



102-07285-MLL/TNW  
June 29, 2016

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

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**  
**Units 1, 2, and 3**  
**Docket Nos. STN 50-528, 50-529, and 50-530**  
**Renewed Operating License Nos. NPF-41, NPF-51, NPF-74**  
**Application to Revise Technical Specifications to Adopt TSTF-523,**  
**Generic Letter 2008-01, Managing Gas Accumulation, using the**  
**Consolidated Line Item Improvement Process**

In accordance with the provisions of Section 50.90 of Title 10 of the *Code of Federal Regulations* (10 CFR), Arizona Public Service Company (APS) is submitting a License Amendment Request (LAR) to revise the Technical Specifications (TS) for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3. The proposed amendment would modify TS requirements to address Generic Letter 2008-01, *Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems*, as described in TSTF-523, Revision 2, *Generic Letter 2008-01, Managing Gas Accumulation*.

The proposed amendment satisfies the commitment made to the NRC in APS letter number 102-05910, dated October 14, 2008 [Agency Document Access and Management System (ADAMS) accession number ML082940032], as modified by letter number 102-06982, dated December 30, 2014 (ADAMS accession number ML15005A386).

The enclosure to this letter provides a description and assessment of the proposed changes including a summary of the technical evaluation, a regulatory evaluation, a no significant hazards consideration, and an environmental evaluation. Additionally, the enclosure contains three attachments. Attachment 1 provides the marked-up existing TS pages. Attachment 2 provides the revised (clean) TS pages. Attachment 3 provides the marked-up TS Bases pages to show the conforming changes.

102-07285-MLL/TNW  
ATTN: Document Control Desk  
U. S. Nuclear Regulatory Commission  
LAR to Revise TS Regarding Managing Gas Accumulation  
Page 2

In accordance with the PVNGS Quality Assurance Program, the Plant Review Board and the Offsite Safety Review Committee have reviewed and approved the LAR. By copy of this letter, this LAR is being forwarded to the Arizona Radiation Regulatory Agency in accordance with 10 CFR 50.91(b)(1).

APS requests approval of the LAR within one year from the date of the submittal and will implement the TS amendment within one year following NRC approval.

No new commitments are made by this letter. Should you have any questions concerning the content of this letter, please contact Michael DiLorenzo, Licensing Section Leader, at (623) 393-3495.

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

Executed on : June 29, 2016  
(Date)

Sincerely,

MLL/TNW/CJS/af

Enclosure: Description and Assessment of Proposed Amendment to Implement  
TSTF 523

cc:	K. M. Kennedy	NRC Region IV Regional Administrator
	S. P. Lingam	NRC NRR Project Manager for PVNGS
	M. M. Watford	NRC NRR Project Manager
	C. A. Peabody	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)
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**TABLE OF CONTENTS**

1.0	SUMMARY DESCRIPTION.....	1
2.0	ASSESSMENT.....	1
3.0	REGULATORY ANALYSIS.....	2
4.0	ENVIRONMENTAL EVALUATION.....	3

**ATTACHMENTS**

- Attachment 1 - Marked-up Technical Specifications Pages
- Attachment 2 - Revised Technical Specifications Pages (Clean Copy)
- Attachment 3 - Marked-up Technical Specification Bases Pages

## Description and Assessment of Proposed Amendment to Implement TSTF 523

## 1.0 SUMMARY DESCRIPTION

The proposed change revises or adds Surveillance Requirements to verify that the Safety Injection (SI) [Emergency Core Cooling System (ECCS), Shutdown Cooling (SDC) and Containment Spray (CS)] system locations susceptible to gas accumulation are sufficiently filled with water and to provide allowances which 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, Revision 2, *Generic Letter 2008-01, Managing Gas Accumulation*. The availability of this Technical Specification (TS) improvement was published in the Federal Register on January 15, 2014, as part of the consolidated line item improvement process (CLIP).

## 2.0 ASSESSMENT

### 2.1 Applicability of Published Safety Evaluation

Arizona Public Service Company (APS) has reviewed the model safety evaluation dated December 23, 2013, as part of the Federal Register Notice of Availability. This review included a review of NRC staff's evaluation, as well as the information provided in TSTF-523. As described in the subsequent paragraphs, APS has concluded that the justifications presented in the TSTF-523 proposal and the model safety evaluation prepared by the NRC staff are applicable to Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, 3 and justify this amendment for the incorporation of the changes into the PVNGS TS.

