proposed change does not impose any new or different requirements that could initiate an accident. The proposed change does not alter assumptions made in the safety analysis and is consistent with the safety analysis assumptions.

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

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

   Response: No.

   The proposed change revises or adds SRs that require verification that the ECCS, the RHR System, and the CS System are not rendered inoperable due to accumulated gas and to provide allowances which permit performance of the revised verification. The proposed change adds new requirements to manage gas accumulation in order to ensure the subject systems are capable of performing their assumed safety functions. The proposed SRs are more comprehensive than the current SRs and will ensure that the assumptions of the safety analysis are protected. The proposed change does not adversely affect any current plant safety margins or the reliability of the equipment assumed in the safety analysis. Therefore, there are no changes being made to any safety analysis assumptions, safety limits, or limiting safety system settings that would adversely affect plant safety as a result of the proposed change.

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

Based on the above, Ameren Missouri 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.

4.0 ENVIRONMENTAL EVALUATION

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 a 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.

ATTACHMENT 1

TECHNICAL SPECIFICATION PAGE MARKUPS

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required loops inoperable. OR No RCS or RHR loop in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	AND		
	B.2	Initiate action to restore one loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify one RHR or RCS loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.2	Verify SG secondary side narrow range water levels are ≥ 7% for required RCS loops.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	In accordance with the Surveillance Frequency Control Program

Insert 1

Insert 1

SR 3.4.6.4	----------------------NOTE-------------------------- Not required to be performed until 12 hours after entering MODE 4. -- Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.7.1	Verify one RHR loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.2	Verify SG secondary side wide range water level is ≥ 86% in required SGs.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.3	Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.4	Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required RHR loops inoperable. <u>OR</u> No RHR loop in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	<u>AND</u>		
	B.2	Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.8.1	Verify one RHR loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.2	Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.3	Verify RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.1	Verify the following valves are in the listed position with power to the valve operator removed.	In accordance with the Surveillance Frequency Control Program

Number	Position	Function
BNHV8813	Open	Safety Injection to RWST Isolation Valve
EMHV8802A	Closed	SI Hot Legs 2 & 3 Isolation Valve
EMHV8802B	Closed	SI Hot Legs 1 & 4 Isolation Valve
EMHV8835	Open	Safety Injection Cold Leg Isolation Valve
EJHV8840	Closed	RHR/SI Hot Leg Recirc Isolation Valve
EJHV8809A	Open	RHR to Accum Inject Loops 1 & 2 Isolation Valve
EJHV8809B	Open	RHR to Accum Inject Loops 3 & 4 Isolation Valve

Insert Z

SR 3.5.2.2	Verify each ECCS 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.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify ECCS ~~piping is full of water~~. locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1	Be in MODE 3.	6 hours
	AND		
	D.2	Be in MODE 5.	36 hours
E. Two containment spray trains inoperable. OR Two containment cooling trains inoperable.	E.1	Be in MODE 3.	6 hours
	AND		
	E.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

Insert Z

SURVEILLANCE		FREQUENCY
SR 3.6.6.1	Verify each containment spray 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.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.2	Operate each containment cooling train fan unit for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program

(continued)

Insert 2

-------------------------NOTE-------------------------
Not required to be met for system vent flow paths opened under administrative control.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.6.6.3	Verify each containment cooling train cooling water flow rate is ≥ 2200 gpm.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.4	Verify each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.6.6.5	Verify each automatic containment spray valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.6	Verify each containment spray pump starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.7	Verify each containment cooling train starts automatically and minimum cooling water flow rate is established on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.8	Verify each spray nozzle is unobstructed.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.9	Verify containment spray locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. RHR loop requirements not met. (continued)	A.3	Initiate action to satisfy RHR loop requirements.	Immediately
	AND		
	A.4	Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.5.1	Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of ≥ 1000 gpm.	In accordance with the Surveillance Frequency Control Program
SR 3.9.5.2	Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.9.6.2	Verify correct breaker alignment and indicated power available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.9.6.3	Verify RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

ATTACHMENT 2

TECHNICAL SPECIFICATION BASES PAGE MARKUPS
(for information only)

BASES

LCO (continued)

An OPERABLE RCS loop is comprised of an OPERABLE RCP and an OPERABLE SG, which has the minimum water level specified in SR 3.4.6.2.

Similarly for the RHR System, an OPERABLE RHR loop comprises an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

Management of voids is important to RHR System OPERABILITY. The RHR System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of either RCS or RHR provides sufficient circulation for these purposes. However, two loops consisting of any combination of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.5, "RCS Loops - MODE 3";
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

If one required loop is inoperable, redundancy for heat removal is lost. Action must be initiated to restore a second RCS or RHR loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

The unit must be brought to MODE 5 within 24 hours if, as indicated in the Note to Required Action A.2, one RHR loop is OPERABLE. Bringing the unit to MODE 5 is a conservative action with regard to decay heat removal. With only one RHR loop OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining RHR loop, it would be safer to initiate that loss from MODE 5 (≤ 200°F) rather than MODE 4 (200 to 350°F). The Completion Time of 24 hours is a

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ 7% for required RCS loops. If the SG secondary side narrow range water level is < 7%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.6.3

Verification that the required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available the required pump. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 3

REFERENCES

1. FSAR Section 15.4.6.

Insert 3
Page 1 of 2

SR 3.4.6.4

RHR System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the required RHR loop(s) and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

Selection of RHR System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The RHR System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the RHR System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

Insert 3
Page 2 of 2

This SR is modified by a Note that states the SR is not required to be performed until 12 hours after entering MODE 4. In a rapid shutdown, there may be insufficient time to verify all susceptible locations prior to entering MODE 4.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES (Continued)

RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. Electrical power source and distribution requirements for the RHR loops are as specified per LCO 3.8.2, "AC Sources - Shutdown"; LCO 3.8.5, "DC Sources - Shutdown"; LCO 3.8.8, "Inverters - Shutdown," and LCO 3.8.10, "Distribution Systems - Shutdown," consistent with the Bases for those Technical Specifications for reduced requirements during shutdown conditions, subject to the provisions and limitations described in the Bases.

Management of gas voids is important to RHR System OPERABILITY. The RHR System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RHR provides sufficient circulation for these purposes. However, one additional RHR loop is required to be OPERABLE, or the secondary side wide range water level of at least two SGs is required to be ≥ 86%.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.5, "RCS Loops - MODE 3";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

If one RHR loop is inoperable and the required SGs have secondary side wide range water levels < 86%, redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore the required SG secondary side water levels. Either Required Action A.1 or Required Action A.2 will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.7.2 (continued)

equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.7.3

Verification that a second RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the RHR pump. If secondary side wide range water level is ≥ 86% in at least two SGs, this Surveillance is not needed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 4

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of SGs to Remove Decay Heat by Natural Circulation."

2. FSAR Section 15.4.6.

3. TDB-001, "Tank Data Book, Steam Generators EBB01 (A,B,C,D)."

Insert 4

SR 3.4.7.4

RHR System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the required RHR loop(s) and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

Selection of RHR System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The RHR System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the RHR System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES (Continued)

LCO

The purpose of this LCO is to require that at least two RHR loops be OPERABLE and one of these loops be in operation. An OPERABLE loop is one that has the capability of transferring heat from the reactor coolant at a controlled rate. Heat cannot be removed via the RHR System unless forced flow is used. A minimum of one running RHR pump meets the LCO requirement for one loop in operation. An additional RHR loop is required to be OPERABLE to meet single failure considerations.

Note 1 permits all RHR pumps to be removed from operation for ≤ 1 hour. The circumstances for stopping both RHR pumps are to be limited to situations when the outage time is short and core outlet temperature is maintained at least 10°F below saturation temperature. The Note prohibits boron dilution with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1 is maintained or draining operations when RHR forced flow is stopped. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted when no RCS loop is in operation. Note that CVCS resin vessels include the resin vessels of its subsystem the BTRS.

Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours, provided that the other loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when these tests are safe and possible.

An OPERABLE RHR loop is comprised of an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

Management of gas voids is important to RHR System OPERABILITY. The RHR System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

Electrical power source and distribution requirements for the RHR loops are as specified per LCO 3.8.2, "AC Sources - Shutdown"; LCO 3.8.5, "DC Sources - Shutdown"; LCO 3.8.8, "Inverters - Shutdown," and LCO 3.8.10, "Distribution Systems - Shutdown," consistent with the Bases for those Technical Specifications for reduced requirements during shutdown conditions, subject to the provisions and limitations described in the Bases.

APPLICABILITY

In MODE 5 with loops not filled, this LCO requires core heat removal and coolant circulation by the RHR System.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

not filled or when no RCS loop is in operation, consistent with Required Action C.1 of LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)." The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must continue until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.8.1

This SR requires verification that one loop is in operation. Verification may include flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.8.2

Verification that a second RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the RHR pump. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 5

REFERENCES

1. FSAR Section 15.4.6.

Insert 5

SR 3.4.8.3

RHR System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the RHR loops and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

Selection of RHR System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The RHR System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the RHR System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

In MODES 1, 2, and 3, an ECCS train consists of a centrifugal charging subsystem, an SI subsystem, and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and automatically transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. Either of the CCPs may be considered OPERABLE with its associated discharge to RCP seal throttle valve, BGHV8357A or BGHV8357B, inoperable. In the long term, the injection flow path may be switched to take its supply from the containment sump and to supply its flow to the RCS hot and cold legs.

During cold leg recirculation operation, the flow path for each train must maintain its designed independence to ensure that no single failure can disable both ECCS trains.

As indicated in Note 1, the SI flow paths may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 3.4.14.1. The flow paths are readily restorable from the control room.

As indicated in Note 2, operation in MODE 3 with ECCS pumps made incapable of injecting, pursuant to LCO 3.4.12, "Cold Overpressure Mitigation System (COMS)," is allowed for up to 4 hours or until the temperature of all RCS cold legs exceeds 375°F, whichever comes first. LCO 3.4.12 requires that certain pumps be rendered incapable of injecting at and below the COMS arming temperature and time is needed to restore the pumps to OPERABLE status.

