

BASES

LCO (continued)

*Management of gas voids is important to RHR System OPERABILITY.*

- 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 low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. The operability of the operating RHR train and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature. If not in its normal RHR alignment from the RCS hot leg and returning to the RCS cold legs, the required RHR loop is OPERABLE provided the system may be placed in service from the control room, or may be placed in service in a short period of time by actions outside the control room and there are no restraints to placing the equipment in service.

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 cavity.

The acceptability of the LCO and the LCO Note is based on preventing boiling in the core in the event of the loss of RHR cooling. However, it has been determined that when the upper internals are in place in the reactor vessel there is insufficient communication with the water above the core for adequate decay heat removal by natural circulation. As a result, boiling in the core could occur in a relatively short time if RHR cooling is lost. Therefore, during the short period of time that the upper internals are installed, administrative processes are implemented to reduce the risk of core boiling. The availability of additional cooling equipment, including equipment not required to be OPERABLE by the Technical Specifications, contributes to this risk reduction. The plant staff assesses these cooling sources to assure that the desired minimal level of risk is maintained. This is commonly referred to as defense-in-depth. This strategy is

## BASES

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### 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  $\geq 23$  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.

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### SURVEILLANCE REQUIREMENTS

#### SR 3.9.4.1

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 RCS temperature is determined to ensure the appropriate decay heat removal is maintained. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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### REFERENCES

1. UFSAR, Section 5.5.7.
2. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).
3. NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

INSERT Bases SR 3.9.4.2 (attached)

INSERT Bases SR 3.9.4.2

SR 3.9.4.2

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 RHR loops and may also prevent water hammer, pump cavitation, and pumping of noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

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BASES

LCO (continued)

*Management of gas voids is important to RHR System OPERABILITY.*

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 low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. The operability of the operating RHR train and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature. If not in its normal RHR alignment from the RCS hot leg and returning to the RCS cold legs, the required RHR loop is OPERABLE provided the system may be placed in service from the control room, or may be placed in service in a short period of time by actions outside the control room and there are no restraints to placing the equipment in service. ↗

Both RHR pumps may be aligned to the Refueling Water Storage Tank to support filling the refueling cavity or for performance of required testing.

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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  $\geq 23$  ft are located in LCO 3.9.4, "Residual Heat Removal (RHR) and Coolant Circulation—High Water Level."

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ACTIONS

A.1 and A.2

If less than the required number of RHR loops are OPERABLE, action shall be immediately initiated and continued until the RHR loop is restored to OPERABLE status and to operation or until  $\geq 23$  ft of water level is established above the reactor vessel flange. When the water level is  $\geq 23$  ft above the reactor vessel flange, the Applicability changes to that of LCO 3.9.4, and only one RHR loop is required to be OPERABLE and in operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

B.1

If no RHR loop is in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron



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SURVEILLANCE REQUIREMENTS (continued)

SR 3.9.5.2

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 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.

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REFERENCES

1. UFSAR, Section 5.5.7.
2. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).

INSERT Basis SR 3.9.5.3 (attached)

INSERT Bases SR 3.9.5.3

SR 3.9.5.3

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 noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

OPERABLE if they are capable of being powered and are able to provide forced flow if required. *A*

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 3.4.17, "RCS Loops—Test Exceptions";  
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

If only one RCS loop is OPERABLE and two RHR loops are 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.

B.1

If only one RHR loop is OPERABLE and in operation and there are no RCS loops OPERABLE, an inoperable RCS or RHR loop must be restored to OPERABLE status to provide a redundant means for decay heat removal.

If the parameters that are outside the limits cannot be restored, the unit must be brought to MODE 5 within 24 hours. 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 ( $\leq 200^{\circ}\text{F}$ ) rather than MODE 4 ( $200$  to  $< 350^{\circ}\text{F}$ ). The Completion Time of 24 hours is a reasonable time, based on operating experience, to reach MODE 5 from MODE 4 in an orderly manner and without challenging plant systems.

*Management of gas voids is important to RHR System OPERABILITY.*

## BASES

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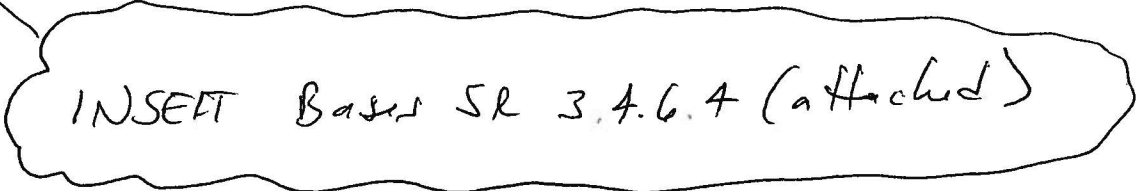
### SURVEILLANCE REQUIREMENTS (continued)

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.