### 2.2 Optional Changes and Variations

PVNGS TS utilize different numbering than the Standard Technical Specifications (STS) on which TSTF-523 was based. In the cases listed below the STS Section number corresponds to a different plant TS Section number.

- Combustion Engineering (CE) STS Section 3.5.2, *ECCS - Operating*, corresponds to PVNGS, Unit 1, 2 and 3 TS Section 3.5.3, *ECCS - Operating*
- CE STS Section 3.6.6A, *Containment Spray and Cooling Systems*, corresponds to PVNGS, Unit 1, 2 and 3 TS Section 3.6.6, *Containment Spray System*

APS is proposing the following variation from the TS changes described in TSTF-523, Revision 2:

- Add NOTE to SR 3.4.7.4: *Not required to be performed until 12 hours after entering MODE 4*

The addition of the NOTE to TS Surveillance Requirement (SR) 3.4.7.4 is needed since the transition from MODE 4 to Reactor Coolant System (RCS) Loops - MODE 5, Loops Filled can be accomplished within 12 hours after entry into MODE 4. Allowing a duration of 12 hours to perform the surveillance after entering MODE 4 is not being changed. The applicability of the NOTE is being extended to include RCS Loops - MODE 5, Loops Filled since the plant could be in that condition within 12 hours. This variance does not impact the requirement for the

## Description and Assessment of Proposed Amendment to Implement TSTF 523

surveillance requirement to be met in the various modes of applicability but rather it is allowing sufficient and necessary flexibility to perform the surveillance.

### 3.0 REGULATORY ANALYSIS

#### 3.1 No Significant Hazards Consideration Determination

Arizona Public Service Company (APS) requests adoption of TSTF-523, Rev. 2, *Generic Letter 2008-01, Managing Gas Accumulation*, which is an approved change to the standard technical specifications (STS), into the PVNGS technical specifications. The proposed change revises or adds Surveillance Requirement(s) (SRs) to verify that the Safety Injection (SI) [Emergency Core Cooling System (ECCS), Shutdown Cooling (SDC) and Containment Spray (CS)] system locations susceptible to gas accumulation are sufficiently filled with water and to provide allowances which permit performance of the verification.

APS has evaluated whether the proposed License Amendment Request constitutes a significant hazards consideration by focusing on the three standards set forth in 10 CFR 50.92, *Issuance of amendment*, as discussed below:

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

Response: No.

The proposed change revises or adds SRs that require verification that the ECCS, the SDC System, and the CS System, are not rendered inoperable due to accumulated gas and to provide allowances which permit performance of the revised 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 of performing their safety functions and are not rendered inoperable due to gas accumulation. Thus, the consequences of any accident previously evaluated are not significantly increased.

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

2. Does the proposed amendment 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 SDC 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 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.

## Description and Assessment of Proposed Amendment to Implement TSTF 523

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 amendment 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 SDC 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, APS 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**

### **Marked-up Technical Specifications Pages**

3.4.6-3  
3.4.7-3  
3.4.8-2  
3.5.3-2  
3.6.6-2  
3.9.4-2  
3.9.5-3

SURVEILLANCE REQUIREMENTS (continued)

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.7.1 Verify one SDC train is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.2 Verify required SG secondary side water level is $\geq 25\%$ .	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.3 Verify correct breaker alignment and indicated power available to the required SDC pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
<p><u>SR 3.4.7.4</u> -----NOTE-----  <u>Not required to be performed until 12 hours after entering MODE 4.</u>  -----  <u>Verify required SDC train locations susceptible to gas accumulation are sufficiently filled with water.</u></p>	<p><u>In accordance with the Surveillance Frequency Control Program</u></p>