Management of gas voids is important to ECCS OPERABILITY. The ECCS is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, a large break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The centrifugal charging pump performance is based on a small break LOCA, which establishes the pump performance curve and has less dependence on power (minimum ECCS large break LOCA assumes the same CCP flow rates as the small break LOCA analysis). The SI pump performance requirements are based on a small break LOCA. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

This LCO is only applicable in MODE 3 and above. The SI signals on low pressurizer pressure and low steam line pressure may be blocked

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1 (continued)

b. The hand control switch for SI pump A (or SI pump B) is placed in pull to lock.

Closure of EMHV8821A or EMHV8821B isolates the associated SI pump from its cold leg injection path rendering that train inoperable; however, the opposite train is prevented from exceeding runout flow conditions which would occur if the opposite pump were connected to both cold leg and hot leg injection paths. The inoperable train's pump is then placed in pull to lock to prevent unanalyzed hot leg injection via its associated 8802 valve. Although one SI train would be rendered inoperable, more than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train would be available, and the plant would be in CONDITION A.1 with a 72 hour restoration time rather than entering LCO 3.0.3.

SR 3.5.2.2

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a non-accident position provided the valve will automatically reposition within the proper stroke time. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown (which may include the use of local or remote indicators), that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves and relief valves. Additionally, vent and drain valves are not within the scope of this SR.

Insert 6

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.5.2.3

ECCS piping and components have the ~~The ECCS pumps are normally in a standby, non-operating mode. As such, flow path piping has the~~ potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the ECCS and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel. ~~Maintaining the piping from the ECCS pumps to the~~

(continued)

Insert 6

The Surveillance is modified by a Note which exempts system vent flow paths opened under administrative control. The administrative control should be proceduralized and include stationing a dedicated individual at the system vent flow path who is in continuous communication with the operators in the control room. This individual will have a method to rapidly close the system vent flow path if directed.

SURVEILLANCE REQUIREMENTS

SR 3.5.2.3 (continued)

~~entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water by venting RHR and SI pump casings and accessible ECCS discharge piping high point vents ensures that the system will perform properly, injecting its full capacity into the RCS upon demand.~~ In conjunction with or in lieu of venting, Ultrasonic Testing (UT) may be performed to verify ECCS pumps and associated piping are Sufficiently full of water.

¶ The design of the centrifugal charging pump is such that significant noncondensible gases do not collect in the pump. Therefore, it is unnecessary to require periodic pump casing venting to ensure the centrifugal charging pumps will remain OPERABLE. ¶, Insert 7 ~~Accessible high point vents are those that can be reached without hazard or high radiation dose to personnel. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling~~. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.5.2.4

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by the ASME Code. This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. The ECCS pumps are required to develop the following differential pressures on recirculation flow: 1) centrifugal charging pumps ≥ 2400 psid; 2) safety injection pumps ≥ 1445 psid; and 3) RHR pumps ≥ 165 psid. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the applicable portions of the Inservice Testing Program, which encompasses the ASME Code. The ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

SR 3.5.2.5 and SR 3.5.2.6

These Surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SI signal or on an actual or simulated RWST Level Low-Low 1 Automatic Transfer signal coincident with an SI signal and that each ECCS pump starts on receipt

(continued)

Insert 7

Selection of ECCS locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The ECCS is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the ECCS System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

ECCS locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to a minimum of two cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to deliver its flow to the RCS hot and cold legs.

This LCO is modified by a Note that allows an RHR subsystem to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4.

Management of gas voids is important to ECCS OPERABILITY. The ECCS is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2.

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable ECCS centrifugal charging pump subsystem when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS centrifugal charging pump subsystem and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A.1

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss of coolant accident or to continue a cooldown using the

(continued)

BASES

LCO (continued)

containment atmosphere and retain volatile iodine species in the sumps, consistent with the safety analysis. To ensure that these requirements are met, two containment spray trains and two containment cooling trains must be OPERABLE. Therefore, in the event of an accident, at least one train in each system operates, assuming the worst case single active failure occurs.

A Containment Spray train typically includes a spray pump, spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an ESF actuation signal and manually transferring to the containment sump.

In addition, management of gas voids is important to Containment Spray System OPERABILITY. The Containment Spray System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

A Containment Cooling train typically includes cooling coils, dampers, two fans, instruments, and controls to ensure an OPERABLE flow path.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment and an increase in containment pressure and temperature requiring the operation of the containment spray trains and containment cooling trains.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Thus, the Containment Spray System and the Containment Cooling System are not required to be OPERABLE in MODES 5 and 6.

ACTIONS

A.1

With one containment spray train inoperable, the inoperable containment spray train must be restored to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE spray and cooling trains are adequate to perform the iodine removal and containment cooling functions. The 72 hour Completion Time takes into account the redundant temperature and pressure reducing capability afforded by the Containment Spray System, reasonable time for repairs, and low probability of a DBA occurring during this period.

The 10 day portion of the Completion Time for Required Action A.1 is based upon engineering judgment. It takes into account the low probability of coincident entry into two Conditions in this Specification coupled with the low probability of an accident occurring during this time.

(continued)

BASES

ACTIONS (continued)

D.1 and D.2

If the Required Action and associated Completion Time of Condition C of this LCO are not 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 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.

E.1 and E.2

With two containment spray trains or two containment cooling trains inoperable, the unit is in a condition outside the accident analysis. Therefore, 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 MODE 3 within six 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 3.6.6.1

Verifying the correct alignment for manual, power operated, and automatic valves in the containment spray flow path provides assurance that the proper flow paths will exist for Containment Spray System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve will automatically reposition within the proper stroke time. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown (which may include the use of local or remote indicators), that those valves outside containment and capable of potentially being mispositioned are in the correct position. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves and relief valves. Additionally, vent and drain valves are not within the scope of this SR.

Insert 8

(continued)

Insert 8

The Surveillance is modified by a Note which exempts system vent flow paths opened under administrative control. The administrative control should be proceduralized and include stationing a dedicated individual at the system vent flow path who is in continuous communication with the operators in the control room. This individual will have a method to rapidly close the system vent flow path if directed.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.6.5 and SR 3.6.6.6 (continued)

reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.6.6.7

This SR requires verification that each containment cooling train actuates upon receipt of an actual or simulated safety injection signal. Upon actuation the fans start in slow speed or, if operating, shift to slow speed and the cooling flow rate increases to a value that enables each train of Containment Coolers to remove the heat load credited in the current Licensing Bases Containment Analysis. Currently, each train of Containment Coolers is credited to remove 100E6 BTU/hr under post-accident conditions. The determination of each train's heat removal capacity will be based upon flow, micro-fouling and macro-fouling. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.6.6.8

With the containment spray inlet valves closed and the spray header drained of any solution, low pressure air or smoke can be blown through test connections. This SR ensures that each spray nozzle is unobstructed and provides assurance that spray coverage of the containment during an accident is not degraded. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 9

REFERENCES

1. 10 CFR 50, Appendix A, GDC 38, GDC 39, GDC 40, GDC 41, GDC 42, GDC 43 and GDC 50.
2. 10 CFR 50, Appendix K.
3. FSAR, Section 6.2.1.
4. FSAR, Section 6.2.2.
5. ASME Code for Operation and Maintenance of Nuclear Power Plants.

Insert 9

SR 3.6.6.9

Containment Spray System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the containment spray trains and may also prevent water hammer and pump cavitation.

Selection of Containment Spray System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration.

The Containment Spray System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the Containment Spray System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

Containment Spray System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

capability. At least one RHR loop must be OPERABLE and in operation to provide:

a. Removal of decay heat;

b. Mixing of borated coolant to minimize the possibility of criticality; and

c. Indication of reactor coolant temperature.

An OPERABLE RHR loop includes an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the RCS temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. In addition, management of gas voids is important to RHR System OPERABILITY. The RHR System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

If both RHR loops are OPERABLE, either RHR loop may be the operating loop. Electrical power source and distribution requirements for the RHR loop(s) are as specified per LCO 3.8.2, "AC Sources – Shutdown"; LCO 3.8.5, "DC Sources – Shutdown"; LCO 3.8.8, "Inverters – Shutdown," and LCO 3.8.10, "Distribution Systems - Shutdown," consistent with the Bases for those Technical Specifications for reduced requirements during shutdown conditions, subject to the provisions and limitations described in the Bases. The standby RHR train may be aligned to the Refueling Water Storage Tank to support filling or draining the refuel pool or for the performance of required testing.

The LCO is modified by a Note that allows the required operating RHR loop to be removed from service for up to 1 hour per 8 hour period, provided no operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to meet the minimum boron concentration of LCO 3.9.1. Boron concentration reduction with coolant at boron concentrations less than required to assure the minimum required RCS boron concentration is maintained is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot leg nozzles and RCS to RHR isolation valve testing. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling pool.

APPLICABILITY

One RHR loop must be OPERABLE and in operation in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to provide decay heat removal. The 23 ft water level was selected because it corresponds to the 23 ft requirement established for fuel movement in

(continued)

BASES

ACTIONS (continued)

A.3

If RHR loop requirements are not met, actions shall be initiated and continued in order to satisfy RHR loop requirements. With the unit in MODE 6 and the refueling water level ≥ 23 ft above the top of the reactor vessel flange, corrective actions shall be initiated immediately.

A.4

If RHR loop requirements are not met, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures dose limits are not exceeded.

The Completion Time of 4 hours is reasonable, based on the low probability of the coolant boiling in that time.

SURVEILLANCE REQUIREMENTS

SR 3.9.5.1

This Surveillance demonstrates that the RHR loop is in operation and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 10

REFERENCES

1. FSAR, Section 5.4.7.

Insert 10

SR 3.9.5.2

RHR System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the required RHR loop and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

Selection of RHR System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The RHR System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the RHR System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

c. Indication of reactor coolant temperature.

An OPERABLE RHR loop consists of an RHR pump, a heat exchanger, valves, piping, instruments and controls to ensure an OPERABLE flow path and to determine the RCS temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. An OPERABLE RHR loop must be capable of being realigned to provide an OPERABLE flow path.

In addition, management of gas voids is important to RHR System OPERABILITY. The RHR System is OPERABLE when it is sufficiently filled with water to perform its specified safety function.