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### REFERENCES

1. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).



INSERT Basis SR 3.4.6.4 (attached)

INSERT Bases SR 3.4.6.4

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 noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and 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 (continued)

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

Note 3 requires that the secondary side water temperature of each SG be  $\leq 50^{\circ}\text{F}$  above each of the RCS cold leg temperatures or that pressurizer water volume be  $< 92\%$  ( $1600\text{ ft}^3$ ) before the start of a reactor coolant pump (RCP) with an RCS cold leg temperature  $\leq 300^{\circ}\text{F}$ . This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

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

RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink when it has an adequate water level.

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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 narrow range water level of at least two SGs is required to be  $\geq 12\%$ .

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 3.4.17 "RCS Loops—Test Exceptions";  
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).

*Management of gas voids is important to RHR System OPERABILITY.*



BASES

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SURVEILLANCE REQUIREMENTS (continued)

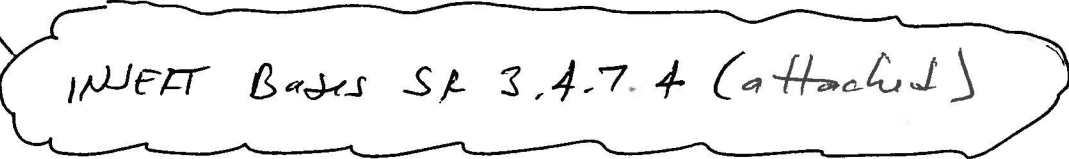
SR 3.4.7.3

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 narrow range water level is  $\geq 12\%$  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.

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REFERENCES

1. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).



INJEFT Bases SR 3.4.7.4 (attached)

INSERT Bases SR 3.4.7.4

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 noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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.

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LCO (continued)

and core outlet temperature is maintained at least 10°F below saturation temperature. The Note prohibits boron dilution with coolant at boron concentration less than required to assure SDM of LCO 3.1.1 is maintained or draining operations when RHR forced flow is stopped.

Note 2 allows one RHR loop to be inoperable for a period of  $\leq 2$  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. 

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APPLICABILITY	In MODE 5 with loops not filled, this LCO requires core heat removal and coolant circulation by the RHR System.
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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 3.4.17, "RCS Loops—Test Exceptions";  
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).

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ACTIONS	<u>A.1</u>
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If only one RHR loop is OPERABLE and in operation, redundancy for RHR is lost. Action must be initiated to restore a second loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If no required RHR loops are OPERABLE or in operation, except during conditions permitted by Note 1, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet SDM of LCO 3.1.1 must be suspended and action must be

*Management of gas voids is important to RHR System OPERABILITY.*

BASES

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ACTIONS (continued)

initiated immediately to restore an RHR loop to OPERABLE status and operation. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however, coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to criticality. 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.

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.8.1

This SR requires verification that one loop is in operation. Verification includes 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 the required number of pumps are 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 required pumps. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).

INSEFT Bases SR 3.4.8.3 (attached)

INSERT Bases SR 3.4.8.3

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 noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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.

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## BASES

### APPLICABLE SAFETY ANALYSES (continued)

It also ensures that the centrifugal charging and SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the centrifugal charging pump delivers sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of 10 CFR 50.36 (Ref. 5).

#### LCO

In MODES 1, 2, and 3, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming 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, 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. In the long term, this 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. The flow path for each train must maintain its designed independence to ensure that no single failure can disable both ECCS trains.

#### 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. The SI pump performance requirements are based on a small break LOCA. For both of these types of pumps, the large break LOCA analysis depends only on the flow value at containment pressure, not on the shape of the flow versus pressure curve at higher pressures. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

*Management of gas voids is important to ECCS OPERABILITY.*



BASES

SURVEILLANCE REQUIREMENTS (continued)

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

*INSERT Basis SR 3.5.2.2 (new paragraph)(attached)*

SR 3.5.2.3

ECCS piping is verified to be water-filled by venting to remove gas from accessible locations susceptible to gas accumulation. Alternative means may be used to verify water-filled conditions (e.g., ultrasonic testing or high point sightglass observation). Maintaining the ECCS pumps and piping 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 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 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 plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses the ASME OM Code. The ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

*INSERT Basis SR 3.5.2.3 (attached)*

## McGuire Units 1 and 2

### INSERT Bases SR 3.5.2.2

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.

### INSERT Bases SR 3.5.2.3

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

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 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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. 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 based on operating experience, equipment reliability, and plant risk and 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 (continued)

ECCS pumps and their respective supply headers to each of the four 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.