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required SDC trains inoperable. <u>OR</u> No SDC train in operation.	B.1 Suspend all operations involving reduction of RCS boron concentration.	Immediately
	<u>AND</u> B.2 Initiate action to restore one SDC train to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p style="text-align: center;">-----NOTE-----  <u>Not required to be met for system vent flow paths opened under administrative control.</u>            -----</p>	
<p>SR 3.5.3.1 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.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.2 <del>Verify ECCS piping is full of water.</del>  <u>Verify ECCS locations susceptible to gas accumulation are sufficiently filled with water.</u></p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.3 Verify each ECCS pump develops the required differential pressure at the flow test point.</p>	<p>In accordance with the Inservice Testing Program</p>
<p>SR 3.5.3.4 Verify each ECCS automatic valve that is not locked, sealed, or otherwise secured in position, in the flow path actuates to the correct position on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.5 Verify each ECCS pump starts automatically on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.6 Verify each LPSI pump stops on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
<p style="text-align: center;">-----NOTE-----  <u>Not required to be met for system vent  flow paths opened under administrative  control.</u>  -----</p>		
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	Verify the containment spray piping is full of water to the 113 ft level in the containment spray header.	In accordance with the Surveillance Frequency Control Program
<u>SR 3.6.6.3</u>	<u>Verify containment spray locations susceptible to gas accumulation are sufficiently filled with water.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>
SR 3.6.6. <del>34</del> <u>4</u>	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. <del>45</del> <u>5</u>	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. <del>56</del> <u>6</u>	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. <del>67</del> <u>7</u>	Verify each spray nozzle is unobstructed.	In accordance with the Surveillance Frequency Control Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.4 Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.4.1 Verify one SDC loop is operable and in operation.	In accordance with the Surveillance Frequency Control Program
<u>SR 3.9.4.2 Verify required SDC loop locations susceptible to gas accumulation are sufficiently filled with water.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<u>SR 3.9.5.3</u> <u>Verify required SDC loop locations susceptible to gas accumulation are sufficiently filled with water.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>

## **ATTACHMENT 2**

### **Revised Technical Specifications Pages (Clean Copy)**

3.4.6-3

3.4.7-3

3.4.8-2

3.5.3-2

3.6.6-2

3.9.4-2

3.9.5-3

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.6.3    Verify correct breaker alignment and indicated power 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 SDC train 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 SDC train is in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.2 Verify required SG secondary side water level is $\geq 25\%$ .	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.3 Verify correct breaker alignment and indicated power available to the required SDC pump that is not in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.4 -----NOTE----- Not required to be performed until 12 hours after entering MODE 4. -----  Verify required SDC train 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 SDC trains inoperable. <u>OR</u> No SDC train in operation.	B.1 Suspend all operations involving reduction of RCS boron concentration.	Immediately
	<u>AND</u> B.2 Initiate action to restore one SDC train to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p style="text-align: center;">-----NOTE----- Not required to be met for system vent flow paths opened under administrative control. -----</p>	
<p>SR 3.5.3.1 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.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.2 Verify ECCS locations susceptible to gas accumulation are sufficiently filled with water.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.3 Verify each ECCS pump develops the required differential pressure at the flow test point.</p>	<p>In accordance with the Inservice Testing Program</p>
<p>SR 3.5.3.4 Verify each ECCS automatic valve that is not locked, sealed, or otherwise secured in position, in the flow path actuates to the correct position on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.5 Verify each ECCS pump starts automatically on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.5.3.6 Verify each LPSI pump stops on an actual or simulated actuation signal.</p>	<p>In accordance with the Surveillance Frequency Control Program</p>

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	<p>-----NOTE----- Not required to be met for system vent flow paths opened under administrative control. -----</p>	
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	Verify the containment spray piping is full of water to the 113 ft level in the containment spray header.	In accordance with the Surveillance Frequency Control Program
SR 3.6.6.3	Verify containment spray locations susceptible to gas accumulation are sufficiently filled with water.	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 spray nozzle is unobstructed.	In accordance with the Surveillance Frequency Control Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.4 Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.4.1 Verify one SDC loop is operable and in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.9.4.2 Verify required SDC 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 3.9.5.3    Verify required SDC loop locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program

## **ATTACHMENT 3**

### **Marked-up Technical Specification Bases Pages**

B 3.4.6-3  
B 3.4.6-5  
B 3.4.6-6  
B 3.4.6-7  
B 3.4.7-4  
B 3.4.7-6  
B 3.4.7-7  
B 3.4.7-8  
B 3.4.8-2  
B 3.4.8-4  
B 3.4.8-5  
B 3.5.3-4  
B 3.5.3-8  
B 3.5.3-9  
B 3.5.3-10  
B 3.5.4-2  
B 3.6.6-5  
B 3.6.6-7  
B 3.6.6-8  
B 3.6.6-9  
B 3.9.4-2  
B 3.9.4-4  
B 3.9.4-5  
B 3.9.5-2  
B 3.9.5-4  
B 3.9.5-5  
B 3.9.5-6