The standby RHR train may be aligned to the Refueling Water Storage Tank to support filling or draining the refuel pool or for the performance of required testing as long as the motor-operated valves EJHV8716A and EJHV8809A are maintained OPERABLE for Train A OPERABILITY and EJHV8716B and EJHV8809B are maintained OPERABLE for Train B OPERABILITY during refuel pool draining. These respective valves plus EJHV8840 must be maintained OPERABLE during refuel pool filling. The standby RHR train may be considered OPERABLE with BN8717 (RHR return to RWST) open as long as it can be isolated by EJHV8716A or B and EJHV8809A or B can be opened to realign the pump discharge to the RCS cold legs. Caution must be exercised whenever BN8717 is open to ensure the operating RHR train's EJHV8716 valve is maintained closed. This is to prevent draining the RCS to the RWST. See Reference 3.

Electrical power source and distribution requirements for the RHR loops are as specified per LCO 3.8.2, "AC Sources – Shutdown"; LCO 3.8.5, "DC Sources – Shutdown"; LCO 3.8.8, "Inverters – Shutdown," and LCO 3.8.10, "Distribution Systems – Shutdown," consistent with the Bases for those Technical Specifications for reduced requirements during shutdown conditions, subject to the provisions and limitations described in the Bases.

APPLICABILITY

Two RHR loops are required to be OPERABLE, and one RHR loop must be in operation in MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, to provide decay heat removal. Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS), and Section 3.5, "Emergency Core Cooling Systems (ECCS)." RHR loop requirements in MODE 6 with the water level ≥ 23 ft are located in LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level." Additional RHR loop requirements in MODE 6 with the water level ≥ 23 feet above the top of the reactor vessel flange are located in FSAR 16.1.2.1, "Flow Path-Shutdown Limiting Condition For Operation."

Since LCO 3.9.6 contains Required Actions with immediate Completion Times related to the restoration of the degraded decay heat removal

(continued)

BASES

ACTIONS

B.3 (continued)

requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures that dose limits are not exceeded.

The Completion Time of 4 hours is reasonable at water levels above reduced inventory, based on the low probability of the coolant boiling in that time. At reduced inventory conditions, additional actions are taken to provide containment closure in a reduced period of time (Reference 2). Reduced inventory is defined as RCS level lower than 3 feet below the reactor vessel flange.

SURVEILLANCE REQUIREMENTS

SR 3.9.6.1

This Surveillance demonstrates that one RHR loop is in operation and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.9.6.2

Verification that the required pump is OPERABLE ensures that an additional RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Insert 11

REFERENCES

1. FSAR, Section 5.4.7.
2. Generic Letter No. 88-17, "Loss of Decay Heat Removal."
3. RFR-15632A.

Insert 11

SR 3.9.6.3

RHR System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the RHR loops and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

Selection of RHR System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walkdowns to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration. Susceptible locations depend on plant and system configuration, such as standby versus operating conditions.

The RHR System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the RHR System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR System locations susceptible to gas accumulation are monitored, and if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

ATTACHMENT 3

RETYPED TECHNICAL SPECIFICATION PAGES

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required loops inoperable. OR No RCS or RHR loop in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	AND		
	B.2	Initiate action to restore one loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify one RHR or RCS loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.2	Verify SG secondary side narrow range water levels are $\geq$ 7% for required RCS loops.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.4.6.3	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.4	-------------------------------- NOTE ---------------------------- Not required to be performed until 12 hours after entering MODE 4. --	
	Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops - MODE 5, Loops Filled

LCO 3.4.7 One residual heat removal (RHR) loop shall be OPERABLE and in operation, and either:

a. One additional RHR loop shall be OPERABLE; or

b. The secondary side wide range water level of at least two steam generators (SGs) shall be ≥ 86%.

--- NOTE ---

1. The RHR pump of the loop in operation may be removed from operation for ≤ 1 hour per 8 hour period provided:

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

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

2. One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.

3. No reactor coolant pump shall be started with any RCS cold leg temperature ≤ 275°F unless the secondary side water temperature of each SG is ≤ 50°F above each of the RCS cold leg temperatures.

4. All RHR loops may be removed from operation during planned heatup to MODE 4 when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One RHR loop inoperable. AND Required SGs secondary side water levels not within limits.	A.1	Initiate action to restore a second RHR loop to OPERABLE status.	Immediately
	OR		
	A.2	Initiate action to restore required SG secondary side water levels to within limits.	Immediately
B. Required RHR loops inoperable. OR No RHR loop in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	AND		
	B.2	Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify one RHR loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.2	Verify SG secondary side wide range water level is ≥ 86% in required SGs.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.3	Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.4	Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.8 RCS Loops - MODE 5, Loops Not Filled

LCO 3.4.8 Two residual heat removal (RHR) loops shall be OPERABLE and one RHR loop shall be in operation.

-- NOTES --

1. All RHR pumps may be removed from operation for ≤ 1 hour provided:

    a. The core outlet temperature is maintained at least 10°F below saturation temperature.

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

    c. No draining operations to further reduce the RCS water volume are permitted.

2. One RHR loop may be inoperable for ≤ 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.

APPLICABILITY: MODE 5 with RCS loops not filled.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One RHR loop inoperable.	A.1	Initiate action to restore RHR loop to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required RHR loops inoperable. OR No RHR loop in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	AND		
	B.2	Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.8.1	Verify one RHR loop is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.2	Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.3	Verify RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.9 Pressurizer

LCO 3.4.9 The pressurizer shall be OPERABLE with:

a. Pressurizer water level ≤ 92%; and

b. Two groups of backup pressurizer heaters OPERABLE with the capacity of each group ≥ 150 kW.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Pressurizer water level not within limit.	A.1	Be in MODE 3.	6 hours
	AND		
	A.2	Fully insert all rods.	6 hours
	AND		
	A.3	Place Rod Control System in a condition incapable of rod withdrawal.	6 hours
	AND		
	A.4	Be in MODE 4.	12 hours
B. One required group of backup pressurizer heaters inoperable.	B.1	Restore required group of backup pressurizer heaters to OPERABLE status.	72 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.9.1	Verify pressurizer water level is ≤ 92%.	In accordance with the Surveillance Frequency Control Program
SR 3.4.9.2	Verify capacity of each required group of backup pressurizer heaters is ≥ 150 kW.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.10 Pressurizer Safety Valves

LCO 3.4.10 Three pressurizer safety valves shall be OPERABLE with lift settings $\geq$ 2411 psig and $\leq$ 2509 psig.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 with all RCS cold leg temperatures > 275°F.

-- NOTES --

The lift settings are not required to be within the LCO limits during MODES 3 and 4 for the purpose of setting the pressurizer safety valves under ambient (hot) conditions. This exception is allowed for 54 hours following entry into MODE 3 provided a preliminary cold setting was made prior to heatup.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One pressurizer safety valve inoperable.	A.1	Restore valve to OPERABLE status.	15 minutes
B. Required Action and associated Completion Time not met. OR Two or more pressurizer safety valves inoperable.	B.1 AND B.2	Be in MODE 3. Be in MODE 4 with any RCS cold leg temperature $\leq$ 275°F.	6 hours 24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.10.1	Verify each pressurizer safety valve is OPERABLE in accordance with the Inservice Testing Program. Following testing, lift settings shall be within ± 1% of 2460 psig.	In accordance with the Inservice Testing Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

-- NOTE --
Separate Condition entry is allowed for each PORV and each block valve.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more PORVs inoperable solely due to excessive seat leakage.	A.1	Close and maintain power to associated block valve.	1 hour
B. One PORV inoperable for reasons other than excessive seat leakage.	B.1	Close associated block valve.	1 hour
	AND		
	B.2	Remove power from associated block valve.	1 hour
	AND		
	B.3	Restore PORV to OPERABLE status.	72 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One block valve inoperable.	------------------ NOTE ------------------ Required Actions do not apply when block valve is inoperable solely as a result of complying with Required Actions B.2 or E.2. --		
	C.1	Place associated PORV in manual control.	1 hour
	AND		
	C.2	Restore block valve to OPERABLE status.	72 hours
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1	Be in MODE 3.	6 hours
	AND		
	D.2	Be in MODE 4.	12 hours
E. Two PORVs inoperable for reasons other than excessive seat leakage.	E.1	Close associated block valves.	1 hour
	AND		
	E.2	Remove power from associated block valves.	1 hour
	AND		
	E.3	Be in MODE 3.	6 hours
	AND		
	E.4	Be in MODE 4.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
F. More than one block valve inoperable.	------------------ NOTE ------------------ Required Action F.1 does not apply when block valve is inoperable solely as a result of complying with Required Action B.2 or E.2. ---		
	F.1	Restore one block valve to OPERABLE status.	2 hours
G. Required Action and associated Completion Time of Condition F not met.	G.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	G.2	Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.11.1	-------------------------------- NOTE --------------------------- Not required to be performed with block valve closed in accordance with the Required Actions of this LCO. --- Perform a complete cycle of each block valve.	In accordance with the Surveillance Frequency Control Program
SR 3.4.11.2	Perform a complete cycle of each PORV.	In accordance with the Inservice Testing Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Cold Overpressure Mitigation System (COMS)

LCO 3.4.12 COMS shall be OPERABLE with a maximum of zero safety injection pumps and one centrifugal charging pump capable of injecting into the RCS and the accumulators isolated and one of the following pressure relief capabilities:

a. Two power operated relief valves (PORVs) with lift settings within the limits specified in the PTLR, or

b. Two residual heat removal (RHR) suction relief valves with setpoints ≥ 436.5 psig and ≤ 463.5 psig, or

c. One PORV with a lift setting within the limits specified in the PTLR and one RHR suction relief valve with a setpoint ≥ 436.5 psig and ≤ 463.5 psig, or

d. The RCS depressurized and an RCS vent of ≥ 2.0 square inches.

-- NOTES --

1. Two centrifugal charging pumps may be made capable of injecting for ≤ 1 hour for pump swap operations.

2. One or more safety injection pumps may be made capable of injecting in MODES 5 and 6 when the RCS water level is below the top of the reactor vessel flange for the purpose of protecting the decay heat removal function.

3. Accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 with any RCS cold leg temperature ≤ 275°F,
MODE 5,
MODE 6 when the reactor vessel head is on.