*Management of gas voids is important to ECCS OPERABILITY.*

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### 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."

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### ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable ECCS centrifugal charging subsystem when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS centrifugal charging 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 RHR pumps and heat exchangers. The Completion Time of immediately to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must continue until the inoperable RHR loop components can be restored to operation so that decay heat removal is continuous.

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## BASES

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### APPLICABLE SAFETY ANALYSES (continued)

Inadvertent actuation is precluded by design features consisting of an additional set of containment pressure sensors which prevents operation when the containment pressure is below the containment pressure control system permissive.

The Containment Spray System satisfies Criterion 3 of 10 CFR 50.36 (Ref. 5).

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#### LCO

During a DBA, one train of Containment Spray System is required to provide the heat removal capability assumed in the safety analyses. To ensure that this requirement is met, two containment spray trains must be OPERABLE with power from two safety related, independent power supplies. Therefore, in the event of an accident, at least one train operates.

Each Containment Spray System includes a spray pump, headers, valves, heat exchangers, nozzles, piping, instruments, and controls to ensure an OPERABLE flow path capable of being manually initiated to take suction from the Containment Sump and delivering it to the Containment Spray Rings.

*Management of gas voids is important to Containment Spray System OPERABILITY.*

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#### 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 System.

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

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#### ACTIONS

##### A.1

With one containment spray train inoperable, the affected train must be restored to OPERABLE status within 72 hours. The components in this degraded condition are capable of providing 100% of the heat removal after an accident. The 72 hour Completion Time was developed taking into account the redundant heat removal and iodine removal capabilities afforded by the OPERABLE train and the low probability of a DBA occurring during this period.

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## BASES

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### ACTIONS (continued)

#### B.1 and B.2

If the affected containment spray train cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 84 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. The extended interval to reach MODE 5 allows additional time and is reasonable when considering that the driving force for a release of radioactive material from the Reactor Coolant System is reduced in MODE 3.

### SURVEILLANCE REQUIREMENTS

#### SR 3.6.6.1

Verifying the correct alignment of manual and power operated valves, excluding check valves, in the Containment Spray System provides assurance that the proper flow path exists for Containment Spray System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position since they were verified in the correct position prior to being secured. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown or computer status indication, 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.

The surveillance includes verifying the correct alignment of the containment spray pump discharge valves.

#### SR 3.6.6.2

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 head 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 bypass flow. This test confirms one point on the pump design curve and 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.

← INSEAT Bases SR 3.6.6.1 (new paragraph)  
(attached)

McGuire Units 1 and 2

INSERT Bases SR 3.6.6.1

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

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.6.3 and SR 3.6.6.4

Not Used.

SR 3.6.6.5 and SR 3.6.6.6

These SRs require verification that each containment spray pump discharge valve can be manually opened or is prevented from opening and each containment spray pump can be manually started or is de-energized and prevented from starting upon receipt of Containment Pressure Control System start and terminate signals. The EDG Load Sequencer must be reset in order for the containment spray pump to start. The CPCS is described in the Bases for LCO 3.3.2, "ESFAS." The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.6.6.7

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. The spray nozzles can also be tested using a vacuum blower to induce air flow through each nozzle to verify unobstructed flow. This SR requires verification that each spray nozzle is unobstructed following activities that could cause nozzle blockage. Normal plant operation and activities are not expected to initiate this SR. However, activities such as inadvertent spray actuation that causes fluid flow through the nozzles, major configuration change, or a loss of foreign material control when working within the respective system boundary, may require surveillance performance.

INSERT Basis SR 3.6.6.8 (attached)

INSERT Bases SR 3.6.6.8

SR 3.6.6.8

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 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 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 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

BASES

LCO (continued)

*Management of gas voids is important to RHR System OPERABILITY.*

- 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 low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. The operability of the operating RHR train and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature.

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 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 cavity.

The acceptability of the LCO and the LCO NOTE is based on preventing boiling in the core in the event of the loss of RHR cooling. However, it has been determined that when the upper internals are in place in the reactor vessel there is insufficient communication with the water above the core for adequate decay heat removal by natural circulation. As a result, boiling in the core could occur in a relatively short time if RHR cooling is lost. Therefore, during the short period of time that the upper internals are installed, administrative processes are implemented to reduce the risk of core boiling. The availability of additional cooling equipment, including equipment not required to be OPERABLE by the Technical Specifications, contributes to this risk reduction. The plant staff assesses these cooling sources to assure that the desired minimal level of risk is maintained. This is commonly referred to as defense-in-depth. This strategy is consistent with NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management." (Ref.3)

BASES

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ACTIONS (continued)

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 RCS temperature is determined to ensure the appropriate decay heat removal is maintained. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR, Section 5.5.7.
2. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).
3. NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management".

