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December 12, 2013

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

Attention: Mr. Perry Buckberg

Docket No. 52-021
MHI Ref: UAP-HF-13280

Subject: MHI's Supplemental Response to US-APWR DCD RAI No.669-5219 Revision 2 (SRP 19)

References:
1) "Request for Additional Information No.669-5219 Revision 2, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19," dated November 29, 2010.
2) Letter MHI Ref: UAP-HF-10345 from Y. Ogata to U.S. NRC "MHI's Responses to US-APWR DCD RAI No. 669-5219 Revision 2 (SRP 19.0)", dated December 27, 2010.
3) Letter MHI Ref: UAP-HF-12023 from Y. Ogata to U.S. NRC "Revised Responses to US-APWR DCD RAI No. 669-5219 Revision 2 (SRP 19.0)", dated February 8, 2012.
4) Letter MHI Ref: UAP-HF-13129 from Y. Ogata to U.S. NRC "MHI's Second Revised Response to US-APWR DCD RAI No.669-5219 Revision 2 (SRP 19)", dated June 13, 2013.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") the document entitled "Supplemental Response to Request for Additional Information No.669-5219 Revision 2, Question 19-494".

Enclosed is the supplemental response to one RAI question contained within Reference 1. This question was responded to previously in References 2, 3, and 4. The response is supplemented to reflect discussion with the NRC in the conference call held on August 8, 2013.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Executive Vice President
Mitsubishi Nuclear Energy Systems, Inc.
On behalf of Mitsubishi Heavy Industries, LTD.

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NRO

Enclosure:

1. Supplemental Response to Request for Additional Information No.669-5219 Revision 2, Question 19-494

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Enclosure 1

UAP-HF-13280
Docket Number 52-021

Supplemental Response to Request for Additional Information
No.669-5219 Revision 2, Question 19-494

December 2013

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/12/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI No.:	**No. 669-5219 Revision 2**
SRP Section:	**19 – PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION**
Application Section:	**19**
Date of RAI Issue:	**11/29/2010**

QUESTION NO. : 19-494

The staff has reviewed MHI's response to RAI 19-442. Based on the US-APWR shutdown risk results on page 19.1-146 of the DCD, the shutdown CDF equals the shutdown LRF frequency. No credit was given for containment closure in the risk assessment. In their response to RAI 19-442, MHI reported that the USAPWR shutdown CDF removing all equipment not required by TS to be 2.1E-5 per reactor year. This result means that the LRF removing all equipment not required by Technical Specifications (TS) to be 2.1E-5 per reactor year which exceeds the Commission's safety goals for new reactors. The staff concludes that voluntary initiatives must be implemented by the COL applicant for the USAPWR design to meet the Commission's safety goals. The staff is requesting MHI to consider adding shutdown TS in accordance with Criterion 4 of 10CFR50.36 (c)(2)(ii) so that this design meets the Commission's safety goals for new reactors without voluntary initiatives or justify in the DCD why these actions are not necessary.

ANSWER:

MHI provided a revised response to this RAI in letter UAP-HF-12023, dated 2/8/2012 (ML 12041A037) and in letter UAP-HF-13129, dated 6/13/2013 (ML 13168A003). This response provides supplemental information.

Subsequent to the MHI 6/13/2013 RAI response, NRC and MHI discussed additional Technical Specification changes to address containment closure requirements on a conference call on 8/8/2013. To address these comments, MHI will revise DCD Technical Specification LCOs 3.4.8 and 3.9.6, as well as incorporate a new LCO 3.6.7, "Containment Penetrations – Shutdown with RCS in Reduced Inventory." Accompanying changes will also be made to DCD Chapter 19 Table 19.1-119.

Impact on DCD

Chapter 16: TS LCOs 3.4.8 and 3.9.6 (and the associated Bases) will be revised, as shown in Attachment 1. A new LCO 3.6.7 (and the associated Bases) is also provided in Attachment 1.

Chapter 19: Table 19.1-119 sheets 35 - 38 will be revised, as shown in Attachment 2.

Impact on R-COLA

Part 2 FSAR: Chapter 19 Table 19.1-119R will need to be revised to be consistent with the DCD markup (Attachment 2).

Part 4 Technical Specifications: TS LCOs 3.4.8 and 3.9.6 (and the associated Bases) will need to be revised, and LCO 3.6.7 (and the associated Bases) will need to be added to be consistent with the DCD markup (Attachment 1).

Impact on PRA

There is no impact on the PRA.

Impact on Technical / Topical Reports

There is no impact on the Technical / Topical Reports.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.8 RCS Loops - MODE 5, Loops Not Filled

LCO 3.4.8 Three residual heat removal (RHR) loops shall be OPERABLE and two RHR loops shall be in operation, and low-pressure letdown line isolation valve shall be OPERABLE, and all sources of unborated water shall be isolated, with:

a. One OPERABLE safety injection (SI) pump, and

b. Required injection water volume from OPERABLE RWSP ~~and refueling cavity~~. DCD_19-494 S03

---NOTES---

1. ~~One~~All CS/RHR pumps may be removed from operation for ≤ 15 minutes when switching from one loop to another provided: DCD_19-494 S03

   a. The core outlet temperature is maintained > 10°F below saturation temperature,

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

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

2. One required RHR loop may be inoperable for ≤ 2 hours for surveillance testing, provided that the other two required RHR loops are OPERABLE and in operation. DCD_19-494 S03

3. Except as prohibited in Note 1 above, an isolation valve for an unborated water source may be opened when in a planned dilution or makeup activity.

APPLICABILITY: MODE 5 with RCS loops not filled.

ACTIONS

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

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One low-pressure letdown isolation valve inoperable.	B.1 Initiate action to restore low-pressure letdown line isolation valve to OPERABLE status.	Immediately
C. Less than two required RHR loops OPERABLE. OR Less than two ~~R~~required RHR loops in operation.	C.1 Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet SDM of LCO 3.1.1. AND C.2 Initiate action to restore two RHR loops to OPERABLE status and operation.	Immediately Immediately
D. -----------NOTE----------- Separate Condition entry is allowed for each unborated water source isolation valve. ---------------------------- -----------NOTE----------- Required Action D.2 must be completed whenever Condition D is entered. ---------------------------- One or more isolation valves for an unborated water source not secured in closed position.	D.1 Initiate actions to secure valve in closed position. AND D.2 Perform SR 3.1.1.1 (SDM verification)	Immediately 4 hours