BASES

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LCO  
(continued)

Note 2 requires secondary side water temperature in each SG is  $< 100^{\circ}\text{F}$  above each of the RCS cold leg temperatures before an RCP may be started with any RCS cold leg temperature less than or equal to the LTOP enable temperature specified in the PTLR.

Satisfying the above condition will preclude a large pressure surge in the RCS when the RCP is started.

Note 3 restricts RCP operation to no more than 2 RCPs with RCS cold leg temperature  $\leq 200^{\circ}\text{F}$ , and no more than 3 RCPs with RCS cold leg temperature  $>200^{\circ}\text{F}$  but  $\leq 500^{\circ}\text{F}$ . Satisfying these conditions will maintain the analysis assumptions of the flow induced pressure correction factors due to RCP operation (Ref. 1)

An OPERABLE RCS loop consists of at least one OPERABLE RCP and an SG that is OPERABLE and has the minimum water level specified in SR 3.4.6.2.

Similarly, for the SDC System, an OPERABLE SDC train is composed of an OPERABLE SDC pump (LPSI) capable of providing flow to the SDC heat exchanger for heat removal. RCPs and SDC 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 SDC System OPERABILITY.](#)

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APPLICABILITY

In MODE 4, this LCO applies because it is possible to remove core decay heat and to provide proper boron mixing with either the RCS loops and SGs or the SDC System.

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";

(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.6.1

This SR requires verification that one required loop or train is in operation and circulating reactor coolant at a flow rate of greater than or equal to 4000 gpm. This ensures forced flow is providing heat removal. Verification includes flow rate, temperature, or pump status monitoring. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.6.2

This SR requires verification of secondary side water level in the required SG(s)  $\geq 25\%$  wide range. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The Surveillance Frequency 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 loop or SDC train 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 pumps. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.6.4

SDC 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 SDC train(s) and may also prevent water hammer, pump cavitation, and pumping of noncondensable gas into the reactor vessel.

Selection of SDC System locations susceptible to gas accumulation is based on a review of system design information, including piping instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walk downs to validate the system high points and to confirm the location and orientation of important components that can become source 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 stand-by versus operating conditions.

BASES (continued)

SURVEILLANCE  
REQUIREMENTSSR 3.4.6.4 (continued)

The SDC 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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the SDC 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.

SDC 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 sub-set 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.

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.

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.6.4 (continued)

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

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REFERENCES

1. PVNGS Operating License Amendments 52, 38 and 24 for Units 1, 2 and 3, respectively, and associated NRC Safety Evaluation dated July 25, 1990.
  2. Not used.
  3. PVNGS Calculation 13-JC-SH-0200, Section 2.9.
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BASES

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LCO  
(continued)

Note 5 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of SDC trains from operation when at least one RCP is in operation. This Note provides for the transition to MODE 4 where an RCP is permitted to be in operation and replaces the RCS circulation function provided by the SDC trains.

An OPERABLE SDC train is composed of an OPERABLE SDC pump (CS or LPSI) capable of providing flow to the SDC heat exchanger for heat removal. Management of gas voids is important to SDC System OPERABILITY.

SDC pumps are OPERABLE if they are capable of being powered and are able to provide flow, if required. A SG can perform as a heat sink when it is OPERABLE and has the minimum water level specified in SR 3.4.7.2.