INSERT Bases SR 3.9.5.2 (attached)

INSERT Bases SR 3.9.5.2

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 RHR loops and may also prevent water hammer, pump cavitation, and pumping of noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

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BASES

LCO (continued)

*Management of gas voids is important to RHR System OPERABILITY.*

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 low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. The operability of the operating RHR train and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature.

Both RHR pumps may be aligned to the Refueling Water Storage Tank to support filling the refueling cavity or for performance of required testing.

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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  $\geq 23$  ft are located in LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation–High Water Level."

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ACTIONS

A.1 and A.2

If less than the required number of RHR loops are OPERABLE, action shall be immediately initiated and continued until the RHR loop is restored to OPERABLE status and to operation or until  $\geq 23$  ft of water level is established above the reactor vessel flange. When the water level is  $\geq 23$  ft above the reactor vessel flange, the Applicability changes to that of LCO 3.9.5, and only one RHR loop is required to be OPERABLE and in operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

B.1

If no RHR loop is in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that which would be required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation.



BASES

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ACTIONS (continued)

B.2

If no RHR loop is in operation, actions shall be initiated immediately, and continued, to restore one RHR loop to operation. Since the unit is in Conditions A and B concurrently, the restoration of two OPERABLE RHR loops and one operating RHR loop should be accomplished expeditiously.

B.3

If no RHR loop is in operation, 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 that dose limits are not exceeded. The Completion Time of 4 hours is appropriate for the majority of time during refueling operations, based on time to coolant boiling, since water level is not routinely maintained at low levels.

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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, prevent vortexing in the suction of the RHR pumps, and to prevent thermal and boron stratification in the core. The RCS temperature is determined to ensure the appropriate decay heat removal is maintained. In addition, during operation of the RHR loop with the water level in the vicinity of the reactor vessel nozzles, the RHR pump suction requirements must be met. 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 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 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 BASES SR 3.9.6.3 (attached)

INSERT Bases SR 3.9.6.3

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 noncondensable 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 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 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 an 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

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 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 based on operating experience, equipment reliability, and plant risk and 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  
(continued)

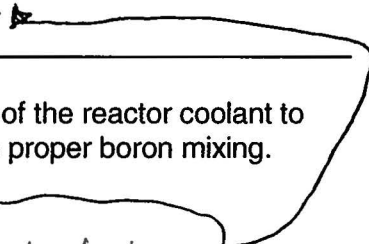
so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

Note 1 also permits the DHR pumps to be stopped for  $\leq 1$  hour per 8 hour period. When the DHR pumps are stopped, no alternate heat removal path exists, unless the RCS and SGs have been placed in service in forced or natural circulation. The response of the RCS without the DHR loop depends on the core decay heat load and the length of time that the DHR pumps are stopped. As decay heat diminishes, the effects on RCS temperature and pressure diminish. Without cooling by DHR, higher heat loads will cause the reactor coolant temperature and pressure to increase at a rate proportional to the decay heat load. Because pressure can increase, the applicable system pressure limits (pressure and temperature (P/T) or low temperature overpressure protection (LTOP) limits) must be observed and forced DHR flow or heat removal via the SGs must be re-established prior to reaching the pressure limit. The circumstances for stopping both DHR trains are to be limited to situations where:

- a. Pressure and temperature increases can be maintained well within the allowable pressure (P/T and LTOP) and 10°F subcooling limits; or
- b. An alternate heat removal path through the SG is in operation.

Note 2 allows a DHR loop to be considered OPERABLE if it is capable of being manually (locally or remotely) realigned to the DHR mode of operation and is not otherwise inoperable. This provision is necessary because of the dual function of the components that comprise the decay heat removal mode of the Low Pressure Injection System.

An OPERABLE RCS loop consists of at least one OPERABLE RCP and an SG that is OPERABLE.

Similarly for the DHR loops, an OPERABLE DHR loop is comprised of the OPERABLE LPI pump(s) capable of providing forced flow to the LPI heat exchanger(s). LPI pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. 

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### 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.

*Management of gas voids is important to DHR System OPERABILITY.*

## BASES

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### ACTIONS

#### B.1 and B.2 (continued)

RCS or DHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must continue until one loop is restored to operation.

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### SURVEILLANCE REQUIREMENTS

#### SR 3.4.6.1

This Surveillance requires verification of the required DHR or RCS loop in operation to ensure forced flow is providing decay heat removal. Verification includes flow rate, temperature, or pump status monitoring. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. In addition, control room indication and alarms will normally indicate loop status.

