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April 25, 2013

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

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-13104

Subject: MHI's Response to US-APWR DCD RAI No.986-6979 (SRP 09.02.02)

Reference: 1) "Request for Additional Information No.986-6979, SRP Section: 09.02.02 – Reactor Auxiliary Cooling Water Systems, Application Section: 9.2.2 and Chapter 16," dated January 14, 2013.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") the document entitled "Response to Request for Additional Information No.986-6979".

Enclosed is the response to one RAI question contained within Reference 1.

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.

Enclosure:

1. Response to Request for Additional Information No.986-6979

D081
NRO

CC: J. A. Ciocco
J. Tapia

<u>Contact Information</u>

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Enclosure 1

UAP-HF-13104
Docket Number 52-021

Response to Request for Additional Information No.986-6979

April 2013

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

04/25/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**986-6979**
SRP SECTION:	**09.02.02 – Reactor Auxiliary Cooling Water Systems**
APPLICATION SECTION:	**DCD SECTIONS 9.2.2 AND CHAPTER 16**
DATE OF RAI ISSUE:	**01/14/2013**

Question No. : 09.02.02-87

This is a follow-up to RAI 584-4468, Question 09.02.02-75 and RAI 343-2208, Question 09.02.02-18: Section 10CFR52.47, "Content of Application," states that "the description shall be sufficient to permit understanding of the system design and their relationship to the safety evaluation." Since Tier 2, DCD Section 9.2.7 has missing design bases information related to the importance of the essential chilled water system (ECWS), the staff generated RAI 09.02.02-18. In addition, the RAI requested that the applicant provide justification of why the US-APWR DCD does not have a separate section in the technical specification related to the ECWS. In its response, the applicant proposed to add a statement on design bases to Tier 2 DCD sections 9.2.7.1 and 9.2.7.3 and provided the definition of "OPERABLE - OPERABILITY" with respect to technical specifications to argue that operability of the ECWS in indirectly included under other primary system LCO which ECWS supports.

In regards to the technical specification, the applicant needs to justify how Criterion 3 of 10CFR50.36(c)(2)(ii) is not applicable as a basis for the need for a technical specification for the ECWS.

"(C) *Criterion 3.* A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier."

Operability problems with the ECWS and non-ECWS could result in the failure of systems used to mitigate a design basis accident to perform their safety function. The applicant should also address the need for technical specification surveillance requirements to ensure operability of the ECWS is maintained (i.e. compression tank 7-day supply inventory and required pressure, chiller discharge temperature, system flow rate requirements, etc.)

In the applicant's response to Question 09.02.02-75, dated June 10, 2010, is was stated that Criterion 3 of 10CFR50.36(c)(2)(ii) is not applicable to the ECWS. In addition, NUREG-1431, Rev. 3.1, Standard Technical Specifications Westinghouse Plants, was used as guidance for developing the US-APWR Technical Specifications for consistency with the Technical Specification Improvement Program. The US-APWR Technical Specifications are consistent with NUREG-1431 in that the standard technical specifications do not explicitly include LCO or surveillance testing requirements for the chilled water system.

Due to the complexity of the four trains of the ECWS (DCD Tier 2 Figure 9.2.7-1) and the importance of the safety-related ECWS to provide cooling to various safety related loads (including some safety-related HVAC systems with crosstie capability) and primary systems addressed in Technical Specifications, the staff finds that the Technical Specification Bases should be revised to address ACRS Full Committee (#597th) Meeting (September 6, 2012) concerns. Therefore, the following should be addressed:

1. State specifically if the ECWS (as described in US-APWR DCD Tier 2 Section 9.2.7) and the main control room heating, ventilation and air conditioning system (Tier 2 Section 9.4.1) are support systems/components for TS 3.7.10, Main Control Room HVAC system (MCRVS). See Tier 2 Figure 9.4.1-1 for additional details.
2. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the class 1E electrical room HVAC system (Tier 2 Section 9.4.5.1.1.2) are support systems/components for TS 3.8, electrical power systems. See Tier 2 Figure 9.4.5-2 for additional details.
3. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safeguard component area HVAC system (Tier 2 Section 9.4.5.1.1.3) are support systems/components for TS 3.4.6 RCS loops-Mode 4, TS 3.4.7 RCS Loops-Mode 5 loops filler, TS 3.4.8 RCS Loops-Mode 5 loops not filled, TS 3.5.2 safety injections system - operating, and TS 3.5.3 safety injection - shutdown. See Tier 2 Figure 9.4.5-3 for additional details.
4. State specifically if the ESWS (as described in Tier 2 Section 9.2.1) the ECWS (as described in Tier 2 Section 9.2.7) and the emergency feedwater pump area HVAC system (Tier 2 Section 9.4.5.1.1.4) are support systems/components for TS 3.7.5 emergency feedwater system. See Tier 2 Figure 9.4.5-4 for additional details.
5. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safety related component area HVAC system (Tier 2 Section 9.4.5.1.1.5) are support systems/components for TS 3.7.7 component cooling water. See Tier 2 Figure 9.4.5-5 (sheet 1) for additional details.
6. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safety related component area HVAC system (Tier 2 Section 9.4.5.1.1.5) are support systems/components for TS 3.7.11 annulus emergency exhaust system. See Tier 2 Figure 9.4.5-5 (sheet 2) for additional details.
7. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safety related component area HVAC system (Tier 2 Section 9.4.5.1.1.5) are support systems/components for TS associated with the penetration area. See Tier 2 Figure 9.4.5-1 for additional details.
8. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safety related component area HVAC system (Tier 2 Section 9.4.5.1.1.5) are support systems/components for TS associated with the charging pump area. See Tier 2 Figure 9.4.5-5 (sheet 2) for additional details.
9. State specifically if the ECWS (as described in Tier 2 Section 9.2.7) and the safety related component area HVAC system (Tier 2 Section 9.4.5.1.1.5) are support systems/components for TS associated with the spent fuel pit pump area. See Tier 2 Figure 9.4.5-5 (sheet 3) for additional details.