The RCS loops may not be considered filled until two conditions needed for operation of the steam generators are met. First, the RCS must be intact. This means that all removable portions of the primary pressure boundary (e.g., manways, safety valves) are securely fastened. Nozzle dams are removed. All manual drain and vent valves are closed, and any open system penetrations (e.g., letdown, reactor head vents) are capable of remote closure from the control room. An intact primary allows the system to be pressurized as needed to achieve the subcooling margin necessary to establish natural circulation cooling. When the RCS is not intact as described, a loss of SDC flow results in blowdown of coolant through boundary openings that also could prevent adequate natural circulation between the core and steam generators. Secondly, the concentration of dissolved or otherwise entrained gases in the coolant must be limited or other controls established so that gases coming out of solution in the SG U-tubes will not adversely affect natural circulation. With these conditions met, the SGs are a functional method of RCS heat removal upon loss of the operating SDC train. The ability to feed and steam SGs at all times is not required when RCS temperature is less than 210°F because significant loss of SG inventory through boiling will not occur during time anticipated to take corrective action. The required SG level provides sufficient time to either restore the SDC train or implement a method for feeding and steaming the SGs (using non-class components if necessary).

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(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.7.1

This SR requires verification that one SDC train is in operation and circulating reactor coolant at a flow rate of greater than or equal to 3780 gpm. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing decay heat removal. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

The SDC flow is established to ensure that core outlet temperature is maintained sufficiently below saturation to allow time for swapper to the standby SDC train should the operating train be lost.

SR 3.4.7.2

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are  $\geq 25\%$  wide range level ensures that redundant heat removal paths are available if the second SDC train is inoperable. The Surveillance is required to be performed when the LCO requirement is being met by use of the SGs. If both SDC trains are OPERABLE, this SR is not needed. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.7.3

Verification that the second SDC train is OPERABLE ensures that redundant paths for decay heat removal are available. The requirement also ensures that the additional train 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 pumps. The Surveillance is required to be performed when the LCO requirement is being met by one of two SDC trains, e.g., both SGs have  $< 25\%$  wide range water level. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.4.7.4

SDC 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 SDC train(s) and may also

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(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.7.4 (continued)

prevent water hammer, pump cavitation, and pumping of noncondensable gas into the reactor vessel.

Selection of SDC 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 walk downs 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 stand-by versus operating conditions.

The SDC 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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the SDC 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.

SDC 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 sub-set 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.

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(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.7.4 (continued)

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.

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 5.

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

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(continued)

BASES (continued)

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LCO  
(continued)

Note 1 permits all SDC pumps to be de-energized  $\leq 1$  hour per 8 hour period. The circumstances for stopping both SDC pumps are to be limited to situations when the outage time is short and the core outlet temperature is maintained  $> 10^{\circ}\text{F}$  below saturation temperature. The 10 degrees F is considered the actual value of the necessary difference between RCS core outlet temperature and the saturation temperature associated with RCS pressure to be maintained during the time the pumps would be de-energized. The instrument error associated with determining this difference is less than 10 degrees F. (There are no special restrictions for instrumentation use.) Therefore, the indicated value of the difference between RCS core outlet temperature and the saturation temperature associated with RCS pressure must be greater than or equal to 20 degrees F in order to use the provisions of the Note allowing the pumps to be de-energized. (Ref. 1) The Note prohibits boron dilution or draining operations when SDC forced flow is stopped.

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

An OPERABLE SDC train is composed of an OPERABLE SDC pump (CS or LPSI) capable of providing flow to the SDC heat exchanger for heat removal. SDC pumps are OPERABLE if they are capable of being powered and are able to provide flow, if required. Note that the CS pumps shall not be used for normal operations if the water level is at or below the top of the hot-leg pipe (103' - 1") due to concerns of potential air entrainment and gas binding of the CS pump (Ref. 2).

[Management of gas voids is important to SDC System OPERABILITY.](#)

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APPLICABILITY

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

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 3.4.7, "RCS Loops – MODE 5, Loops Filled";
  - LCO 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation – High Water Level" (MODE 6); and
- (continued)

BASES (continued)

SURVEILLANCE  
REQUIREMENTS

SR 3.4.8.3

SDC 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 SDC trains and may also prevent water hammer, pump cavitation, and pumping of noncondensable gas into the reactor vessel.

Selection of SDC 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 walk downs 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 stand-by versus operating conditions.

The SDC 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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the SDC 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.

SDC 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 sub-set 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

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.8.3 (continued)

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.

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REFERENCES

1. PVNGS Calculation 13-JC-SH-0200, Section 2.9.
  2. PVNGS Calculation 13-MC-SI-0250, Appendix C.
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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

The LCO ensures that an ECCS train will deliver sufficient water to match decay heat boiloff rates soon enough to minimize core uncover for a large LOCA. It also ensures that the HPSI pump will deliver sufficient water during a small break LOCA and provide sufficient boron to maintain the core subcritical following an SLB.