ACTIONS

---------- NOTE ----------
LCO 3.0.4.b is not applicable when entering MODE 4.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more safety injection pumps capable of injecting into the RCS.	A.1	Initiate action to verify a maximum of zero safety injection pumps are capable of injecting into the RCS.	Immediately
B. Two centrifugal charging pumps capable of injecting into the RCS.	B.1	Initiate action to verify a maximum of one centrifugal charging pump is capable of injecting into the RCS.	Immediately
C. An accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	C.1	Isolate affected accumulator.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1	Increase all RCS cold leg temperatures to > 275°F.	12 hours
	<u>OR</u>		
	D.2	Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours
E. One required RCS relief valve inoperable in MODE 4.	E.1	Restore required RCS relief valve to OPERABLE status.	7 days
F. One required RCS relief valve inoperable in MODE 5 or 6.	F.1	Restore required RCS relief valve to OPERABLE status.	24 hours
G. Two required RCS relief valves inoperable. <u>OR</u> Required Action and associated Completion Time of Condition A, B, D, E, or F not met. <u>OR</u> COMS inoperable for any reason other than Condition A, B, C, D, E, or F.	G.1	Depressurize RCS and establish RCS vent of ≥ 2.0 square inches.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1	Verify a maximum of zero safety injection pumps are capable of injecting into the RCS.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.2	Verify a maximum of one centrifugal charging pump is capable of injecting into the RCS.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.3	Verify each accumulator is isolated when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.4	Verify RHR suction isolation valves are open for each required RHR suction relief valve.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.5	Verify required RCS vent $\geq$ 2.0 square inches open.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.12.6	Verify PORV block valve is open for each required PORV.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.7	Not used.	
SR 3.4.12.8	-------------------------------- NOTE ---------------------------- Not required to be performed until 12 hours after decreasing any RCS cold leg temperature to ≤ 275°F. --	
	Perform a COT on each required PORV, excluding actuation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.12.9	Perform CHANNEL CALIBRATION for each required PORV actuation channel.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE; and

d. 150 gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. RCS operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.	A.1	Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> Pressure boundary LEAKAGE exists. <u>OR</u> Primary to secondary LEAKAGE not within limit.	B.1 <u>AND</u> B.2 .	Be in MODE 3. Be in MODE 5	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.13.1	------------------------- NOTES ------------------------------ 1. Not required to be performed until 12 hours after establishment of steady state operation. 2. Not applicable to primary to secondary LEAKAGE --- Verify RCS operational LEAKAGE is within limits by performance of RCS water inventory balance.	In accordance with the Surveillance Frequency Control Program
SR 3.4.13.2	------------------------- NOTE ------------------------------ Not required to be performed until 12 hours after establishment of steady state operation. --- Verify primary to secondary LEAKAGE is ≤ 150 gallons per day through any one SG.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 RCS Pressure Isolation Valve (PIV) Leakage

LCO 3.4.14 Leakage from each RCS PIV shall be within limit.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4, except valves in the residual heat removal (RHR) flow path when in, or during the transition to or from, the RHR mode of operation.

ACTIONS

-- NOTES --

1. Separate Condition entry is allowed for each flow path.

2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more flow paths with leakage from one or more RCS PIVs not within limit.	A.1	----------- NOTE ------------ Each valve used to satisfy Required Action A.1 must have been verified to meet SR 3.4.14.1 and be in the reactor coolant pressure boundary. -------------------------------	
		Isolate the high pressure portion of the affected system from the low pressure portion by use of one deactivated remote manual or check valve.	4 hours
	<u>AND</u>		
	A.2	Restore RCS PIV to within limits.	72 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required Action and associated Completion Time for Condition A not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	36 hours
C. RHR suction isolation valve interlock function inoperable.	C.1	Isolate the affected penetration by use of one deactivated remote manual valve.	4 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.14.1	-------------------------------- NOTES ------------------------- 1. Not required to be performed in MODES 3 and 4. 2. Not required to be performed on the RCS PIVs located in the RHR flow path when in the shutdown cooling mode of operation. 3. RCS PIVs actuated during the performance of this Surveillance are not required to be tested more than once if a repetitive testing loop cannot be avoided. ---	
	Verify leakage from each RCS PIV is equivalent to $\leq$ 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm at an RCS pressure $\geq$ 2215 psig and $\leq$ 2255 psig.	In accordance with the Inservice Testing Program, <u>AND</u> In accordance with the Surveillance Frequency Control Program <u>AND</u> Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more and if leakage testing has not been performed in the previous 9 months <u>AND</u> (continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.14.1 (continued)		Within 24 hours following check valve actuation due to flow through the valve
SR 3.4.14.2	Verify RHR suction isolation valve interlock prevents the valves from being opened with a simulated or actual RCS pressure signal ≥ 425 psig except when the valves are open to satisfy LCO 3.4.12.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.15 RCS Leakage Detection Instrumentation

LCO 3.4.15 The following RCS leakage detection instrumentation shall be OPERABLE:

a. The containment sump level and flow monitoring system;

b. One containment atmosphere particulate radioactivity monitor; and

c. The containment cooler condensate monitoring system.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Required containment sump level and flow monitoring system inoperable.	A.1	----------- NOTE ------------ Not required until 12 hours after establishment of steady state operation. -------------------------------- Perform SR 3.4.13.1.	Once per 24 hours
	AND		
	A.2	Restore required containment sump level and flow monitoring system to OPERABLE status.	30 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required containment atmosphere particulate radioactivity monitor inoperable.	B.1.1	Analyze samples of the containment atmosphere.	Once per 24 hours
	<u>OR</u>		
	B.1.2	----------- NOTE ------------ Not required until 12 hours after establishment of steady state operation. ------------------------------- Perform SR 3.4.13.1.	Once per 24 hours
	<u>AND</u>		
	B.2.1	Restore required containment atmosphere particulate radioactivity monitor to OPERABLE status.	30 days
	<u>OR</u>		
	B.2.2	Verify containment air cooler condensate monitoring system is OPERABLE.	30 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required containment cooler condensate monitoring system inoperable.	C.1	Perform SR 3.4.15.1.	Once per 8 hours
	<u>OR</u>		
	C.2	----------- NOTE ------------ Not required until 12 hours after establishment of steady state operation. --------------------------------- Perform SR 3.4.13.1.	Once per 24 hours
D. Required containment atmosphere particulate radioactivity monitor inoperable. <u>AND</u> Required containment cooler condensate monitoring system inoperable.	D.1	Restore required containment atmosphere particulate radioactivity monitor to OPERABLE status.	30 days
	<u>OR</u>		
	D.2	Restore required containment cooler condensate monitoring system to OPERABLE status.	30 days
E. Required Action and associated Completion Time not met.	E.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	E.2	Be in MODE 5.	36 hours
F. All required monitoring methods inoperable.	F.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.15.1	Perform CHANNEL CHECK of the required containment atmosphere particulate radioactivity monitor.	In accordance with the Surveillance Frequency Control Program
SR 3.4.15.2	Perform COT of the required containment atmosphere particulate radioactivity monitor.	In accordance with the Surveillance Frequency Control Program
SR 3.4.15.3	Perform CHANNEL CALIBRATION of the required containment sump level and flow monitoring system.	In accordance with the Surveillance Frequency Control Program
SR 3.4.15.4	Perform CHANNEL CALIBRATION of the required containment atmosphere particulate radioactivity monitor.	In accordance with the Surveillance Frequency Control Program
SR 3.4.15.5	Perform CHANNEL CALIBRATION of the required containment cooler condensate monitoring system.	In accordance with the Surveillance Frequency Control Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

LCO 3.4.16 RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 not within limit.	------------------- NOTE ------------------- LCO 3.0.4.c is applicable. ---	
	A.1 Verify DOSE EQUIVALENT I-131 $\leq$ 60 μCi/gm.	Once per 4 hours
	<u>AND</u>	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours
B. DOSE EQUIVALENT XE-133 not within limit.	------------------- NOTE ------------------- LCO 3.0.4.c is applicable. ---	
	B.1 Restore DOSE EQUIVALENT XE-133 to within limit.	48 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met. OR DOSE EQUIVALENT I-131 > 60 μCi/gm.	C.1 AND C.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.16.1	-------------------- NOTE -------------------- Only required to be performed in MODE 1. -- Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity ≤ 225 μCi/gm.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.16.2	------------------------------- NOTE ------------------------------ Only required to be performed in MODE 1. --- Verify reactor coolant DOSE EQUIVALENT I-131 specific activity $\leq$ 1.0 μCi/gm.	In accordance with the Surveillance Frequency Control Program AND Between 2 and 6 hours after a THERMAL POWER change of $\geq$ 15% RTP within a 1 hour period

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.17 Steam Generator (SG) Tube Integrity

LCO 3.4.17 SG tube integrity shall be maintained.

AND

All SG tubes satisfying the tube repair criteria shall be plugged in accordance with Steam Generator Program.

APPLICABILITY: MODES 1 2, 3, and 4.