DCD_19-494 S03

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
E. No SI pump is OPERABLE. OR RWSP ~~and refueling cavity~~ water volume is not within limits. OR RWSP boron concentration is not within limits.	E.1 Initiate action to restore OPERABILITY of SI pump.	Immediately	
	AND		
	E.2 Initiate actions to suspend activities that may cause a reduction in RCS water volume.	Immediately	DCD_19-494 S03
	AND		
	E.3 Initiate actions to restore RWSP ~~and refueling cavity~~ water volume to within limits.	Immediately	DCD_19-494 S03
	AND		
	E.4 Initiate actions to restore RWSP boron concentration to within limits.	Immediately	
F. No RHR loop is in operation.	F.1 Close the equipment hatch and secure with [four] bolts.	~~4 hours~~Prior to the onset of steaming into containment	DCD_19-494 S03
	AND		
	F.2 Close one door in each air lock.	~~4 hours~~Prior to the onset of steaming into containment	DCD_19-494 S03
	AND		
	F.3.1 Close each penetration providing direct access from the containment atmosphere to the outside atmosphere with a manual or automatic isolation valve, blind flange, or equivalent. OR	~~4 hours~~Prior to the onset of steaming into containment	
	F.3.2 Verify each penetration is capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.	~~4 hours~~Prior to the onset of steaming into containment	DCD_19-494 S03

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.8.4	------------------------------NOTE------------------------- Not required to be performed unless no RCPs are in operation. --- Verify each valve that isolates unborated water sources is secured in the closed position.	[7 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.4.8.5	Verify RHR loop locations susceptible to gas accumulation are sufficiently filled with water.	[31 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.4.8.6	Verify the RWSP borated water volume ~~(including water available in the refueling cavity)~~ is $\geq$ 79,920 ft^3 (597,800 gallons).	[7 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.4.8.7	Verify that the RWSP boron concentration is $\geq$ 4000 ppm and $\leq$ 4200 ppm.	[7 days OR In accordance with the Surveillance Frequency Control Program]

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3.6 CONTAINMENT SYSTEMS

3.6.7 Containment Penetrations – Shutdown with RCS in Reduced Inventory

LCO 3.6.7 The containment penetrations shall be in the following status:

a. The equipment hatch closed and held in place by [four] bolts or, if open, clear of obstructions such that the hatches can be closed prior to steaming into the containment.

b. One door in each air lock closed or, if open, the containment air locks shall be clear of obstructions such that they can be closed prior to steaming into the containment.

c. The containment spare penetrations, if open, shall be clear of obstructions such that the penetrations can be closed prior to steaming into the containment.

d. Each penetration providing direct access from the containment atmosphere to the outside atmosphere shall be either:

1. Closed by a single manual or automatic isolation valve, blind flange, or equivalent,

2. Capable of being closed by a single isolation valve via a manually initiated containment isolation signal or remote manual isolation valve actuation, or

3. Capable of being closed by installation of a blind flange or equivalent prior to steaming into containment.

APPLICABILITY: MODE 5 with the reactor coolant system (RCS) loops not filled; and MODE 6 with the water level < 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Restore containment penetrations to required status.	1 hour

ACTIONS (continued) DCD_19-494 S03

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met. OR LCO not met for reasons other than Condition A.	B.1.1 If in MODE 5, initiate action to be in MODE 5 with the RCS loops filled. OR B.1.2 If in MODE 6, initiate action to be in MODE 6 with the water level ≥ 23 feet above the top of the reactor vessel flange. AND B.2 Suspend positive reactivity additions.	Immediately Immediately Immediately

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S03

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify each required containment penetration is in the required status.	[7 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.6.7.2	---------------------------NOTE------------------------ Only required to be met for an open equipment hatch. --- Verify that the hardware, tools, equipment and power source necessary to install the equipment hatch are available.	Prior to hatch removal AND [7 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.6.7.3	---------------------------NOTE------------------------ Not required to be met for isolation valve(s) in penetrations that comply with LCO 3.6.7.d.1 or 3.6.7.d.3. --- Verify one isolation valve in each open penetration providing direct access from the containment atmosphere to the outside atmosphere actuates to the isolation position on a manually initiated containment isolation signal, or from remote manual actuation.	[24 months OR In accordance with the Surveillance Frequency Control Program]

3.9 REFUELING OPERATIONS

3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level

LCO 3.9.6 Three RHR loops shall be OPERABLE, and two RHR loops shall be in operation, and low-pressure letdown line isolation valve shall be OPERABLE, with:

a. One OPERABLE safety injection (SI) pump, and

b. Required injection water volume from OPERABLE RWSP and refueling cavity.

--NOTES--

1. All CS/RHR pumps may be removed from operation for ≤ 15 minutes when switching from one train to another provided:

   a. The core outlet temperature is maintained > 10° ~~degrees~~ F below saturation temperature, DCD_19-494 S03

   b. No operations are permitted that would cause introduction of coolant into the Reactor Coolant System (RCS) with boron concentration less than that required to meet the minimum required boron concentration of LCO 3.9.1, and

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

2. One required RHR loop may be inoperable for ~~up to~~≤ 2 hours for surveillance testing, provided that the other two required RHR loops are OPERABLE and in operation. DCD_19-494 S03

APPLICABILITY: MODE 6 with the water level < 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Less than the required number of RHR loops OPERABLE.	A.1 Initiate action to restore required RHR loops to OPERABLE status. <u>OR</u>	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
	A.2	Initiate action to establish ≥ 23 ft of water above the top of reactor vessel flange.	Immediately
B. One low-pressure letdown isolation valve inoperable.	B.1	Initiate action to restore low-pressure letdown line isolation valve to OPERABLE status.	Immediately
C. No RHR loop in operation.	C.1	Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet the boron concentration of LCO 3.9.1.	Immediately
	AND		
	C.2	Initiate action to restore two RHR loops to operation.	Immediately
	AND		
	C.3	Close equipment hatch and secure with [four] bolts.	~~4 hours~~Prior to the onset of steaming into containment DCD_19-494 S03
	AND		
	C.4	Close one door in each air lock.	~~4 hours~~Prior to the onset of steaming into containment DCD_19-494 S03
	AND		

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	C.5.1 Close each penetrations providing direct access from the containment atmosphere to the outside atmosphere with a manual or automatic isolation valve, blind flange, or equivalent.	~~4 hours~~Prior to the onset of steaming into containment DCD_19-494 S03
	OR	
	C.5.2 Verify each penetration is capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.	~~4 hours~~Prior to the onset of steaming into containment DCD_19-494 S03
D. No SI pump is OPERABLE. OR RWSP and refueling cavity water volume is not within limits. OR RWSP boron concentration is not within limits.	D.1 Initiate action to restore OPERABILITY of SI pump.	Immediately
	AND	
	D.2 Initiate actions to suspend activities that may cause a reduction in RCS water volume.	Immediately
	AND	
	D.3 Initiate actions to restore RWSP and refueling cavity water volume to within limits.	Immediately
	AND	
	D.4 Initiate actions to restore RWSP boron concentration to within limits.	Immediately

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.8 RCS Loops - MODE 5, Loops Not Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops not filled, the primary function of the reactor coolant is the removal of decay heat generated in the fuel, and the transfer of this heat to the component cooling water via the containment spray/residual heat removal (CS/RHR) heat exchangers. The steam generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the reactor coolant is to act as a carrier for the soluble neutron poison, boric acid.