#### SR 3.4.6.2

Verification that the required pump is OPERABLE ensures that an additional RCS or DHR loop 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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### REFERENCES

1. 10 CFR 50.36.
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INSERT SR 3.4.6.3 (attached)

INSERT Bases SR 3.4.6.3

SR 3.4.6.3

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

Selection of DHR 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 DHR 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 it is determined by subsequent evaluation that the DHR 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

DHR 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.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and 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  
(continued)

Note 2 allows one required DHR loop to be inoperable for a period of  $\leq 2$  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 such testing is safe and possible.

Note 3 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting DHR loops to not be in 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 DHR loops.

Note 4 allows a DHR loop to be considered OPERABLE during alignment and when aligned for low pressure injection if it is capable of being manually (locally or remotely) realigned to the DHR mode of operation and is not otherwise inoperable. This provision is necessary because of the dual requirements of the components that comprise the low pressure injection/decay heat removal system.

To be considered OPERABLE, a DHR loop must consist of a pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the temperature. The flow path starts in one of the RCS hot legs and is returned to reactor vessel via one or both Core Flood tank injection nozzles. The BWST recirculation crossover line through valves LP-40 and LP-41 may be part of a flow path if it provides adequate decay heat removal capability. The operability of the operating DHR loop and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature. LPSW and ECCW are required to support the OPERABLE DHR train(s). One LPSW pump and one ECCW header can simultaneously support one or two DHR trains. Single failure protection is not required for LPSW or support systems in these modes.

To be considered OPERABLE, DHR loops must be capable of being powered and are able to provide flow if required. An SG can perform as a heat sink when it has an adequate water level and is OPERABLE.

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### APPLICABILITY

In MODE 5 with loops filled, forced circulation is provided by this LCO to remove decay heat from the core and to provide proper boron mixing. One loop of DHR in operation provides sufficient circulation for these purposes.

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";

*Management of gas voids is important to  
DHR System OPERABILITY.*



BASES

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SURVEILLANCE  
REQUIREMENTS  
(continued)

SR 3.4.7.2

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are  $\geq 50\%$  ensures that redundant heat removal paths are available if the second DHR loop is not OPERABLE. If both DHR loops are OPERABLE, 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.

SR 3.4.7.3

Verification that each required DHR pump is OPERABLE ensures that a DHR loop can be placed in operation if needed to maintain decay heat removal and reactor coolant circulation. If the secondary side water level is  $\geq 50\%$  in both SGs, this Surveillance is not needed. Verification is performed by verifying proper breaker alignment and power available to the required pumps. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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REFERENCES

1. 10 CFR 50.36.
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INSERT Basis SR 3.4.7.4 (attached)

Oconee Units 1, 2, and 3

INSERT Bases SR 3.4.7.4

SR 3.4.7.4

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

Selection of DHR 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 DHR 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 it is determined by subsequent evaluation that the DHR 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

DHR 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 based on operating experience, equipment reliability, and plant risk and 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 (continued)

unless forced flow is used. A minimum of one running pump meets the LCO requirement for one loop in operation. An additional DHR loop is required to be OPERABLE to provide redundancy for heat removal.

Note 1 permits the DHR pumps to not be in operation for  $\leq 15$  minutes when switching from one loop to the other or for testing. The circumstances for stopping both DHR pumps are to be limited to situations where the outage time is short and temperature is maintained  $\leq 140^{\circ}\text{F}$ . The Note prohibits boron dilution or draining operations when DHR forced flow is stopped.

Note 2 allows one DHR loop to be inoperable for a period of  $\leq 2$  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.

Note 3 allows a DHR loop to be considered OPERABLE if it is capable of being manually (locally or remotely) realigned to the DHR mode of operation and is not otherwise inoperable. This provision is necessary because of the dual function of the components that comprise the low pressure injection/decay heat removal system.

To be considered OPERABLE, a DHR loop must consist of a pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the temperature. The flow path starts in one of the RCS hot legs and is returned to reactor vessel via one or both Core Flood tank injection nozzles. The BWST recirculation crossover line through valves LP-40 and LP-41 may be part of a flow path if it provides adequate decay heat removal capability. The operability of the operating DHR loop and the supporting heat sink is dependent on the ability to maintain the desired RCS temperature. LPSW and ECCW are required to support the OPERABLE DHR train(s). One LPSW pump and one ECCW header can simultaneously support one or two DHR trains. Single failure protection is not required for LPSW or support systems in these modes.