ACTIONS

----- NOTE -----
Separate Condition entry is allowed for each SG tube.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more SG tubes satisfying the tube repair criteria and not plugged in accordance with the Steam Generator Program.	A.1	Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or inspection.	7 days
	AND		
	A.2	Plug the affected tube(s) in accordance with the Steam Generator Program.	Prior to entering MODE 4 following the next refueling outage or SG tube inspection

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required Action and associated Completion Time of Condition A not met. OR SG tube integrity not maintained.	B.1 AND B.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.17.1	Verify SG tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.17.2	Verify that each inspected SG tube that satisfies the tube repair criteria is plugged in accordance with the Steam Generator Program.	Prior to entering MODE 4 following a SG tube inspection

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.1	Verify the following valves are in the listed position with power to the valve operator removed. <u>Number</u> / <u>Position</u> / <u>Function</u> BNHV8813 / Open / Safety Injection to RWST Isolation Valve EMHV8802A / Closed / SI Hot Legs 2 & 3 Isolation Valve EMHV8802B / Closed / SI Hot Legs 1 & 4 Isolation Valve EMHV8835 / Open / Safety Injection Cold Leg Isolation Valve EJHV8840 / Closed / RHR/SI Hot Leg Recirc Isolation Valve EJHV8809A / Open / RHR to Accum Inject Loops 1 & 2 Isolation Valve EJHV8809B / Open / RHR to Accum Inject Loops 3 & 4 Isolation Valve	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.2	------------------------------- NOTE -------------------------- Not required to be met for system vent flow paths opened under administrative control. --- Verify each ECCS 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.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify ECCS locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1 AND D.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours
E. Two containment spray trains inoperable. OR Two containment cooling trains inoperable.	E.1 AND E.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.6.1	------------------------------- NOTE --------------------------- Not required to be met for system vent flow paths opened under administrative control. --- Verify each containment spray 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.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.2	Operate each containment cooling train fan unit for $\geq$ 15 minutes.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.6.3	Verify each containment cooling train cooling water flow rate is ≥ 2200 gpm.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.4	Verify each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.6.6.5	Verify each automatic containment spray valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.6	Verify each containment spray pump starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.7	Verify each containment cooling train starts automatically and minimum cooling water flow rate is established on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.8	Verify each spray nozzle is unobstructed.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.6.9	Verify containment spray locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

3.6 CONTAINMENT SYSTEMS

3.6.7 Recirculation Fluid pH Control (RFPC) System

LCO 3.6.7 The RFPC System shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. RFPC System inoperable.	A.1	Restore RFPC System to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	84 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify the integrity of the RFPC System.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.7.2	Verify the RFPC System ensures an equilibrium sump pH $\geq$ 7.1.	In accordance with the Surveillance Frequency Control Program

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. RHR loop requirements not met. (continued)	A.3	Initiate action to satisfy RHR loop requirements.	Immediately
	<u>AND</u>		
	A.4	Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.5.1	Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of $\geq$ 1000 gpm.	In accordance with the Surveillance Frequency Control Program
SR 3.9.5.2	Verify required RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.9.6.2	Verify correct breaker alignment and indicated power available to the required RHR pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.9.6.3	Verify RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

ATTACHMENT 4

PROPOSED FSAR CHANGES
(for information only)

LDCN 14-0003

TABLE OF CONTENTS (Continued)

No Changes

LDCN 14-0003

Each valve has a relief flow capacity of 20 gpm at a set pressure of 600 psig. These relief valves are located in the ECCS (see Figure 6.3-1).

The fluid discharged by the suction side relief valves is collected in the pressurizer relief tank. The fluid discharged by the discharge side relief valves is collected in the recycle holdup tank of the boron recycle system.

The design of the RHRS includes two motor-operated gate isolation valves in series on each inlet line between the high pressure RCS and the lower pressure RHRS. They are closed during normal operations, and are only opened for residual heat removal during a plant cooldown after the RCS pressure is reduced below approximately 400 psig and RCS temperature is reduced to approximately 350°F. During a plant startup, the inlet isolation valves are shut after drawing a bubble in the pressurizer and prior to increasing RCS pressure above 600 psig. These isolation valves are provided with "prevent-open" interlocks which are designed to prevent possible exposure of the RHRS to normal RCS operating pressure. The inlet isolation valves in each subsystem are separately and independently interlocked with pressure signals to prevent their being opened whenever the RCS pressure is greater than 360 psig. A control room alarm will actuate if an RHR suction isolation valve is not fully closed and RCS pressure is greater than the design pressures for RHR system operation.

The use of two independently powered, motor-operated valves in each of the two inlet lines, along with two independent pressure interlock signals for each function, assures a design which meets applicable single failure criteria. These protective interlock designs, in combination with plant operating procedures, provide diverse means of accomplishing the protective function. For further information on the instrumentation and control features, see Section 7.6.2.

The RHR inlet isolation valves are provided with red-green position indicator lights on the main control board.

Isolation of the low pressure RHRS from the high pressure RCS is provided on the discharge side by two check valves in series. These check valves are located in the ECCS, and their testing is described in Section 6.3.4.2.

5.4.7.2.6 Applicable Codes and Classifications

The entire RHRS is designed as Safety Class 2, with the exception of the suction isolation valves, which are Safety Class 1. Class 1 discharge valves are discussed in Section 6.3. Component codes and classifications are given in Section 3.2.

5.4.7.2.7 System Reliability Considerations

General Design Criterion 34 requires that a system to remove residual heat be provided. The safety function of this required system is to transfer fission product decay heat and other residual heat from the core at a rate sufficient to prevent fuel or pressure boundary design limits from being exceeded. Safety grade systems are provided in the plant design, both nuclear steam supply system (NSSS) scope and balance-of-plant (BOP) scope, to perform this function. The NSSS scope safety grade systems which perform this function for all plant conditions, except a LOCA are: the RCS and steam generators, which operate in conjunction with the auxiliary feedwater system and the steam generator safety and power-operated relief valves; and the RHRS, which operates in conjunction with the component cooling water and service water systems. The BOP scope safety grade systems which perform this function for all plant conditions, except a LOCA, are: the auxiliary feedwater system; the steam generator safety and power-operated relief valves, which operate in conjunction with the RCS and the steam generators; and the component cooling water and service water systems, which operate in conjunction with the RHRS. For LOCA conditions, the safety grade system which performs the function of removing residual heat from the reactor core is the ECCS, which operates in conjunction with the component cooling water system and the essential service water system.

The auxiliary feedwater system, along with the steam generator safety and power-operated relief valves, provides a completely separate, independent, and diverse means of performing the safety function of removing residual heat, which is normally performed by the RHRS when RCS temperature is less than 350°F.

The auxiliary feedwater system is capable of performing this function for an extended period of time following plant shutdown.

The RHRS is provided with two residual heat removal pumps and heat exchangers arranged in two separate, independent flow paths. To assure reliability, each residual heat removal pump is connected to a different vital bus. Each train is isolated from the RCS on the suction side by two motor-operated valves in series with each valve receiving power via a separate motor control center and from a different vital bus. Each suction isolation valve is also interlocked and alarmed to prevent exposure of the RHRS to the normal operating pressure of the RCS (see Section 5.4.7.2.5). Insert 5.4.7.2.7

RHRS operation for normal conditions and for major failures is accomplished completely from the control room. The redundancy in the RHRS design provides the system with the capability to maintain its cooling function even with a major single failure, such as failure of a residual heat removal pump, valve, or heat exchanger without impact on the redundant train's continued heat removal.

Although such major system failures are within the system design basis, there are other less significant failures which can prevent opening of the residual heat removal suction isolation valves from the control room. Since these failures are of a minor nature, improbable to occur, and easily corrected outside the control room, with ample time to do so, they have been realistically excluded from the engineering design basis. Such failures are not likely to occur during the limited time period in which they can have any effect (i.e., when opening the suction isolation valves to initiate residual heat removal operation). However, even if they should occur, they have no adverse safety impact and

Insert 5.4.7.2.7

RHR system piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation in the pump suction and pump discharge piping, however, supports proper operation of the RHR system and may also prevent water hammer, pump cavitation, and pumping of noncondensible gas into the reactor vessel.

LDCN 14-0003

No changes

can be readily corrected. In such a situation, the auxiliary feedwater system and the steam generator power-operated relief valves can be used to perform the safety function of removing residual heat and, in fact, can be used to continue the plant cooldown below 350°F, until the RHRS is made available.

One example of this type of a failure is the interlock circuitry which is designed to prevent exposure of the RHRS to the normal operating pressure of the RCS (see Section 5.4.7.2.5). In the event of such a failure, RHRS operation can be initiated by defeating the "prevent-open" interlock through corrective action at the solid state protection system cabinet or at the individual affected motor control centers.

The other type of failure which can prevent opening the residual heat removal suction isolation valves from the control room is a failure of an electrical power train. Such a failure is extremely unlikely to occur during the few minutes out of a year's operating time during which it can have any consequence. If such an unlikely event should occur, several alternatives are available. The most realistic approach would be to obtain restoration of offsite power, which can be expected to occur in less than 1/2 hour. Other alternatives are to restore the emergency diesel generator to operation or to bring in an alternative power source.

The only impact of either of the above types of failures is some delay in initiating residual heat removal operation, while action is taken to open the residual heat removal suction isolation valves. This delay has no adverse safety impact because of the capability of the auxiliary feedwater system and steam generator power-operated relief valves to continue to remove residual heat, and, in fact, to continue plant cooldown.

A failure mode and effects analysis of the RHRS for normal plant cooldown is provided as Table 5.4-9.

5.4.7.2.8 Manual Actions

The RHRS is designed to be fully operable from the control room for normal operation. Manual operations required of the operator are: opening the suction isolation valves, positioning the flow control valves downstream of the RHRS heat exchangers, and starting the residual heat removal pumps.

Manual actions required outside the control room, under conditions of single failure, are discussed in Section 5.4.7.2.7.

5.4.7.3 Performance Evaluation

The performance of the RHRS in reducing reactor coolant temperature is evaluated through the use of heat balance calculations on the RCS, and the component cooling water system at stepwise intervals following the initiation of RHR operation. Heat removal through the RHR and component cooling water heat exchangers is calculated at each interval by use of standard water-to-water heat exchanger performance correlations. The resultant fluid temperatures for the RHRS and component cooling water system are calculated and used as input to the next interval's heat balance calculation.

Assumptions utilized in the series of the heat balance calculations describing plant RHR cooldown are as follows:

a. RHR operation is initiated 4 hours after reactor shutdown (16 hours after shutdown for single train cooldown, as per WCAP-16140, Callaway Replacement Steam Generator Program NSSS Engineering Report.

b. RHR operation begins at a reactor coolant temperature of 350°F.

c. Thermal equilibrium is maintained throughout the RCS during the cooldown.

d. Component cooling water temperature at the CCW heat exchanger outlet during cooldown is limited to a maximum of 120°F.

e. Expected cooldown rates of 50°F per hour are not exceeded.

Cooldown curves calculated using this method are provided for the case of all residual heat removal components operable (Figure 5.4-9) and for the case of a single train residual heat removal cooldown (Figure 5.4-10).

5.4.7.4 Preoperational Testing

Preoperational testing of the RHRS is addressed in Chapter 14.0.

5.4.8 REACTOR WATER CLEANUP SYSTEM

This section is not applicable to SNUPPS.

5.4.9 MAIN STEAM LINE AND FEED WATER PIPING

Discussion pertaining to the main steam line and feedwater piping are contained in the following sections:

a. Main Steam Line Piping - Section 10.3.

b. Main Feedwater Piping - Section 10.4.7.

c. Auxiliary Feedwater Piping - Section 10.4.9.

d. Inservice Inspection of a, b, and c - Section 6.6.