In MODE 5 with the RCS loops not filled, only CS/RHR pumps can be used for coolant circulation. The number of pumps in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least two CS/RHR pumps for decay heat removal and transport and to require that three paths be available to provide redundancy for heat removal.

The CS/RHR pumps do not provide sufficient circulation of water through the RCS to ensure that the concentration of soluble boron in the reactor coolant is homogeneous. Therefore, all isolation valves for reactor makeup water sources containing unborated water that are connected to the RCS must be secured closed to prevent unplanned boron dilution of the reactor coolant.

In MODE 5 with the RCS loops not filled, low-pressure letdown line isolation valves are automatically closed upon detection of RCS loop low level signal to prevent loss of RCS inventory. The function is effective to prevent core damage during plant shutdown, based on probabilistic risk assessment. DCD_19-494 S03

In Mode 5 with the RCS loops not filled, one additional source of injection water (beyond a CS/RHR pump) will reduce the calculated core damage frequency. One safety injection (SI) pump can provide this injection source. A water source is also required. DCD_19-494 S03

The Safeguards Component Area HVAC System is a support system that provides temperature control for the CS/RHR Pump Room and CS/RHR Heat Exchanger Room, and includes electric heating coils, cooling coils, fans, ductwork, dampers, and instrumentation and controls necessary to perform the support function. The Essential Chilled Water System is a support system and provides chilled water to the air handling unit cooling coil. The Essential Service Water System supports operation of the essential chiller. For each RHR loop required to be OPERABLE, the associated train of Safeguards Component Area HVAC System, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, or available to operate on demand, and capable of performing its related support function.

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The flow provided by two RHR loops is adequate for heat removal. The prevention of an accidental boron dilution event is ensured by requiring that all sources of unborated water be isolated from the RCS when RCS circulation is not provided by at least one operating RCP.

The need for one SI pump is based on the PRA insight that maintaining at least one RCS injection function operable results in a reduction in core damage risk during shutdown conditions (Mode 5) with the RCS partially filled. DCD_19-494 S03

RCS loops in MODE 5 (loops not filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

~~The need for one SI pump is based on the PRA insight that maintaining at least one RCS injection function operable results in a reduction in core damage risk during shutdown conditions (Mode 5) with the RCS partially filled.~~ DCD_19-494 S03

LCO

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

Additionally, this LCO requires that all sources of unborated water be isolated from the RCS to prevent an inadvertent boron dilution event in MODE 5. However, planned dilution and makeup operations are sometimes required during MODE 5 to compensate for transient conditions which result in a continuous change in the RCS mass (see discussion of Note 3 below).

The LCO requires the low-pressure letdown line isolation valves to be OPERABLE to mitigate the effects associated with loss of RCS inventory.

The LCO also requires that one SI pump be OPERABLE such that in response to a manual operator start the pump can provide sufficient water to mitigate a drain-down event while in Mode 5 with the RCS partially filled. The LCO requires that a source of water (i.e., reactor water storage pit (RWSP) ~~and water available from the refueling cavity~~) be available and contain the necessary volume of water. The capability to provide injection water is important to achieve defense-in-depth during Mode 5 with the RCS partially filled. The ability of the pump to provide flow to the RCS while partially filled DCD_19-494 S03

BASES

LCO (continued)

(and at near atmospheric pressure) and have electrical power are the criteria necessary to be OPERABLE in Mode 5. No pump automatic start features are required to be OPERABLE in Mode 5 as these capabilities were not credited in the PRA.

Note 1 permits ~~one~~the CS/RHR pumps to be removed from operation for ≤ 15 minutes when switching from one loop to another. The circumstances for stopping ~~one~~ CS/RHR pumps ~~is~~are to be limited to situations when the outage time is short and core outlet temperature is maintained > 10°F below saturation temperature. The Note prohibits boron dilution with coolant at boron concentrations less than required to assure SDM of LCO 3.1.1 is maintained or draining operations when RHR forced flow is stopped. DCD_19-494 S03 DCD_19-494 S03

Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours, provided that the other two required loops are 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 permits the opening of isolation valves for unborated water sources for when in a planned and procedurally controlled dilution or makeup activity provided that this activity is not prohibited by Note 1. Planned dilution and makeup operations are sometimes required to compensate for transient conditions which result in a continuous change in the RCS mass. Procedures should minimize to the extent practicable the time unborated water sources are not isolated during the conduct of these operations. Once such an operation is complete the exception no longer applies and action to close the valves must be initiated immediately. It is expected that any unborated water isolation valve used in the planned activity will be secured in the closed position within 15 minutes following the planned activity.

An OPERABLE RHR loop is comprised of an OPERABLE CS/RHR pump capable of providing forced flow to an OPERABLE CS/RHR heat exchanger. CS/RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. Management of gas voids is important to RHR System OPERABILITY.

BASES

ACTIONS (continued)

E.1, E.2, E.3, E.4

In the event that no SI pump is available to inject water into the RCS, the RWSP does not contain sufficient water volume (SR 3.4.8.6), or boron concentration is not within limits (SR 3.4.8.7) to mitigate a RCS drain-down event in Mode 5 while the RCS is partially filled, then actions must be initiated immediately to restore this capability. The PRA indicates that the availability of an injection water source reduces the core damage frequency. Additionally, until such capability is restored, any activity that could result in lowering RCS water volume must be suspended. The immediate ~~COMPLETION TIME~~Completion Time reflects the importance of maintaining water injection capability while the RCS is in a partially filled condition. DCD_19-494 S03

F.1, F.2, F.3.1 and F.3.2

If no RHR loop is in operation, the following actions must be taken:

a. The equipment hatch must be closed and secured with [four] bolts,

b. One door in each air lock must be closed, and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere must be either closed by a manual or automatic isolation valve, blind flange, or equivalent, or verified to be capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.