To be considered OPERABLE DHR pumps must be capable of being powered and are able to provide flow if required. *Management of gas voids is important to DHR system OPERABILITY.*

### APPLICABILITY

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

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";

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.4.8.2 (continued)

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

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REFERENCES

1. Generic Letter 88-17, October 17, 1988.
  2. 10 CFR 50.36.
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INSERT Bases SR 3.4.8.3 (attached)

Oconee Units 1, 2, and 3

INSERT Bases SR 3.4.8.3

SR 3.4.8.3

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

Selection of DHR 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 DHR 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 it is determined by subsequent evaluation that the DHR 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

DHR 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 based on operating experience, equipment reliability, and plant risk and 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 (continued)

When a LPI-HPI flow path is inoperable due to the flow path's associated LPI train being inoperable for maintenance only, the piggyback line and associated components may also be inoperable for greater than 72-hours up to the associated LPI train's maximum allowed outage time of 7-days. For this scenario, any valve along the piggyback line flowpath can be used as an isolation boundary, with power removed as necessary, but no physical work is allowed to be performed on any component along the piggyback line flowpath without entering the applicable TS LCO condition.

This is allowed because with an associated LPI train inoperable, there is no water source for the LPI-HPI piggyback function. This support (LPI train) and supported (LPI-HPI piggyback) relationship is subject to the requirements of TS LCO 3.0.6.

During an event requiring HPI actuation, a flow path is provided to ensure an abundant supply of water from the BWST to the RCS via the HPI pumps and their respective discharge flow paths to each of the four cold leg injection nozzles and the reactor vessel. In the recirculation phase, this flow path is transferred from the control room to take its supply from the reactor building sump and to supply borated water to the RCS via the LPI-HPI flow path (piggy-back mode).

*Management of gas voids is important to HPI System OPERABILITY.*

The OPERABILITY of the HPI System must be maintained to ensure that no single active failure can disable both HPI trains. Additionally, while the HPI System was not designed to cope with passive failures, the HPI trains must be maintained independent to the extent possible during normal operation. The NRC approved exception to this principle is cross-connecting the HPI suction headers during normal operation (Ref. 6).

### APPLICABILITY

In MODES 1 and 2, and MODE 3 with RCS temperature > 350°F, the HPI System OPERABILITY requirements for the small break LOCA are based on analysis performed at 100% RTP. The HPI pump performance is based on the small break LOCA, which establishes the pump performance curve. Mode 2 and MODE 3 with RCS temperature > 350°F requirements are bounded by the MODE 1 analysis.

In MODE 3 with RCS temperature ≤ 350°F and in MODE 4, the probability of an event requiring HPI actuation is significantly lessened. In this operating condition, the low probability of an event requiring HPI actuation and the LCO 3.5.3 requirements for the LPI System provide reasonable assurance that the safety injection function is preserved.

In MODES 5 and 6, unit conditions are such that the probability of an event requiring HPI injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops – MODE 5, Loops



BASES

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SURVEILLANCE  
REQUIREMENTSSR 3.5.2.1

Verifying the correct alignment for manual and non-automatic power operated valves in the HPI flow paths provides assurance that the proper flow paths will exist for HPI operation. This SR does apply to the HPI suction header cross-connect valves, the HPI discharge cross-connect valves, the HPI discharge crossover valves, and the LPI-HPI flow path discharge valves (LP-15 and LP-16). 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. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

*INSERT Bases SR 3.5.2.1 (new paragraph) (attached)*

SR 3.5.2.2

With the exception of the HPI pump operating to provide normal makeup, the other two HPI pumps are normally in a standby, non-operating mode. As such, the emergency injection flow path piping has the potential to develop voids and pockets of entrained gases. Venting the HPI pump casings periodically reduces the potential that such voids and pockets of entrained gases can adversely affect operation of the HPI System. This will also reduce the potential for water hammer, pump cavitation, and pumping of noncondensable gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an ESPS signal. This Surveillance is modified by a Note that indicates it is not applicable to operating HPI pump(s) providing normal makeup. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

*INSERT Bases SR 3.5.2.2 (attached)*

SR 3.5.2.3

Periodic surveillance testing of HPI pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code (Ref. 5). SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code.

INSERT Bases SR 3.5.2.1

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.

INSERT Bases SR 3.5.2.2

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

Selection of HPI 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 HPI 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 it is determined by subsequent evaluation that the HPI 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

HPI 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Surveillance Frequency may vary by location susceptible to gas accumulation.

## BASES (continued)

### LCO

In MODES 1, 2, and 3, two independent (and redundant) LPI trains are required to ensure that at least one LPI train is available, assuming a single failure in the other train. Additionally, individual components within the LPI trains may be called upon to mitigate the consequences of other transients and accidents. Each LPI train includes the piping, instruments, pumps, valves, heat exchangers and controls to ensure an OPERABLE flow path capable of taking suction from the BWST upon an ES signal and the capability to manually (remotely) transfer suction to the reactor building sump. The safety grade flow indicator of an LPI train is required to support OPERABILITY of the LPI and RBS trains to preclude NPSH or runout problems. RBS flow is hydraulically maintained by system resistance, and throttling of RBS flow is not required. Therefore, RBS flow indication is not required to support LPI or RBS train OPERABILITY. The safety grade flow indicator associated with LPSW flow to an LPI cooler is required to be OPERABLE to support LPI train OPERABILITY.