5.4.7.5 Gas Management

INSERT 5.4.7.5

Insert 5.4.7.5

The RHR system is operable when it is sufficiently filled with water. The Technical Specifications include Surveillance Requirements for verifying systems are sufficiently full of water. Voiding may occur, however, due to the accumulation of entrained gas; acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criterion for the susceptible location (or if the volume of accumulated gas at one or more susceptible locations exceeds an acceptance criterion for gas volume at the suction or discharge of a pump), the Technical Specification Surveillance Requirement is not met and past operability reviews are initiated. If it is determined by subsequent evaluation that the RHR system was not rendered inoperable by the accumulated gas (i.e., the system was sufficiently filled with water), the Surveillance Requirement may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

RHR system locations susceptible to gas accumulation are monitored and, if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path that are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations, alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system operability. The accuracy of the method used for monitoring the susceptible locations and trending of the results must be sufficient to assure system operability between surveillance performances.

LDCN 14-0003

 No changes

The tank is an atmospheric storage tank vented directly to the atmosphere. Thermal insulation and heating are provided to prevent the tank contents from freezing. A manway is provided for tank internal inspection. Tank level indication and high and low level alarms are also provided. Additional information is provided in Section 6.3.

VALVES - CSS motor-operated valves are capable of being operated from the control room. All valve seats are capable of limiting through leakage to less than 2 cubic centimeters per hour per nominal inch of pipe diameter. Gate and globe valves are provided with backseats.

Encapsulation - The containment spray system suction lines from the containment recirculation sumps are each provided with a single remote manual gate isolation valve outside the containment. The piping from the sump up to and including the valve and its motor operator is enclosed in an encapsulation arrangement which is leaktight at the containment design pressure. A seal is provided so that the encapsulation is not connected directly to the containment sump or containment atmosphere. A single passive or active failure in the sump lines or in the encapsulation arrangement will not provide a path for leakage to the environment.

Each encapsulated gate valve is designed with an expansion pipe assembly to preclude the occurrence of thermally induced pressure locking. The expansion pipe assembly provides additional free volume to accommodate thermal expansion of water that may be in the valve bonnet, to prevent a significant increase in bonnet pressure. Each expansion pipe assembly is connected through tubing to the packing leakoff line from the valve bonnet.

PIPING - The piping of each spray header contains a test connection. Air can be introduced into this connection to verify spray nozzle flow. Check valves immediately upstream of each spray ring header prevent system contamination due to pressurization in the containment and provide containment isolation backup protection.

A containment spray pump test line between the pumps' discharges and the RWST is installed for periodic testing.

6.2.2.1.2.3 System Operation

The CSS has two phases of operation, which are initiated sequentially following system actuation; they are the injection phase and the recirculation phase.

INJECTION PHASE - The CSS is actuated either manually from the control room or on the coincidence of two-out-of-four containment Hi-3 pressure signals.

Both containment spray pumps start and the motor-operated spray ring header isolation valves open to begin the injection phase. A summary of the accident chronology for the containment spray system is provided in Table 6.2.2-3 for the injection phase of a LOCA and MSLB inside the containment.

LDCN 14-0003

The containment spray pump inlet nozzle, located at El. 1,970, takes suction from the RWST, located at El. 2,000'-6", through locked open valves. More than 95 percent of the pump discharge is directed to the containment spray ring headers. These headers are located at elevations up to 2,201 feet, the highest practical level to maximize iodine removal (discussed in Section 6.5.2). The headers are located outside of and above the internal containment structures which serve as missile barriers and are thereby protected from missiles generated during a LOCA or MSLB. The remaining portion of the containment spray pump discharge is recirculated.

On coincidence of two-out-of-four low level signals from the RWST level transmitters, the emergency core cooling system (ECCS) pumps switch suction to the containment recirculation sump, as described in Section 6.3.2. The low-low-1 level setpoint indicates that 121,464 useable gallons remain in the RWST. Switchover for the spray pumps is manually initiated when the low-low-2 level in the RWST is reached. The low-low-2 level indicates imminent depletion of the RWST. Switchover initiated at the time of the low-low-2 level alarm ensures that ~~the system piping remains full of water and that~~ adequate NPSH for the spray pumps is maintained. The RWST low-low-2 level alarms and level indicators inform the operator of the need to make this switchover.

INSERT 6.2.2.1.2.3

The time length of the containment spray injection phase is given in Table 6.2.2-4. These times are based on the minimum RWST volume and are given for credible combinations of minimum and maximum containment spray and ECCS operation and runout flow rates of these pumps.

RECIRCULATION PHASE - The recirculation phase is initiated by the operator manually shifting containment spray pump suction from the RWST to the containment recirculation sump. The accident chronology for the containment spray system for the recirculation phase of a LOCA is provided in Table 6.2.2-3.

The RWST suction line valves remain open during the switchover to the recirculation phase to preclude the loss of supply to the containment spray pumps in the highly unlikely event that the isolation valve in the recirculation line is delayed in opening. The operator then remote manually closes the motor-operated valves in the RWST suction lines

The suction line from the containment recirculation sump to the spray pump is a sloped line which precludes air from entering the system. The single valve in the containment sump recirculation line for the containment spray pump is encapsulated and located outside the containment. The flow paths from the spray pumps are the same as in the injection phase. Check valves are provided in the recirculation sump suction lines to prevent the establishment of a flow path between the RWST and the containment sump.

Containment spray in the recirculation mode maintains an equilibrium temperature between the containment atmosphere and the recirculation sump water. The length of time that the CSS operates during the recirculation phase is determined by the operator. The spray cannot be terminated until completion of the injection phase.

Insert 6.2.2.1.2.3

Containment spray system piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation in the pump suction and pump discharge piping, however, supports proper operation of the containment spray system and may also prevent water hammer and pump cavitation.

LDCN 14-0003

No changes

source which releases water to the reactor building and its associated mass and each potential water loss mechanism and the volume of water not assumed to contribute to the water level within the containment for a large LOCA and a MSLB, respectively. The static head available to contribute to the NPSH of the pump, suction line losses, and the minimum NPSH available are also given in Table 6.2.2-7. The CSS pump NPSH versus flow is shown in Figure 6.2.2-5. The reduction in water level due to potential water loss mechanisms is considered in the calculated NPSH available.

SAFETY EVALUATION TWELVE - Recirculation sump strainer construction provides straining down to 0.045 inch to prevent entrained particles in excess of that size from entering the containment recirculation sump and containment spray system suction piping.

Since the containment spray pumps are designed to operate with entrained particles up to 1/4 inch in diameter and the minimum constriction size in the spray nozzles is 7/16 inch, the strainers are adequate to assure proper system operability.

Each strainer is designed to ensure sufficient NPSH to the containment spray and ECCS pumps to maintain recirculation capability during the recirculation phase of an event. The strainer arrangement is shown in Figure 6.2.2-3.

The strainer arrangement does not allow flow into the sump below 6 inches above the concrete floor level surrounding the sump. This arrangement leaves ample depth for buildup of high-density debris without affecting sump performance. Additionally, the velocity of recirculated fluids approaching the strainer will be less than 0.08 fps for all modes of operation following a LOCA or MSLB, and thus a low velocity settling region for high-density particles is provided. Table 6.2.2-9 provides the approach flow velocity for a large LOCA and an MSLB.

Any debris which eludes the strainers and settling region passes into the sump through the 0.045 inch perforated plate and will be drawn into the suction piping for the containment spray and residual heat removal systems. Such debris is small enough to pass through any restriction in either system or the reactor vessel channels, and will eventually be pumped back into the containment.

A comparison of the containment recirculation sump design features with each of the positions of Regulatory Guide 1.82, "Sump for Emergency Core Cooling and Containment Spray Systems," is provided in Table 6.2.2-1.

6.2.2.1.4 Tests and Inspections

Testing and inspection of components of the CSS are discussed in this section.

Each containment spray pump has a shop test to generate complete performance curves. The test includes verifying total developed head (TDH), efficiency, and brake horsepower for various flow rates. An NPSH test for various flow rates was performed

LDCN 14-0003

No changes

on one pump. A shop thermal transient analysis, from ambient temperature to 350°F in 10 seconds, has been performed on the CSS pump. Results of that analysis assure that the design is suitable for the switchover from the injection to the recirculation phase.

The strainer configuration on the containment recirculation sumps is shop tested to verify that all design requirements are adequately met.

The spray nozzles' design parameters were verified with prototype tests in the vendor's shop. Results of those test are provided in Section 6.5.2.2.2.

PREOPERATIONAL TESTING - Instruments are calibrated prior to system preoperational testing. Alarm functions are checked for operability and limits during preoperational testing. The flow paths and flow capacities of all components are verified during preoperational tests.

The functional test of the ECCS, described in Section 6.3, demonstrates proper transfer to the emergency diesel generator power source in the event of a loss of power. A test signal simulating the containment spray signal is used to demonstrate the operation of the spray system up to the isolation valves on the pump discharge. The isolation valves are closed for the test. These isolation valves are functionally tested separately.

The spray header nozzle performance is verified during the preoperational testing by blowing air through the nozzles and observing the movement of the telltales.

The objectives of preoperational testing are to:

a. Demonstrate that the system is adequate to meet the design pressure and temperature conditions. Components are tested in conformance with applicable codes.

b. Demonstrate that the spray nozzles in the containment spray header are clear of obstructions by passing air through them, utilizing test connections.

c. Verify that the proper sequencing of valves and pumps occurs on initiation of the CSS and demonstrate the proper operation of remotely operated valves.

d. Verify the operation of the spray pumps. Each spray pump is operated at full flow to verify that it meets the design curve generated during shop testing. Both design point and runout flow rates are utilized to verify that the pump performance is within design. In addition, each spray pump is operated at minimum flow, which is directed back to the refueling water storage tank. A flow orifice is provided to regulate minimum flow to that required for routine testing.

LDCN 14-0003

The containment recirculation sump strainers have been evaluated for vortex formation, air ingestion, and void fraction. The results of these evaluations were determined to be acceptable. In addition, scaled head loss testing was performed for the strainers. Data from these tests together with known pressure drops across suction lines and valves (determined using standard engineering calculations) verified that the available net positive suction head is adequate.