With RHR loop requirements not met, the potential exists during an RCS drain down event for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions stated above ensures that all containment penetrations are either closed or can be closed ~~so that the dose limits are not exceeded. The Completion Time of 4 hours allows fixing of most CS/RHR pumps problems and is reasonable, based on the availability of the standby RHR loop and one SI train for injection water, and on the low probability of the coolant boiling in that time~~to reduce the risk of a significant radiological release. DCD_19-494 S03

BASES

ACTIONS (continued)

In MODE 5 while the RCS is in reduced inventory, RCS heatup and direct venting could result in steaming into the containment if normal shutdown cooling is no longer available and (1) backup cooling from the refueling water storage pit (RWSP) via the backup containment spray/residual heat removal (CS/RHR) pump or safety injection (SI) pump operating in the injection mode becomes less effective over the long term as RWSP water heats up or (2) no injection flow is available. In response to such an event the equipment hatch, air locks and penetrations must be closed prior to steaming into containment. In MODE 5, the potential for containment pressurization as a result of an accident is not likely; therefore, requirements to isolate the containment from the outside atmosphere can be less stringent. Therefore, containment does not need to be leak tight as required for MODES 1 through 4. Since there is no requirement for containment leak tightness, compliance with the Appendix J leakage criteria and tests is not required. DCD_19-494 S03

The Completion Time for this Action would be calculated prior to entering into the applicable conditions for the two sets of plant conditions (i.e., backup injection flow available and no injection flow available). The time from loss of normal cooling until steam release to the containment is dependent on various plant parameters (RCS temperature, RWSP temperature, etc.), plant configuration (RCS pressure boundary intact, RCS open, backup injection flow available, etc.), and the time after shutdown. In determining the minimum time to steaming, core decay heat, RCS configuration, and initial RCS inventory are used to calculate the time to steaming. The time to close the penetrations before steaming to containment includes time for the diagnosis and decision-making time, in addition to the time required to physically complete the closure action.

The assumptions used in determining the required closure time for the various containment openings should be consistent with the plant operating procedures, staffing levels, and status of the containment openings. The evaluation should consider the ability to close the containment for the limiting loss of shutdown cooling event, and considering the possibility of a station blackout.

Containment will need to be closed prior to entry into the applicable mode if the time permitted for containment closure is shorter than the time to diagnose, make a decision that closure is needed following an event, and complete the closure actions. The time needed to close containment for the reduced RCS inventory period should be evaluated prior to the beginning of each new entry into this condition since decay heat varies with the time after shutdown and the effect of the partial core replacement with new fuel.

BASES

ACTIONS (continued)

The containment equipment hatch, if required to be closed, must be held in place by at least [four] bolts. Good engineering practice dictates that bolts required by this Required Action be approximately equally spaced. DCD_19-494 S03

Containment penetrations, including purge system flow paths, that provide direct access from containment atmosphere to outside atmosphere must be isolated or capable of being isolated. Isolation may be achieved by a single automatic isolation valve, or by a single manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary barrier for the containment penetrations. The equivalent isolation barrier must be capable of maintaining containment closure at the containment design pressure of 68 psig (Ref. 1).

SURVEILLANCE REQUIREMENTS

SR 3.4.8.1

This SR requires verification every 12 hours that the required loops are in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. [The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RHR loop performance. OR 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 each required CS/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 each required pump. Alternatively, verification that a CS/RHR pump is in operation also verifies proper breaker alignment and power availability. [The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

SURVEILLANCE REQUIREMENTS (continued)

[The 31 day Frequency takes into consideration the gradual nature of gas accumulation in the RHR System piping and the procedural controls governing system operation.

OR

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

SR 3.4.8.6

Verification that the RWSP contains a borated water volume ~~(including water available in the refueling cavity)~~ ≥ 79,920 ft^3 (597,800 gallons) ensures that the pump will have a sufficient inventory of water to mitigate the Mode 5 RCS drain-down event assumed in the probabilistic risk assessment (PRA). [Since the RWSP volume ~~(including the water available in the refueling cavity)~~ is normally stable, is protected by an alarm, and in view of other administrative controls available, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.] DCD_19-494 S03

SR 3.4.8.7

The boron concentration of the RWSP should be verified to be within the required limits. This SR ensures that the reactor will remain subcritical following a RCS drain down event. [Since the RWSP volume ~~(including the water available in the refueling cavity)~~ is normally stable, a 7 day sampling Frequency to verify boron concentration is appropriate and has been shown to be acceptable through operating experience. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.] DCD_19-494 S03

BASES

SURVEILLANCE REQUIREMENTS (continued)

OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.] DCD_16-305

SR 3.4.8.11

SR 3.4.8.11 is the performance of a MIC for the low pressure letdown isolation instrumentation in the same manner as SR 3.3.1.6.

[The Frequency of 24 months is based on engineering judgment, taking into consideration the conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle length. This equipment is not at risk of imminent damage as it is designed to remain functional and in good condition while in operation, thus significant degradation due to a longer surveillance interval should not be of major concern. The design reliability is, therefore, maintained by taking these considerations into account based on sound engineering judgment. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

SR 3.4.8.12

SR 3.4.8.12 requires the performance of a CHANNEL CALIBRATION for each of the required reactor coolant system loop water level instrumentation channel in the same manner as SR 3.3.1.8.

[The Frequency of 24 months is based on engineering judgment, taking into consideration the conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle length. This equipment is not at risk of imminent damage as it is designed to remain functional and in good condition while in operation, thus significant degradation due to a longer surveillance interval should not be of major concern. The design reliability is, therefore, maintained by taking these considerations into account based on sound engineering judgment. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

REFERENCES ~~None.~~1. DCD Chapter 6 DCD_19-494 S03

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B 3.6 CONTAINMENT SYSTEMS

B 3.6.7 Containment Penetrations – RCS in Reduced Inventory

BASES

BACKGROUND

Containment closure capability is required during shutdown operations, with reduced reactor coolant system (RCS) inventory (i.e., MODE 5 with the RCS loops not filled or MODE 6 with the water level < 23 ft above the top of reactor vessel flange) when there is fuel inside the reactor vessel. Containment closure reduces the risk of significant radiological release in the event that there is a loss of residual heat removal (RHR) decay heat removal capability by ensuring that containment openings and penetrations are closed or can be closed prior to steaming into containment. In MODES 5 and 6, the potential for containment pressurization as a result of an accident is not likely; therefore, requirements to isolate the containment from the outside atmosphere can be less stringent. Therefore, containment does not need to be leak tight as required for MODES 1 through 4.

In MODES 5 and 6 while the RCS is in reduced inventory, the LCO requirements are referred to as "containment closure" rather than "containment OPERABILITY." Containment closure means that all potential leak paths are closed or capable of being closed. Since there is no requirement for containment leak tightness, compliance with the Appendix J leakage criteria and tests is not required.