LPI BWST Suction Valves, LP-21 and LP-22 do not have an ES signal to open. These valves shall be open when automatic initiation of the LPI and the RBS system is required to be OPERABLE. If either one is closed during this time, the associated LPI and RBS train is inoperable.

In MODE 4, one of the two LPI trains is required to ensure sufficient LPI flow is available to the core.

During an event requiring LPI injection, a flow path is required to provide an abundant supply of water from the BWST to the RCS, via the LPI pumps and their respective supply headers, to the reactor vessel. In the long term, this flow path may be switched to take its supply from the reactor building sump. <sup>4</sup>

This LCO is modified by three Notes. Note 1 changes the LCO requirement when in MODE 4 for the number of OPERABLE trains from two to one. Note 2 allows an LPI train to be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually (remotely) realigned to the LPI mode of operation. This provision is necessary because of the dual requirements of the components that comprise the LPI and decay heat removal modes of the LPI System. Note 3 requires the LPI discharge header crossover valves inside containment to be open in MODES 1, 2, and 3. If one of these valves is closed, then the system will be unable to sustain a single failure.

*Management of gas voids is important to LPI System OPERABILITY.*

## BASES

### ACTIONS

#### D.2 (continued)

Required Action D.2 requires that the unit be placed in MODE 5 within 24 hours. This Required Action is modified by a Note that states that the Required Action is only required to be performed if a DHR loop is OPERABLE. This Required Action provides for those circumstances where the LPI trains may be inoperable but otherwise capable of providing the necessary decay heat removal. Under this circumstance, the prudent action is to remove the unit from the Applicability of the LCO and place the unit in a stable condition in MODE 5. The Completion Time of 24 hours is reasonable, based on operating experience, to reach MODE 5 in an orderly manner and without challenging unit systems.

### SURVEILLANCE REQUIREMENTS

#### SR 3.5.3.1

Verifying the correct alignment for manual and non-automatic power operated valves in the LPI flow paths provides assurance that the proper flow paths will exist for LPI 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. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. 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 based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

When in MODE 4 an LPI train may be considered OPERABLE during alignment, when aligned or when operating for decay heat removal if capable of being manually realigned to the LPI mode of operation.

Therefore, for this condition, the SR verifies that LPI is capable of being manually realigned to the LPI mode of operation.

*INSERT Bases SR 3.5.3.1 (new paragraph) (attached)*

#### SR 3.5.3.2

With the exception of systems in operation, the LPI pumps are normally in a standby, non-operating mode. As such, the flow path piping has the potential to develop voids and pockets of entrained gases. Venting the LPI pump casings periodically reduces the potential that such voids and pockets of entrained gases can adversely affect operation of the LPI System. This will also minimize the potential for water hammer, pump

*INSERT Bases SR 3.5.3.2 (attached)*

## BASES

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### SURVEILLANCE REQUIREMENTS

#### SR 3.5.3.2 (continued)

cavitation, and pumping of noncondensable gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an ESPS signal or during shutdown cooling. This Surveillance is modified by a Note that indicates it is not applicable to operating LPI pump(s). The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

#### SR 3.5.3.3

Periodic surveillance testing of LPI pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code (Ref. 6). SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code.

#### SR 3.5.3.4 and SR 3.5.3.5

These SRs demonstrate that each automatic LPI valve actuates to the required position on an actual or simulated ESPS signal and that each LPI pump starts on receipt of an actual or simulated ESPS signal. This SR is not required for valves that are locked, sealed, or otherwise secured in position under administrative controls. The test will be considered satisfactory if control board indication verifies that all components have responded to the ESPS actuation signal properly (all appropriate ESPS actuated pump breakers have opened or closed and all ESPS actuated valves have completed their travel). The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The actuation logic is tested as part of the ESPS testing, and equipment performance is monitored as part of the Inservice Testing Program.



Oconee Units 1, 2, and 3

#### INSERT Bases SR 3.5.3.1

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.

#### INSERT Bases SR 3.5.3.2

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

Selection of LPI 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 LPI 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 it is determined by subsequent evaluation that the LPI 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. If the accumulated gas is eliminated or brought within the acceptance criteria limits as part of the Surveillance performance, the Surveillance is considered met and the system is OPERABLE. Past operability is then evaluated under the Corrective Action program. If it is suspected that a gas intrusion event is occurring, then this is evaluated under the Operability Determination Process.