ECCS - Operating satisfies Criterion 3 of 10 CFR 50.36 (c)(2)(ii).

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LCO

In MODES 1, 2, and 3, with pressurizer pressure  $\geq 1837$  psia or with RCS  $T_c \geq 485^\circ\text{F}$  two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming there is a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

In MODES 1 and 2, and in MODE 3 with pressurizer pressure  $\geq 1837$  psia or with RCS  $T_c \geq 485^\circ\text{F}$  an ECCS train consists of a HPSI subsystem and a LPSI subsystem.

Each train includes the piping, instruments, valves, and controls to ensure the availability of an OPERABLE flow path capable of taking suction from the RWT on a SIAS and automatically transferring suction to the containment sump upon a Recirculation Actuation Signal (RAS). [Management of gas voids is important to ECCS OPERABILITY.](#)

During an event requiring ECCS actuation, a flow path is provided to ensure an abundant supply of water from the RWT to the RCS, via the HPSI and LPSI pumps and their respective supply headers, to each of the four cold leg injection nozzles. In the long term (post RAS), this flow path is manually switched two to three hours after a LOCA to supply part of its HPSI flow to the RCS hot legs via the HPSI hot leg injection valves which connect to the Shutdown Cooling (SDC) suction nozzles.

(continued)

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## BASES (continued)

SURVEILLANCE  
REQUIREMENTSSR 3.5.3.1

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 valves 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 automatically repositions within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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.

SR 3.5.3.2

~~With the exception of systems in operation, the ECCS piping pumps are normally in a standby, nonoperating mode. As such, flow path piping has the ECCS 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 ECCS and may also The method of ensuring that any voids or pockets of gases are removed from the ECCS piping is to vent the accessible discharge piping high points, which is controlled by PVNGS procedures. Maintaining the piping from the ECCS pumps to the RCS full of water 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 noncondensable gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SIAS or during SDC. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

(continued)

## BASES

SURVEILLANCE  
REQUIREMENTSSR 3.5.3.2 (continued)

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 walk downs 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 stand-by 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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the ECCS 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 sub-set 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.

(continued)

## BASES

SURVEILLANCE  
REQUIREMENTSSR 3.5.3.2 (continued)

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.

SR 3.5.3.3

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 OM Code. This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. 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 unit safety analysis. SRs are specified in the Inservice Testing Program, which encompasses the ASME OM Code (Ref. 7). The frequency of this SR is in accordance with the Inservice Testing Program.

SR 3.5.3.4, SR 3.5.3.5, and SR 3.5.3.6

These SRs demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SIAS and on an RAS, that each ECCS pump starts on receipt of an actual or simulated SIAS, and that the LPSI pumps stop on receipt of an actual or simulated RAS. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

The following valve actuations must be verified:

on an actual or simulated recirculation actuation signal, the containment sump isolation valves open, and the HPSI, LPSI and CS minimum bypass recirculation

(continued)

BASES

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LCO In MODE 3 with pressurizer pressure < 1837 psia and with RCS  $T_c < 485^\circ\text{F}$  and in MODE 4 an ECCS subsystem is composed of a single HPSI subsystem. Each HPSI subsystem includes the piping, instruments, valves, and controls to ensure an OPERABLE flow path capable of taking suction from the RWT and transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to supply water from the RWT to the RCS via the HPSI pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term post (RAS), this flow path is manually switched 2 to 3 hours after a LOCA to supply part of its HPSI flow to the RCS hot legs via the HPSI hot leg injection valves which connect to the Shutdown Cooling (SDC) suction nozzles. [Management of gas voids is important to ECCS OPERABILITY.](#)

With RCS pressure < 1837 psia and with RCS  $T_c < 485^\circ\text{F}$ , one HPSI pump is acceptable without single failure consideration, based on the stable reactivity condition of the reactor and the limited core cooling requirements. The Low Pressure Safety Injection (LPSI) pumps may therefore be released from the ECCS train for use in SDC.

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APPLICABILITY In MODES 1, 2, and 3 with RCS pressure  $\geq 1837$  psia or with RCS  $T_c \geq 485^\circ\text{F}$ , the OPERABILITY requirements for ECCS are covered by LCO 3.5.3.