In MODES 5 and 6 while the RCS is in reduced inventory, RCS heatup and direct venting could result in steaming into the containment if normal shutdown cooling is no longer available and (1) backup cooling from the refueling water storage pit (RWSP) via the backup containment spray/residual heat removal (CS/RHR) pump or safety injection (SI) pump operating in the injection mode becomes less effective over the long term as RWSP water heats up or (2) no injection flow is available. In response to such an event the equipment hatch, air locks and penetrations must be closed prior to steaming into containment.

The allowable closure times for the two sets of plant conditions (i.e., backup injection flow available and no injection flow available) would be calculated prior to entering into the applicable conditions. The time from loss of normal cooling until steam release to the containment is dependent on various plant parameters (RCS temperature, RWSP temperature, etc.), plant configuration (RCS pressure boundary intact, RCS open, backup injection flow available, etc.), and the time after shutdown. In determining the minimum time to steaming, core decay heat, RCS configuration, and initial RCS inventory are used to calculate the time to steaming.

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BASES

BACKGROUND (continued)

Time to steaming is dependent on the postulated RCS configuration (intact versus open), and is based on the response of the plant considering features such as the operation of the standby CS/RHR and SI pumps in the injection mode if necessary, status of the upper internals, status of refueling cavity, etc. The time to close the penetrations before steaming to containment includes time for the diagnosis and decision-making time, in addition to the time required to physically complete the closure action.

The assumptions used in determining the required closure time for the various containment openings should be consistent with the plant operating procedures, staffing levels, and status of the containment openings. The evaluation should consider the ability to close the containment for the limiting loss of shutdown cooling event, and considering the possibility of a station blackout.

Containment will need to be closed if the time permitted for containment closure is shorter than the time to diagnose, make a decision that closure is needed following an event, and complete the closure actions. The time needed to close containment for the reduced RCS inventory period should be evaluated prior to the beginning of each new entry into this condition since decay heat varies with the time after shutdown and the effect of the partial core replacement with new fuel.

The containment equipment hatch, which is part of the containment pressure boundary, provides a means for moving large equipment and components into and out of containment. If closed, the equipment hatch must be held in place by at least [four] bolts. Good engineering practice dictates that bolts required by this LCO be approximately equally spaced. Alternatively, if open, the equipment hatch can be installed using a dedicated set of hardware, tools and equipment. Large equipment and components may be moved through the hatch as long as they can be removed and the hatch closed prior to steaming into the containment.

The design of the equipment hatch is such that the [four] bolts would only be needed to support the hatch in place and provide adequate strength to support the hatch dead weight and associated loads. The hatch is installed on the inside containment and is held in place against a matching flange surface with mating bolt pattern by the bolts. Once the dead weight is supported, any pressure (greater than atmospheric) within containment will serve to exert closure force on the hatch toward the mating flange surface serving to reduce stresses on bolts. Therefore the determination of the number of bolts is limited to the quantity required to support the hatch itself and not related to any potential containment pressure.

BASES

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BACKGROUND (continued)

The containment air locks, which are also part of the containment pressure boundary, provide a means for personnel access during MODES 1, 2, 3, and 4 unit operation in accordance with LCO 3.6.2, "Containment Air Locks." Each air lock has a door at both ends. The doors are normally interlocked to prevent simultaneous opening when containment OPERABILITY is required. During periods of unit shutdown when containment closure is required, the door interlock mechanism may be disabled, allowing both doors of an air lock to remain open for extended periods when frequent containment entry is necessary. Temporary equipment connections (e.g., power or communications cables) are permitted as long as they can be removed to allow containment closure prior to steaming into the containment.

Containment spare penetrations which also provide a part of the containment boundary provide for temporary support services (electrical, I&C, air, and water supplies) during MODES 5 and 6. Each penetration is flanged and normally closed. During periods of plant shutdown, temporary support systems may be routed through the penetrations; temporary equipment connections (e.g., power or communications cables) are permitted as long as they can be removed to allow containment closure prior to steaming into the containment. The spare penetrations must be closed or, if open, capable of closure prior to steaming to containment.

Containment penetrations, including purge system flow paths, that provide direct access from containment atmosphere to outside atmosphere must be isolated or capable of being isolated. Isolation may be achieved by a single automatic isolation valve, or by a single manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary barrier for the containment penetrations. The equivalent isolation barrier must be capable of maintaining containment closure at the containment design pressure of 68 psig (Ref. 1).

APPLICABLE SAFETY ANALYSES

For postulated shutdown events in MODES 5 and 6, RCS heat removal is provided by either CS/RHR heat exchangers or RWSP water injection and recirculation using CS/RHR or SI pumps. Containment closure is required to reduce the risk of significant radiological release from containment in the event that there is a loss of RCS heat removal capability.

Containment closure is based on insights obtained from the PRA.

BASES

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LCO

This LCO reduces the risk of significant radiological release in the event that there is a loss of RHR decay heat removal capability by ensuring that containment openings and penetrations are closed or can be closed prior to steaming into containment. Penetrations closed in accordance with these requirements are not required to be leak tight.

The LCO requires any penetration providing direct access from the containment atmosphere to the outside atmosphere to be closed or capable of being closed prior to steaming into the containment. The equipment hatches may be open; however, the hatches shall be clear of obstructions such that capability to close the hatch within the required time period is maintained. The hardware, tools, equipment and power sources necessary to install the hatch shall be available when the hatch is open. Both doors in each containment air lock may be open; however, the air locks shall be clear of obstructions such that the capability to close at least one door within the required time period is maintained. Alternatively, one door in an air lock may be closed. Containment spare penetrations may be open; however, the penetrations shall be capable of being closed within the required time period. Direct access penetrations shall be closed by at least one manual or automatic isolation valve, blind flange or equivalent or capable of being closed by at least one valve actuated by a containment isolation signal or by remote manual actuation or by installation of a blind flange or equivalent prior to steaming into containment.

APPLICABILITY

The containment penetration requirements are applicable during reduced RCS inventory conditions in MODES 5 and 6. The capability to close containment is required to reduce the risk of significant radiological release from containment in the event that there is a loss of RCS heat removal capability.

In MODES 1, 2, 3, and 4, containment penetration requirements are addressed by LCO 3.6.1.

ACTIONS

A.1

If the containment equipment hatch, air locks, or any containment penetration that provides direct access from the containment atmosphere to the outside atmosphere is not in the required status, including the remote manual containment isolation function not capable of actuation when isolation valves are open, the penetration(s) must be restored to the required status within 1 hour.