LPI 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 based on operating experience, equipment reliability, and plant risk and 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 (continued)

Each reactor building spray train shall include a spray pump, spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the BWST (via the LPI System) upon an Engineered Safeguards Protective System signal and manually transferring suction to the reactor building sump. The OPERABILITY of RBS train flow instrumentation is not required for OPERABILITY of the corresponding RBS train because system resistance hydraulically maintains adequate NPSH to the RBS pumps and manual throttling of RBS flow is not required. During an event, LPI train flow must be monitored and controlled to support the RBS train pumps to ensure that the NPSH requirements for the RBS pumps are not exceeded. If the flow instrumentation or the capability to control the flow in a LPI train is unavailable then the associated RBS train's OPERABILITY is affected until such time as the LPI train is restored or the associated LPI pump is placed in a secured state to prevent actuation during an event.

Each reactor building cooling train shall include cooling coils, fusible dropout plates or duct openings, an axial vane flow fan, instruments, valves, and controls to ensure an OPERABLE flow path. Two headers of the LPSW RB Waterhammer Prevention Discharge Isolation Valves are required to support flowpath OPERABILITY or one header of LPSW RB Waterhammer Prevention Discharge Isolation Valves shall be manually opened (remote or local) to prevent automatic closure. Valve LPSW-108 shall be locked open to support system OPERABILITY.

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### APPLICABILITY

In MODES 1, 2, 3, and 4, an accident could cause a release of radioactive material to containment and an increase in containment pressure and temperature, requiring the operation of the reactor building spray trains and reactor building 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 Reactor Building Spray System and the Reactor Building Cooling System are not required to be OPERABLE in MODES 5 and 6.

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### ACTIONS

The Actions are modified by a Note indicating that the provisions of LCO 3.0.4 do not apply for Unit 2 only. As a result, this allows 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, consideration of the results, determination of the acceptability of entering the MODE or other specified condition in the Applicability, and

*Management of gas voids is important to RBS OPERABILITY.*

## BASES

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### ACTIONS

#### G.1 (continued)

conditions from full power conditions in an orderly manner and without challenging unit systems.

#### H.1

With two reactor building spray trains, two reactor building cooling trains or any combination of three or more reactor building spray and reactor building cooling trains inoperable in MODE 1 or 2, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

With any combination of two or more required reactor building spray and reactor building cooling trains inoperable in MODE 3 or 4, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

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### SURVEILLANCE REQUIREMENTS

#### SR 3.6.5.1

Verifying the correct alignment for manual and non-automatic power operated valves in the reactor building spray and cooling flow path provides assurance that the proper flow paths will exist for Reactor Building Spray and Cooling 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. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown, 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.

INSERT Bases SR 3.6.5.1 (new paragraph)(attached)

Oconee Units 1, 2, and 3

INSERT Bases SR 3.6.5.1

The Surveillance is modified by a second Note which exempts reactor building spray 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

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SURVEILLANCE  
REQUIREMENTS  
(continued)

SR 3.6.5.5 and 3.6.5.6

These SRs require verification that each automatic reactor building spray and cooling valve actuates to its correct position and that each reactor building spray pump starts upon receipt of an actual or simulated actuation signal. The test will be considered satisfactory if visual observation and control board indication verifies that all components have responded to the actuation signal properly; the appropriate pump breakers have closed, and all valves have completed their travel. This SR is not required for valves that are locked, sealed, or otherwise secured in position under administrative controls. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

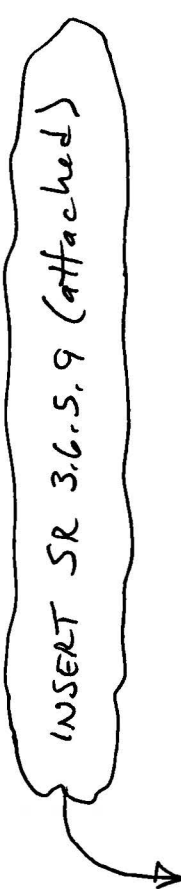
SR 3.6.5.7

This SR requires verification that each required reactor building cooling train actuates upon receipt of an actual or simulated actuation signal. The test will be considered satisfactory if control board indication verifies that all components have responded to the actuation signal properly, the appropriate valves have completed their travel, and fans are running at half speed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.6.5.8

With the reactor building spray header isolated and drained of any solution, station compressed air is introduced into the spray headers. This SR requires verification that each spray nozzle is unobstructed following activities which could cause nozzle blockage. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

INSERT SR 3.6.5.9 (attached)



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REFERENCES

1. UFSAR, Section 3.1.
2. UFSAR, Section 6.2.
3. 10 CFR 50.36.
4. ASME, Boiler and Pressure Vessel Code, Section XI.