In MODE 3 with RCS pressure < 1837 psia and with RCS  $T_c < 485^\circ\text{F}$  and in MODE 4, one OPERABLE ECCS train is acceptable without single failure consideration, based on the stable reactivity condition of the reactor and the limited core cooling requirements.

In MODES 5 and 6, unit 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 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation – High Water Level," and LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level."

(continued)

BASES

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LCO  
(continued)

containment spray actuation signal and automatically transferring suction to the containment sump on a recirculation actuation signal. Each spray train flow path from the containment sump shall be via an OPERABLE shutdown cooling heat exchanger.

Therefore, in the event of an accident, the minimum requirements are met, assuming that the worst case single active failure occurs.

Each Containment Spray System typically includes a spray pump, a shutdown cooling heat exchanger, spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWT upon an ESF actuation signal and automatically transferring suction to the containment sump. Management of gas voids is important to Containment Spray System OPERABILITY.

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APPLICABILITY

In MODES 1, 2, and 3, and Mode 4 with RCS pressure  $\geq 385$  psia, 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.

In MODE 4 with RCS pressure  $< 385$  psia and 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 is not required to be OPERABLE in these MODES.

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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 train is adequate to perform the iodine removal, hydrogen mixing, and containment cooling functions. The 72 hour Completion Time takes into account the redundant heat removal capability afforded by the Containment Spray System, reasonable time for repairs, and the low probability of a DBA occurring during this period.

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.6.6.1 (continued)

The Surveillance is modified by a Note which exempts system and 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.

SR 3.6.6.2

Verifying that the containment spray header piping is full of water to the 113 ft level minimizes the time required to fill the header. This ensures that spray flow will be admitted to the containment atmosphere within the time frame assumed in the containment analysis. The analyses shows that the header may be filled with unborated water which helps to reduce boron plate out due to evaporation. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The value of 113 ft is an indicated value which accounts for instrument uncertainty.

SR 3.6.6.3

Containment Spray System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the required 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 walk downs 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 stand-by versus operating conditions.

(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.6.6.3 (continued)

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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. 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 limit.

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 sub-set 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.

(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS  
(continued)

SR 3.6.6.34

Verifying that each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head ensures that spray pump performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by the ASME OM Code (Ref. 6). Since the containment spray pumps cannot be tested with flow through the spray headers, they are tested on recirculation flow (either full flow or miniflow as conditions permit). This test is indicative of overall performance. Such inservice inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of this SR is in accordance with the Inservice Testing Program.

SR 3.6.6.4-5 and SR 3.6.6.56

These SRs verify that each automatic containment spray valve actuates to its correct position and that each containment spray pump starts upon receipt of an actual or simulated safety injection actuation signal, recirculation actuation signal and containment spray actuation signal as applicable. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

The surveillance of containment sump isolation valves is also required by SR 3.5.3.5. A single surveillance may be used to satisfy both requirements.

SR 3.6.6.67

Unobstructed flow headers and nozzles are determined by either flow testing or visual inspection.

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. Performance of this SR demonstrates 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 controlled under the Surveillance Frequency Control Program.

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(continued)

BASES (continued)

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LCO Only one SDC loop is required for decay heat removal in MODE 6, with water level  $\geq$  23 ft above the top of the reactor vessel flange. Only one SDC loop is required because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one SDC loop must be in operation to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of a criticality; and
- c. Indication of reactor coolant temperature.

An OPERABLE SDC train is composed of an OPERABLE SDC pump (LPSI or CS) capable of providing flow to the SDC heat exchanger for heat removal. SDC 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 SDC System OPERABILITY.

The LCO is modified by a Note that allows the required operating SDC loop to be removed from service for up to 1 hour in each 8 hour period, provided no operations are permitted that would cause a reduction of the RCS boron concentration. Boron concentration reduction 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, surveillance testing of ECCS pumps, and RCS to SDC isolation valve testing. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity.

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APPLICABILITY One SDC loop must be in operation in MODE 6, with the water level  $\geq$  23 ft above the top of the reactor vessel flange, to provide decay heat removal. The 23 ft level was selected because it corresponds to the 23 ft requirement established for fuel movement in LCO 3.9.6, "Refueling Water Level - Fuel Assemblies."