Further details of each preoperational test to be performed are discussed in Chapter 14.0.

OPERATIONAL TESTING - The CSS is designed to permit periodic determination of proper system operability, as specified in the Callaway Technical Specifications. The objectives of operational testing are to:

a. Verify that the proper sequencing of valves and pumps occurs on initiation of the containment spray signal and demonstrate the proper operation of remotely operated valves.

b. Verify the operation of the spray pumps. Each pump is run at a minimum flow and the flow is directed back to the RWST. Full flow testing capability is provided by recirculation lines connecting the pump discharge to the pump suction for each train. The recirculation lines contain a globe valve for throttling and a flow orifice that is used to measure the flowrate. The recirculation lines allow the pumps to achieve a discharge flowrate within +/-20% of pump design flow.

To assure the structural and leaktight integrity of components, the operability and performance of the active components, and the operability of the system as a whole, the system is periodically tested up to the last isolation valve before the containment penetration. The testing is accomplished by using a recirculation line (sized to take 10 percent of the design flow) back to the RWST.

All instrumentation will also be periodically checked and calibrated. The CSS actuation is verified as follows:

a. A containment spray actuation signal (CSAS) subchannel is actuated during a plant outage to start the containment spray pump.

b. A separate CSAS slave relay is actuated during normal reactor operation to ensure the opening of the containment header valves. The CSS pump will not be operating.

→ INSERT 6.2.2.1.4

6.2.2.1.5 Instrumentation Requirements

The CSS instrumentation was designed to facilitate automatic operation, remote control, and continuous indication of system parameters.

Insert 6.2.2.1.4

Gas Management

The containment spray system is operable when it is sufficiently filled with water. The Technical Specifications include Surveillance Requirements for verifying systems are sufficiently full of water. Voiding may occur, however, due to the accumulation of entrained gas, and acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criterion for the susceptible location (or if the volume of accumulated gas at one or more susceptible locations exceeds an acceptance criterion for gas volume at the suction or discharge of a pump), the Technical Specification Surveillance Requirement is not met and past operability reviews are initiated. If it is determined by subsequent evaluation that the containment spray system was not rendered inoperable by the accumulated gas (i.e., the system was sufficiently filled with water), the Surveillance Requirement may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

Containment spray system locations susceptible to gas accumulation are monitored and, if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path that are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations, alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system operability. The accuracy of the method used for monitoring the susceptible locations and trending of the results must be sufficient to assure system operability between surveillance performances.

LDCN 14-0003

to the RHR suction will close automatically after the sump suction valves are open. This interlock is also discussed in Section 7.6.5.

2. The safety injection pump and charging pump recirculation suction isolation valves, EJ-HV-8804A and B, can be opened provided that either the safety injection system miniflow isolation valve, BN-HV-8813, or both safety injection pump miniflow isolation valves, EM-HV-8814A and B, are closed. Additionally, one of the two RHR hot leg suction valves on Loop 1, BB-PV-8702A and EJ-HV-8701A, and on Loop 4, BB-PV-8702B and EJ-HV-8701B, must be closed.

6.3.2.2 Equipment and Component Descriptions

Codes and standards applicable to the ECCS are listed in Tables 3.2-1 and 6.3-1.

The component design and operating conditions are specified as the most severe conditions to which each respective component is exposed, during either normal plant operation or operation of the ECCS. For each component, these conditions are considered in relation to the code to which it is designed. By designing the components in accordance with applicable codes, and with due consideration for the design and operating conditions, the fundamental assurance of structural integrity and operability of the ECCS components is maintained. Components of the ECCS are designed to withstand the appropriate seismic loadings, in accordance with their safety class as given in Table 3.2-1. ~~Maintaining the piping from the ECCS pumps to the RCS full of water by venting RHR and SI pump casings and accessible ECCS discharge piping high point vents ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling.~~

INSERT 6.3.2.2

The elevated temperature of the sump solution during recirculation is well within the design temperature of all ECCS components. In addition, consideration has been given to the potential for corrosion of various types of metals exposed to the fluid conditions prevalent immediately after the accident or during long-term recirculation operations.

The following is a discussion of the major components of the ECCS:

Accumulators

The accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. During normal operation, each accumulator is isolated from the RCS by two check valves in series. Should the RCS pressure fall below the accumulator pressure, the check valves open and borated water is forced into the RCS. One accumulator is attached to each of the cold legs of the RCS. Mechanical operation of the swing-disc check valves is the only action required to open the injection path from the accumulators to the core via the cold leg.

Insert 6.3.2.2

ECCS piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation in the pump suction and pump discharge piping, however, supports proper operation of the ECCS and may also prevent water hammer, pump cavitation and pumping of noncondensible gas into the reactor vessel.

LDCN 14-0003

No changes

evaluated for potential effects on valve position and operator information. Therefore, the flooding of these motor operators and any resultant postulated failure do not present any problems for either the short- or long-term ECCS operations, containment isolation, or any other safety-related function.

6.3.2.3 Applicable Codes and Construction Standards

The applicable codes and construction standards for the ECCS are identified in Tables 3.2-1 and 6.3-1 and discussed in Section 3.2.

6.3.2.4 Material Specifications and Compatibility

Materials employed for components of the ECCS are given in Table 6.3-4. Materials are selected to meet the applicable material requirements of the codes in Table 3.2-1 and the following additional requirements:

a. All the parts of the components in contact with borated water are fabricated of or clad with austenitic stainless steel or equivalent corrosion-resistant material.

b. All the parts of the components in contact (internal) with the sump solution during recirculation are fabricated of austenitic stainless steel or equivalent corrosion-resistant material.

c. Valve seating surfaces are hard faced with Stellite Number 6, or equivalent, to prevent galling and to reduce wear.

d. Valve stem materials are selected for their corrosion resistance, high tensile properties, and resistance to surface scoring by the packing.

6.3.2.5 System Reliability

Reliability of the ECCS is considered in all aspects of the system, from initial design to periodic testing of the components, during plant operation. The ECCS is a two train, fully redundant, standby emergency safety feature. The system has been designed and proven by analysis to withstand any single credible active failure during injection or active or passive failure during recirculation and maintain the performance objectives desired in Section 6.3.1. Two trains of pumps, heat exchangers, and flow paths are provided for redundancy as only one train is required to satisfy the performance requirements. The initiating signals for the ECCS, as described in Section 7.3, are derived from independent sources as measured from process (e.g., low pressurizer pressure) or environmental variables (e.g., containment pressure).

Redundant, as well as functionally independent variables, are measured to initiate the safety injection signals. Each train is physically separated and protected, where necessary, so that a single event cannot initiate a common failure. Power sources for

LDCN 14-0003

 No changes

the ECCS are divided into two independent trains supplied from the Class 1E emergency busses from offsite power. Sufficient diesel generating capacity is maintained onsite to provide required power to each train. The diesel generators and their auxiliary systems are completely independent, and each supplies power to one of the two ECCS trains.

The reliability program extends to the procurement of the ECCS components so that only designs which have been proven by past use in similar applications are acceptable for use. For example, the ECCS pumps (safety injection, centrifugal charging, and residual heat removal pumps) are the same type of pumps that have been used extensively in other operating plants. Their function during recurrent normal power and cooldown operations in such plants as Zion, D.C. Cook, Trojan, and Farley has successfully demonstrated their performance capability. Reliability tests and inspections (see Section 6.3.4.2) further confirm their long-term operability. Nevertheless, design provisions are included that would allow maintenance on ECCS pumps if necessary during long-term operation.

The preoperational testing program assures that the systems, as designed and constructed, will meet the functional requirements calculated in the design.

The ECCS is designed with the ability for on-line testing of most components so the availability and operational status can be readily determined.

In addition to the above, the integrity of the ECCS is assured through examination of critical components during the routine inservice inspection.

A failure modes and effects analysis is provided in Table 6.3-5.

Consideration of an active failure of any Westinghouse nuclear steam supply system (NSSS) check valve is excluded from Tables 6.3-5 and 6.3-6 since the NSSS check valves are not considered to the active (powered) components per the Westinghouse ECCS design, particularly with respect to ECCS failure modes and effects and single active failure analyses. As discussed in Section 3.9(N).3.2.1, NSSS check valves are characteristically simple in design and their operation is not affected by seismic accelerations or the maximum applied nozzle loads. Their design is compact and there are no extended structures or masses whose motion could cause distortions that could restrict operation of the valve. The nozzle loads due to maximum seismic excitation do not affect the functional ability of the valve since the valve disc is typically designed to be isolated from the body wall. The clearance supplied by the design around the disc prevents the disc from becoming bound or restricted due to any body distortions caused by nozzle loads. Therefore, the design of these valves is such that once the structural integrity of the valve is ensured using standard methods, the ability of the valve to operate is ensured by the design features.

Although the design of the NSSS check valves provides assurance of their ability to operate, these NSSS check valves undergo in-shop hydrostatic and seat leakage testing (prior to installation) as well as periodic in-situ valve exercising and inspection to ensure

LDCN 14-0003

No changes

their functional capability. (As discussed in Section 3.1.1.1, the definition of an active component for the purpose of supporting the pump and valve operability program includes NSSS check valves. These check valves, although not powered components, meet the definition of having mechanical motion and are therefore included in Table 3.9(N)-11.)

a. Active Failure Criteria

The ECCS is designed to accept a single failure following an accident without loss of its protective function. The system design will tolerate the failure of any single active component in the ECCS itself or in the necessary associated service systems at any time during the period of required system operations following an accident.

A single active failure analysis is presented in Table 6.3-6, and demonstrates that the ECCS can sustain the failure of any single active component in either the short or long term and still meet the level of performance for core cooling.

Since the operation of the active components of the ECCS following a steam line rupture is identical to that following a LOCA, the same analysis is applicable, and the ECCS can sustain the failure of any single active component and still meet the level of performance for the addition of shutdown reactivity.

b. Passive Failure Criteria

The following philosophy provides for necessary redundancy in the component and system arrangement to meet the intent of the GDC on single failure, as it specifically applies to failure of passive components in the ECCS. Thus, for the long term, the system design is based on accepting either a passive or an active failure.