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BASES

ACTIONS (continued)

B.1.1, B.1.2, and B.2

If Required Action A.1 is not completed within 1 hour or the LCO is not met for reasons other than Condition A, action must be taken to minimize the consequences of an accident.

In MODE 5, actions must be initiated, immediately, to be in MODE 5 with the RCS loops filled. In MODE 6, action must be initiated, immediately, to be in MODE 6 with the refueling cavity water level ≥ 23 feet above the top of the reactor vessel flange. Additionally, action to suspend positive reactivity additions is required to ensure that the SDM is maintained. Sources of positive reactivity addition include boron dilution, withdrawal of reactivity control assemblies, and excessive cooling of the RCS.

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1

This Surveillance demonstrates that each of the required containment penetrations is either closed or capable of being closed. As part of this demonstration, the Surveillance will verify that the valve operator for each valve not closed has motive power, which will ensure that each valve is capable of being closed by a manual containment isolation signal or a remote manual valve actuation. Open containment spare penetrations shall be verified capable of being closed prior to steaming to containment by removal of obstructions and installation of the flange or by other closure means which will limit the release of radionuclides from containment.

[The Surveillance interval of every 7 days is selected to ensure that the required penetration status is maintained during shutdown inspections, testing, and maintenance. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

SR 3.6.7.2

The equipment hatch is provided with a set of hardware, tools, equipment, and self-contained power source for moving the hatch from its storage location and installing it in the opening. The required set of hardware and tools shall be visually inspected to ensure that they can perform the required functions. The equipment and power source shall be inspected and/or operated as necessary to verify that the hatch can be installed. The power source shall be verified as containing sufficient energy to install the hatch from the storage location.

BASES

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SURVEILLANCE REQUIREMENTS (continued)

[The 7 day Frequency is adequate considering that the hardware, tools, equipment, and power sources are dedicated to the associated equipment hatch and not used for any other functions. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

The SR is modified by a Note which only requires that the surveillance be met for an open equipment hatch. If the equipment hatch is installed in position, then the availability of the means to install the hatch is not required.

SR 3.6.7.3

This Surveillance demonstrates that for each required containment penetration that is open at least one valve actuates to its isolation position on remote manual actuation or on a manual initiation of containment isolation system. [The 24 month Frequency maintains consistency with other similar valve testing requirements. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

The SR is modified by a Note stating that this Surveillance is not required to be met for valves in isolated penetrations or in penetrations that are capable of being closed by installation of a blind flange or equivalent prior to steaming into containment. The LCO provides the option to close penetrations in lieu of requiring remote actuation capability.

REFERENCES 1. DCD Chapter 6

B 3.9 REFUELING OPERATIONS

B 3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level

BASES

BACKGROUND

The purpose of the RHR System in MODE 6 is to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34, to provide mixing of borated coolant, and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the Containment Spray (CS)/RHR heat exchangers where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the CS/RHR heat exchanger(s) and the bypass lines. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

In MODE 6 Low Water Level, low-pressure letdown line isolation valves are automatically closed upon detection of RCS loop low-level signal to prevent loss of RCS inventory. The function is effective to prevent core damage during plant shutdown, based on probabilistic risk assessment. DCD_19-494 S03

In Mode 6 with low water level (<23 feet above the vessel flange), one additional source of injection water (beyond a CS/RHR pump) will reduce the calculated core damage frequency. One safety injection (SI) pump can provide this injection source. A water source is also required.

The Safeguards Component Area HVAC System is a support system that provides temperature control for the CS/RHR Pump Room and CS/RHR Heat Exchanger Room, and includes electric heating coils, cooling coils, fans, ductwork, dampers, and instrumentation and controls necessary to perform the support function. The Essential Chilled Water System is a support system and provides chilled water to the air handling unit cooling coil. The Essential Service Water System supports operation of the essential chiller. For each RHR loop required to be OPERABLE, the associated train of Safeguards Component Area HVAC System, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, or available to operate on demand, and capable of performing its related support function.

BASES

APPLICABLE SAFETY ANALYSES

While there is no explicit analysis assumptions for the decay heat removal function of the RHR System in MODE 6, if the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of refueling cavity water level. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant will eventually challenge the integrity of the fuel cladding, which is a fission product barrier. Three trains of the RHR System are required to be OPERABLE, and two trains in operation, in order to prevent this challenge.

The need for one SI pump is based on the PRA insight that maintaining at least one RCS injection function operable results in a reduction in core damage risk during shutdown conditions (Mode 6) with water level <23 feet above the top of the reactor vessel flange. DCD_19-494 S03

RHR and Coolant Circulation – Low Water Level satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

~~The need for one SI pump is based on the PRA insight that maintaining at least one RCS injection function operable results in a reduction in core damage risk during shutdown conditions (Mode 6) with water level <23 feet above the top of the reactor vessel flange.~~ DCD_19-494 S03

LCO

In MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, three RHR loops must be OPERABLE. Additionally, two loops of RHR must be in operation in order to provide:

a. Removal of decay heat,

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

c. Indication of reactor coolant temperature.

The LCO requires the low-pressure letdown line isolation valves to be OPERABLE to mitigate the effects associated with loss of RCS inventory.

The LCO also requires that one SI pump be OPERABLE such that in response to a manual operator start the pump can provide sufficient water to mitigate a drain-down event while in Mode 6 with water level <23 feet above the top of the reactor vessel flange. The LCO requires that a source of water (i.e., reactor water storage pit (RWSP) and water available from the refueling cavity) be available and contain the necessary volume of water. The capability to provide injection water is important to achieve defense-in-depth during Mode 6 with water level <23 feet above the top of the reactor vessel flange. The ability of the pump to provide flow to the RCS while partially filled

BASES

LCO (continued)

(and at near atmospheric pressure) and have electrical power are the criteria necessary to be OPERABLE in Mode 6. No pump automatic start features are required to be OPERABLE in Mode 6 as these capabilities were not credited in the PRA.

This LCO is modified by two Notes. Note 1 permits the CS/RHR pumps to be removed from operation for ≤ 15 minutes when switching from one train to another. The circumstances for stopping all CS/RHR pumps are to be limited to situations when the outage time is short and the core outlet temperature is maintained > 10° ~~derees~~ F below saturation temperature. The Note prohibits boron dilution or draining operations when RHR forced flow is stopped. DCD_19-494 S03

Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours provided the other two required loops are OPERABLE and in operation. Prior to declaring the loop inoperable, consideration should be given to the existing plant configuration. This consideration should include that the core time to boil is short, there is no draining operation to further reduce RCS water level and that the capability exists to inject borated water into the reactor vessel. This permits surveillance tests to be performed on the inoperable loop during a time when these tests are safe and possible. DCD_19-494 S03

An OPERABLE RHR loop consists of a CS/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. Management of gas voids is important to RHR System OPERABILITY.