(continued)

BASES

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ACTIONS  
(continued)

A.4

If SDC loop requirements are not met, all containment penetrations to the outside atmosphere must be closed to prevent fission products, if released by a loss of decay heat event, from escaping the containment building. The 4 hour Completion Time allows fixing most SDC problems without incurring the additional action of violating the containment atmosphere.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.4.1

This Surveillance demonstrates that the SDC loop is in operation and circulating reactor coolant at a flowrate of greater than or equal to 3780 gpm. 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 controlled under the Surveillance Frequency Control Program.

SR 3.9.4.2

SDC 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 SDC loop(s) and may also prevent water hammer, pump cavitation, and pumping of noncondensable gas into the reactor vessel.

Selection of SDC System locations susceptible to gas accumulation is based on a review of system design information including piping and instrumentation drawings, isometrics drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walk downs 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 stand-by versus operating conditions.

BASES

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SURVEILLANCE      SR 3.9.4.2 (continued)  
REQUIREMENTS

The SDC 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 acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the SDC 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.

SDC 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 sub-set 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

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LCO

In MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, both SDC loops must be OPERABLE. Additionally, one loop of the SDC System must be in operation in order to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of a criticality; and
- c. Indication of reactor coolant temperature.

An OPERABLE SDC train is composed of an OPERABLE SDC pump (LPSI or CS) capable of providing flow to the SDC heat exchanger for heat removal. SDC pumps are OPERABLE if they are capable of being powered and are able to provide flow, if required. Note that the CS pumps shall not be used for normal operations if the water level is at or below the top of the hot-leg pipe (103' - 1") due to concerns of potential air entrainment and gas binding of the CS pump (Ref. 2).

[Management of gas voids is important to SDC System OPERABILITY.](#)

Both SDC pumps may be aligned to the Refueling Water Tank (RWT) to support filling the refueling cavity or for performance of required testing.

The LCO is modified by a Note that allows a required operating SDC loop to be removed from service for up to 1 hour in each 8 hour period, provided no operations are permitted that would cause a reduction of the RCS boron concentration. Boron concentration reduction 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, surveillance testing of ECCS pumps, and RCS to SDC isolation valve testing. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity.

This LCO is modified by a Note that allows one SDC loop to be inoperable for a period of 2 hours provided the other loop is OPERABLE and in operation. Prior to declaring the loop inoperable, consideration should be given to the existing plant configuration. This consideration should include that the core time to boil is not short, there is no draining operation to further reduce RCS water level and that the capacity exists to inject borated water into the reactor vessel. This permits surveillance tests to be performed on the non-operating loop during a time when these tests are safe and possible.

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(continued)

BASES

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ACTIONS  
(Continued)

B.3

the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the SDC 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 that 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.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.5.1

This Surveillance demonstrates that one SDC loop is operating and circulating reactor coolant at a flowrate of greater than or equal to 3780 gpm. 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. In addition, this Surveillance demonstrates that the other SDC loop is OPERABLE.

In addition, during operation of the SDC loop with the water level in the vicinity of the reactor vessel nozzles, the SDC loop flow rate determination must also consider the SDC pump suction requirements. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.9.5.2

Verification that the required pump that is not in operation is OPERABLE ensures that an additional SDC 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 controlled under the Surveillance Frequency Control Program.

SR 3.9.5.3

SDC 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 SDC loops and may also prevent water hammer, pump cavitation, and pumping of noncondensable gas into the reactor vessel.

BASES

SURVEILLANCE      SR 3.9.5.3 (continued)  
REQUIREMENTS

Selection of SDC 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 walk downs 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 stand-by versus operating conditions.

The SDC 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 an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If the accumulated gas is eliminated or brought within the acceptance criteria limits during performance of the Surveillance, the SR is met and past system OPERABILITY is evaluated under the Corrective Action Program. If it is determined by subsequent evaluation that the SDC 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.

SDC 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 sub-set 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.

BASES

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SURVEILLANCE      SR 3.9.5.3 (continued)  
REQUIREMENTS

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

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- REFERENCES
1. UFSAR, Section 5.4.7.
  2. PVNGS Calculation 13-MC-SI-0250, Appendix C.
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