A single passive failure analysis is presented in Table 6.3-7. It demonstrates that the ECCS can sustain a single passive failure during the long-term phase and still retain an intact flow path to the core to supply sufficient flow to keep the core covered and effect the removal of decay heat. The procedure followed to establish the alternate flow path also isolates the component that failed.

Redundancy of Flow Paths and Components for Long-Term Emergency Core Cooling

The following criteria are utilized in the design of the ECCS:

LDCN 14-0003

 No changes

1. During the long-term cooling period following a postulated loss-of-coolant accident, the emergency core cooling flow paths shall be separable into two subsystems, either of which can provide minimum core cooling functions and return spilled water from the floor of the containment back to the RCS.

2. Either of the two subsystems can be isolated and removed from service in the event of a leak outside the containment.

3. Should one of these two subsystems be isolated in this long-term period, the other subsystem remains operable.

4. Adequate redundancy of the check valves is provided to tolerate failure of a check valve during the long term as a passive component.

5. Provisions are made in the design to detect leakage from components outside the containment, collect this leakage, and provide for maintenance of the affected equipment. For further discussion, see Section 9.3.3 concerning the equipment and floor drainage system.

Thus, for the long-term emergency core cooling function, adequate core cooling capacity exists with one flow path removed from service.

Subsequent Leakage from Components in the ECCS

Leakage from mechanical equipment outside the containment will be detected before it propagates to major proportions by a program for periodic visual inspection and leak detection. A review of the equipment in the system indicates that the largest sudden leak potential would be the sudden failure of a pump shaft seal. Evaluation of leak rate, assuming only the presence of a seal retention ring around the pump shaft, showed flows less than 7.5 gpm would result. Piping leaks, valve packing leaks, or flange gasket leaks have been of a nature to build up slowly with time and are considered less severe than the pump seal failure. The auxiliary building floor and equipment drain system leakage detection capability is discussed in Section 9.3.3.

Larger leaks in the ECCS are prevented by the following:

1. The piping is classified in accordance with ANS Safety Class 2 and receives a quality assurance program in accordance with 10 CFR 50, Appendix B (refer to Section 3.2).

LDCN 14-0003

2. The piping, equipment, and supports are designed to ANS Safety Class 2 seismic classification, permitting no loss of function for the SSE (refer to Section 3.2).

3. The system piping is located within a controlled area of the plant.

4. The piping system receives periodic pressure tests, and is accessible for periodic visual inspection.

5. The piping is austenitic stainless steel which, due to its ductility, can withstand severe distortion without failure.

Process Flow Diagram

Figure 6.3-2 is a simplified illustration of the ECCS. The notes provided with Figure 6.3-2 contain information relative to the operation of the ECCS in its various modes. The modes of operation illustrated are full operation of all ECCS components, cold leg recirculation with RHR pump B operating, and hot leg recirculation with RHR pump A operating. These are representative of the operation of the ECCS during accident conditions.

Lag Times

Lag times for initiation and operation of the ECCS are limited by pump startup time and consequential loading sequence of these motors onto the Class 1E busses. Most valves are normally in the required position for the ECCS to fulfill its safety function.

Therefore, valve opening time is not considered for these valves. Power to the valve operators is available anytime the Class 1E busses are energized. If there is no loss of offsite power, all pump motors are still sequenced on the Class 1E busses upon receipt of an SIS. In the case of a loss of offsite power, a 12-second delay is assumed for diesel startup, then pumps are loaded according to the sequencer. For the small and large break LOCAs, the ECCS is assumed to deliver flow to the RCS 29 seconds after generation of an SIS, which includes time required for sensor response (2 seconds), diesel startup (12 seconds), opening the RWST suction isolation valves (BN-LCV-112D and E), and loading of ECCS pumps onto the Class 1E busses (15 seconds). (Note: Although the ECCS is assumed to begin delivering flow to the RCS in 29 seconds, full ECCS flow is not reached until 44 seconds after generation of the SIS. The 44-second interval includes a 15-second duration for the RHR mini-flow valve to close.) For the steamline break accident, an additional 10 second delay (39 seconds total) is assumed which accounts for closing of the VCT outlet isolation valves (BG-LCV-112B and C) to the CCPs. The steamline break transient is the only one analyzed in Chapter 15 which relies on short term boration from the RWST for transient mitigation.

Potential Boron Precipitation] (move to top of next page) to determine pump head and flow at this time. Pumps are then run on miniflow circuits and data taken to determine a second point on the head flow characteristic curve.

Section 6.2.2.1.4 discusses the hydraulic model testing used to verify that the available net positive suction head is adequate when the RHR pumps and containment spray pumps take suction from the containment recirculation sumps.

Accumulators

Each accumulator is filled with water from the RWST and pressurized with the motor-operated valve on the discharge line closed. Then the valve is opened and the accumulator allowed to discharge into the reactor vessel with the reactor cold and the vessel head off.

6.3.4.2 Reliability Tests and Inspections

Insert 6.3.4.2

6.3.4.2.1 Description of Tests Planned

Routine periodic testing of the ECCS components and all necessary support systems at power is planned. Valves which operate after a LOCA are operated through a complete cycle, and pumps are operated individually in this test on their miniflow lines, except the charging pumps, if they have been tested by their normal charging function. If such testing indicates a need for corrective maintenance, the redundancy of equipment in these systems permits such maintenance to be performed without shutting down or reducing load under certain conditions. These conditions include considerations, such as the period within which the component should be restored to service and the capability of the remaining equipment to provide the minimum required level of performance during such a period.

The operation of the remote stop valve and check valve in each accumulator tank discharge line is tested per the required in-service testing (ASME OM Code).

Where series pairs of check valves form the high pressure to low pressure isolation barrier between the RCS and safety injection system piping outside the reactor containment, periodic testing of these check valves is performed to provide assurance that certain postulated failure modes will not result in a loss-of-coolant from the low pressure system outside the containment with a simultaneous loss of safety injection pumping capacity.

The safety injection system test line subsystem provides the capability for determining the integrity of the pressure boundary formed by series check valves. The tests performed verify that each of the series check valves can independently sustain differential pressure across its disc, and also verify that the valve is in its closed position. The required periodic tests are to be performed after each refueling just prior to plant startup, after the RCS has been pressurized.

Insert 6.3.4.2

Gas Management

The ECCS is operable when it is sufficiently filled with water. The Technical Specifications include Surveillance Requirements for verifying systems are sufficiently full of water. Voiding may occur, however, due to the accumulation of entrained gas; acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criterion for the susceptible location (or if the volume of accumulated gas at one or more susceptible locations exceeds an acceptance criterion for gas volume at the suction or discharge of a pump), the Technical Specification Surveillance Requirement is not met and past operability reviews are initiated. If it is determined by subsequent evaluation that the ECCS was not rendered inoperable by the accumulated gas (i.e., the system was sufficiently filled with water), the Surveillance Requirement may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

ECCS locations susceptible to gas accumulation are monitored and, if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path that are subject to the same gas intrusion mechanisms may be verified by monitoring a representative subset of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations, alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system operability. The accuracy of the method used for monitoring the susceptible locations and trending of the results must be sufficient to assure system operability between surveillance performances.

Lines in which the series check valves are to be tested are the safety injection pump cold and hot leg injection lines and the RHR pump cold and hot leg injection lines.

Chapter 16.0 and the Technical Specifications provide ~~provides~~ periodic component testing requirements. During periodic system testing, a visual inspection of pump seals, valve packings, flanged connections, and relief valves is made to detect leakage. Inservice inspection provides further confirmation that no significant deterioration is occurring in the ECCS fluid boundary.

Design measures have been taken to assure that the following testing can be performed:

a. Active components may be tested periodically for operability (e.g., pumps on miniflow, certain valves, etc.).

b. An integrated system actuation test* can be performed when the plant is cooled down and the RHRS is in operation. The ECCS will be aligned so that no flow will be introduced into the RCS for this test.

c. An initial flow test of the full operational sequences can be performed.

The design features which assure this test capability are specifically:

a. Power sources are provided to permit individual actuation of each active component of the ECCS.

b. The safety injection pumps can be tested periodically during plant operation, using the minimum flow recirculation lines provided.

c. The RHR pumps are used every time the RHRS is put into operation. They can also be tested periodically when the plant is at power, using the miniflow recirculation lines.

d. The centrifugal charging pumps are either normally in use for charging service or can be tested periodically on miniflow.

e. Remote-operated valves can be exercised during routine plant maintenance.

f. Level and pressure instrumentation is provided for each accumulator tank, for continuous monitoring of these parameters during plant operation.

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* Details of the testing of the sensors and logic circuits associated with the generation of an SIS, together with the application of this signal to the operation of each active component, are given in Section 7.2.

LDCN 14-0003

g. Flow from each accumulator tank can be directed through a test line in order to determine valve operability. The test line can be used, when the RCS is pressurized, to ascertain backleakage through the accumulator check valves.

h. A flow indicator is provided in the centrifugal charging pump, safety injection pump, and RHR pump headers. Pressure instrumentation is also provided in these lines.

i. An integrated system test can be performed when the plant is cooled down and the RHRS is in operation. This test does not introduce flow into the RCS but does demonstrate the operation of the valves, pump circuit breakers, and automatic circuitry, including diesel starting and the automatic loading of ECCS components of the diesels (by simultaneously simulating a loss of offsite power to the vital electrical busses).

See Chapter 16.0 (and the Technical Specifications) for the selection of test frequency, acceptability of testing, and measured parameters. A description of the inservice inspection program is included in Section 6.6. ECCS components and systems are designed to meet the intent of the ASME Code, Section XI for inservice inspection.

6.3.5 INSTRUMENTATION REQUIREMENTS

Instrumentation and associated analog and logic channels employed for initiation of ECCS operation are discussed in Section 7.3.

This section describes the instrumentation employed for monitoring ECCS components during normal plant operation and also ECCS postaccident operation. All alarms are annunciated in the control room.

6.3.5.1 Temperature Indication

RHR Heat Exchanger Temperature

The fluid temperature at both the inlet and the outlet of each RHR heat exchanger is recorded in the control room.

6.3.5.2 Pressure Indication

Centrifugal Charging Pump Inlet, Discharge Pressure

There is local pressure indication at the suction and discharge of each centrifugal charging pump.

Safety Injection Pump Suction Pressure