All CS/RHR pumps may be aligned to the Refueling Water Storage Pit to support filling or draining the refueling cavity or for performance of required testing.

APPLICABILITY

Three RHR loops are required to be OPERABLE, and two RHR loops 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 and mixing of the borated coolant. Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS), and Section 3.5, Emergency Core Cooling Systems (ECCS). RHR loop requirements in MODE 6 with the water level ≥ 23 ft are located in LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level."

In MODE 6 Low Water Level, low-pressure letdown line isolation valves are automatically closed upon detection of RCS loop low-level signal to prevent loss of RCS inventory.

The function is effective to prevent core damage during plant shutdown, based on probabilistic risk assessment.

BASES

ACTIONS (continued)

C.3, C.4, C.5.1, and C.5.2

If no RHR is in operation, the following actions must be taken:

a. The equipment hatch must be closed and secured with [four] bolts,

b. One door in each air lock must be closed, and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere must be either closed by a manual or automatic isolation valve, blind flange, or equivalent, or verified to be capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.

With RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions stated above ensures that all containment penetrations are either closed or can be closed ~~so that the dose limits are not exceeded~~to reduce the risk of a significant radiological release. DCD_19-494 S03

~~The Completion Time of 4 hours allows fixing of most RHR problems and is reasonable, based on the availability of the standby RHR loop and one SI train for injection water, and on the low probability of the coolant boiling in that time.~~

In MODE 6 while the RCS is in reduced inventory, RCS heatup and direct venting could result in steaming into the containment if normal shutdown cooling is no longer available and (1) backup cooling from the refueling water storage pit (RWSP) via the backup containment spray/residual heat removal (CS/RHR) pump or safety injection (SI) pump operating in the injection mode becomes less effective over the long term as RWSP water heats up or (2) no injection flow is available. In response to such an event the equipment hatch, air locks and penetrations must be closed prior to steaming into containment. In MODE 6, the potential for containment pressurization as a result of an accident is not likely; therefore, requirements to isolate the containment from the outside atmosphere can be less stringent. Therefore, containment does not need to be leak tight as required for MODES 1 through 4. Since there is no requirement for containment leak tightness, compliance with the Appendix J leakage criteria and tests is not required.

BASES

ACTIONS (continued)

The Completion Time for this Action would be calculated prior to entering into the applicable conditions for the two sets of plant conditions (i.e., backup injection flow available and no injection flow available). The time from loss of normal cooling until steam release to the containment is dependent on various plant parameters (RCS temperature, RWSP temperature, etc.), plant configuration (RCS pressure boundary intact, RCS open, backup injection flow available, etc.), and the time after shutdown. In determining the minimum time to steaming, core decay heat, RCS configuration, and initial RCS inventory are used to calculate the time to steaming. The time to close the penetrations before steaming to containment includes time for the diagnosis and decision-making time, in addition to the time required to physically complete the closure action. DCD_19-494 S03

The assumptions used in determining the required closure time for the various containment openings should be consistent with the plant operating procedures, staffing levels, and status of the containment openings. The evaluation should consider the ability to close the containment for the limiting loss of shutdown cooling event, and considering the possibility of a station blackout.

Containment will need to be closed prior to entering the applicable mode if the time permitted for containment closure is shorter than the time to diagnose, make a decision that closure is needed following an event, and complete the closure actions. The time needed to close containment for the reduced RCS inventory period should be evaluated prior to the beginning of each new entry into this condition since decay heat varies with the time after shutdown and the effect of the partial core replacement with new fuel.

The containment equipment hatch, if required to be closed, must be held in place by at least [four] bolts. Good engineering practice dictates that bolts required by this Required Action be approximately equally spaced.

Containment penetrations, including purge system flow paths, that provide direct access from containment atmosphere to outside atmosphere must be isolated or capable of being isolated. Isolation may be achieved by a single automatic isolation valve, or by a single manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary barrier for the containment penetrations. The equivalent isolation barrier must be capable of maintaining containment closure at the containment design pressure of 68 psig (Ref. 2).

BASES

ACTIONS (continued)

D.1, D.2, D.3, and D.4

In the event that no SI pump is available to inject water into the RCS, the RWSP does not contain sufficient water volume (SR 3.9.6.5), or boron concentration is not within limits (SR 3.9.6.6) to mitigate a RCS drain-down event in Mode 6 with <23 feet above the top of the reactor vessel flange, then actions must be initiated immediately to restore this capability. The PRA indicates that the availability of an injection water source reduces the core damage frequency. Additionally, until such capability is restored, any activity that could result in lowering RCS water volume must be suspended. The immediate ~~COMPLETION TIME~~Completion Time reflects the importance of maintaining water injection capability while the RCS is in a low water level condition. DCD_19-494 S03

BASES

SURVEILLANCE REQUIREMENTS (continued)

OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.] DCD_16-305

SR 3.9.6.10

SR 3.9.6.10 is the performance of a MIC for the low pressure letdown isolation instrumentation in the same manner as SR 3.3.1.6.

[The Frequency of 24 months is based on engineering judgment, taking into consideration the conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle length. This equipment is not at risk of imminent damage as it is designed to remain functional and in good condition while in operation, thus significant degradation due to a longer surveillance interval should not be of major concern. The design reliability is, therefore, maintained by taking these considerations into account based on sound engineering judgment. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

SR 3.9.6.11

SR 3.9.6.11 requires the performance of a CHANNEL CALIBRATION for each of the required reactor coolant system loop water level instrumentation channel in the same manner as SR 3.3.1.8.

[The Frequency of 24 months is based on engineering judgment, taking into consideration the conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle length. This equipment is not at risk of imminent damage as it is designed to remain functional and in good condition while in operation, thus significant degradation due to a longer surveillance interval should not be of major concern. The design reliability is, therefore, maintained by taking these considerations into account based on sound engineering judgment. OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

REFERENCES

1. Subsection 5.4.7
2. DCD Chapter 6 DCD_19-494 S03

Table 19.1-119 Key Insights and Assumptions (Sheet 35 of 51)

Key Insights and Assumptions	Dispositions	
18. Surge line flooding may occur if decay heat removal function is lost during plant operating states where the pressurizer manway is the only vapor release pass from the RCS. Water held up in the pressurizer can erroneous readings of water level indicators measured with reference to the pressurizer. This phenomenon can also prevent gravity injection from the SFP. Measures to prevent accident evolution caused by surge line flooding are important. Adoption of both measures listed below can reduce risk from surge line flooding event. - Installation of an temporary RCP water level sensor that measure the MCP water level with reference to pressure at the reactor vessel head vent line and cross over leg when the RCS is vented at a high elevation. - Operational procedures to perform continuous RCS injections when loss of RHR occurs under conditions where the pressurizer manway is the only vapor release pass from the RCS. The temporary water level will satisfy the following specifications. - Water level can be read outside the containment vessel (CV) in order to be effective during events which involve harsh environment in the CV - Tygon tubing monometer will not be used - Instrumentation piping diameter will be sufficient enough to prevent delay in response	5.4.7.2.3.6 19.2.5 COL 19.3(6) COL 13.5(7)	
19. Two types of instruments are provided in US-APWR design to measure the temperature representative of the core exit whenever the reactor vessel head is located on top of the reactor vessel. The first one is core exit thermocouples located inside the RV. The second is resistance temperature detectors in the reactor coolant hot leg. These two independent instruments will be available whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel.	5.4.7.2.3.6	
20. Technical Specification controls to ensure the OPERABILITY of a train of the SIS and associated water source (i.e., RWSP and refueling cavity in refueling mode) as an RCS makeup function during cold shutdown in reduced inventory conditions and during refueling with water level <23 ft above the top of reactor vessel flange.	TS 3.4.8~~,~~ TS 3.9.6	DCD_19-494 S03 DCD_19-494 S03
21. Operating procedural controls to ensure the availability of the refueling cavity level instrument and alarm while the refueling cavity is flooded.	COL 13.5(5) 9.1.4.2.1.13	DCD_19-592
22. Operating procedural controls to ensure the availability of at least one safety-related pump, e.g., a CS/RHR pump, to provide makeup to the refueling cavity when the cavity is flooded.	COL 13.5(5)	

Table 19.1-119 Key Insights and Assumptions (Sheet 36 of 51)

Key Insights and Assumptions	Dispositions
23. ~~Administrative~~Technical Specification controls to ensure that the availability of equipment necessary to achieve containment isolation, specifically, the equipment hatch hoist, lifting rig, and AACs while the containment remains open.	~~COL 13.5(7)~~ TS 3.4.8 TS 3.6.7 TS 3.9.6
24. All containment penetrations are closed ~~immediately~~prior to the onset of steaming into containment after a loss of all RHR trains.	~~COL 13.5(7)~~ TS 3.4.8 TS 3.6.7 TS 3.9.6

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Table 19.1-119 Key Insights and Assumptions (Sheet 37 of 51)

Key Insights and Assumptions	Dispositions
Expeditious actions outlined in GL 88-17 The following actions described as expeditious actions in Generic Letter 88-17 (Reference 19.1-54) are important to plant safety and should be implemented prior to operating in a reduced inventory condition. The expeditious actions applicable to the US-APWR design are the followings:	
1. Discuss the Diablo Canyon event, related events, lessons learned, and implications with appropriate plant personnel. Provide training shortly before entering a reduced inventory condition.	COL 13.5(7)
2. Implement procedures and ~~administration~~Technical Specification controls that reasonably assure that containment closure will be achieved prior to the time at which ~~a core uncover~~steaming into containment could result from a loss of decay heat removal coupled with an inability to initiate alternate cooling or addition of water to the RCS inventory. These procedures and ~~administrative~~Technical Specification controls should be active and in use prior to entering a reduced RCS inventory condition. Procedures should reflect that the containment is capable of being closed prior to ~~reaching 200 °F in the RCS~~the onset of steaming into containment.	~~COL 13.5(7)~~ TS 3.4.8 TS 3.6.7 TS 3.9.6
3. Provide at least two independent, continuous temperature indications that are representative of the core exit conditions whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel.	COL 13.5(7)
Two types of instruments provided in the US-APWR design to measure RV temperature are core exit thermocouples located inside the RV and the resistance temperature detectors in the reactor coolant hot leg.	7.5.1.1.3.1 7.5.1.1.3.3
4. Provide at least two independent, continuous RCS water level indications whenever the RCS is in a reduced inventory condition.	COL 13.5(7)
Redundant narrow range level instruments are provided to meet this requirement.	5.4.7.2.3.6
5. Implement procedures and administrative controls that generally avoid operations that deliberately or knowingly lead to perturbations to the RCS and/or to systems that are necessary to maintain the RCS in a stable and controlled condition while the RCS is in a reduced inventory condition.	COL 13.5(7)
6. Provide at least two available or operable means of adding inventory to the RCS that are in addition to pumps that are a part of the normal DHR systems.	COL 13.5(7) TS 3.4.8 TS3.9.6
Means of adding inventory to the RCS in the US-APWR design can be safety injection pumps, charging pump and gravity injection from the SFP.	6.3.2.1.1 5.4.7.2.3.6 9.3.4.2.6.1

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Table 19.1-119 Key Insights and Assumptions (Sheet 38 of 51)

Key Insights and Assumptions	Dispositions
7. Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by nozzle dams unless a vent path is provided that is large enough to prevent pressurization of the upper plenum of the RV. ~~As noted in GL 88-17 (Reference 19.1-54), there is a possibility of rapid loss of RCS inventory by ejection of water through the cold leg SG manways in the event of a loss of RHR and subsequent RCS pressurization. To minimize this potential, an RCS vent path is required in accordance with GL 88-17. Whenever a cold leg opening is made without the associated cold leg nozzle dam installed, a hot leg SG manway and its associated nozzle dam will be kept open to provide an adequate vent path. Consistent with guidance provided in IN 88-36 (Reference 19.1-55), a hot leg SG manway will be the first manway opened and a hot leg nozzle dam will be the last dam to be installed~~As noted in GL 88-17 (Reference 19.1-54), there is a possibility of rapid loss of RCS inventory by ejection of water through the cold leg opening in the event of a loss of RHR and subsequent RCS pressurization. To minimize this potential, an RCS vent path is recommended as an expeditious action in accordance with GL 88-17. A vent path through a hot leg SG manway, and its associated hot leg piping, will be kept open whenever a cold leg opening is made. Consistent with guidance provided in IN 88-36 (Reference 19.1-55), a hot leg SG manway will be the first manway opened and a hot leg nozzle dam will be the last dam to be installed.	5.4.7.2.3.6 COL 13.5(7)
8. Plant personnel calculate a plant-specific time to reach ~~200 °F in the RCS~~steaming into containment and time to hatch closure in order to determine if the hatch is "capable of being closed" prior to reaching harsh environment in containment in the event of loss of RHR.	~~COL 13.5(7)~~ TS 3.4.8 TS 3.6.7 TS 3.9.6

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