Please note that in the standard TS Bases for BWR6 (NUREG 1434) B.3.7.4, control room air conditioning AC system, it states that each subsystem consists of components that support air movement with heating and cooling coils.

An example would be to state that primary TS system consists of support components that consists of HVAC systems which include; heating coils, cooling coils (supported by chiller systems), fans, filters, ductwork, dampers, and instrumentation and controls to provide temperature control.

ANSWER:

As stated in the response to RAI 584-4468, Question 09.02.02-75, dated June 10, 2010, Criterion 3 of 10CFR50.36(c)(2)(ii) is not applicable to the ECWS because the system is not part of the primary success path to mitigate a design basis accident that involves a challenge or failure of a fission product barrier. The ECWS is a support system and supports the room temperature control function of ventilation systems, which support control room habitability and operation of safety related equipment.

As a support system, the ECWS, and applicable ventilation systems, are required to be capable of performing their support functions in order for the supported system, subsystem, train, component, or device to be considered operable consistent with the definition of OPERABLE – OPERABILITY in the US-APWR Technical Specifications Section 1.1. To clarify the support role of the ECWS and applicable ventilation systems, the Technical Specification Bases for supported systems and components with Technical Specification limiting conditions for operation (LCO) will be revised to include a description of the applicable support function.

The following addresses the Items 1 through 9 listed in the RAI Question 09.02.02-87:

Item 1 The ECWS is a support system for the Main Control Room HVAC System. Technical Specification (TS) Bases (B) 3.7.10 Main Control Room HVAC System (MCRVS) BACKGROUND section will be revised to include the support function of the ECWS. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS.

Item 2 The ECWS and the Class 1E electrical room HVAC system are support systems for portions of the Class 1E electrical power systems. TS B 3.3.1 Reactor Trip System (RTS) System Instrumentation - <u>Reactor Trip Breakers</u>, TS B 3.8.4 DC Sources – Operating, TS B 3.8.7 Inverters – Operating, and TS B 3.8.9 Distribution Systems - Operating BACKGROUND section will be revised to include the support function of the ECWS and the Class 1E electrical room HVAC system. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS.

The Control Rod Drive Mechanism (CRDM) Cabinet Room, M-G set and M-G Set Panel Rooms, Leakage Rate Testing (LRT) Room, and AAC Selector Circuit Panel Room are non-safety related ventilation loads, as indicated in DCD Subsection 9.4.5.2.2, and the Class 1E electrical room HVAC system, ECWS, and ESWS are not support systems required for OPERABILITY of the components within these rooms.

Item 3 The ECWS and the safeguard component area HVAC system are support systems for RHR loops, safety injection system and containment spray system components. TS B 3.4.6 RCS Loops - MODE 4, TS B 3.4.7 RCS Loops - MODE 5, Loops Filled, B 3.4.8 RCS Loops - MODE 5, Loops Not Filled, and B 3.5.2 Safety Injection System (SIS) – Operating, TS B 3.6.6 Containment Spray System, TS B 3.9.5 Residual Heat Removal (RHR) and Coolant Circulation – High Water Level and TS B 3.9.6 Residual Heat Removal (RHR) and Coolant Circulation – Low Water Level BACKGROUND section will be revised to include the support function of the ECWS and the

safeguard component area HVAC system. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS. TS B 3.5.3 Safety Injection System (SIS) – Shutdown BACKGROUND section refers to B 3.5.2 and does not require revision.

Item 4 The ECWS and the emergency feedwater pump area HVAC system are support systems for the emergency feedwater system. TS B 3.7.5 Emergency Feedwater System (EFWS) BACKGROUND section will be revised to include the support function of the ECWS and the emergency feedwater pump area HVAC system. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS.

Item 5 The ECWS and the safety related component area HVAC system are support systems for the component cooling water system. TS B 3.7.7 Component Cooling Water (CCW) System BACKGROUND section will be revised to include the support function of the ECWS and the safety related component area HVAC system. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS.

Item 6 The ECWS and the safety related component area HVAC system are support systems for the annulus emergency exhaust system. TS B 3.7.11 Annulus Emergency Exhaust System BACKGROUND section will be revised to include the support function of the ECWS and the safety related component area HVAC system. The ESWS supports operation of the ECWS chillers; the BACKGROUND section will also be revised to include the support function of the ESWS.

Item 7 There are no TS LCO associated with the penetration area.

Item 8 There are no TS LCO associated with the charging pump area.

Item 9 There are no TS LCO associated with the spent fuel pit pump area.

In addition to the items identified above, based on site-specific requirements the ECWS and the safety related component area HVAC system may be required support systems for the ESWS and ultimate heat sink. TS B 3.7.8 Essential Service Water System (ESWS) and TS B 3.7.9 Ultimate Heat Sink (UHS) BACKGROUND section will be revised to include the support function of the ECWS and the safety related component area HVAC system as conceptual design information (CDI). The ESWS supports operation of the ECWS chillers; these BACKGROUND sections will also be revised to include the support function of the ESWS as CDI.

During the preparation of the response to this RAI Question, it was identified that the AAC Selector Circuit Panel Room was not indicated to be a non-safety related ventilation load. DCD Subsection 9.4.5.2.2 will be revised to indicate that the AAC Selector Circuit Panel Room ventilation is non-safety related.

Impact on DCD

DCD Chapter 16, Technical Specifications, Bases Sections 3.3.1, 3.4.6, 3.4.7, 3.4.8, 3.5.2, 3.6.6, 3.7.5, 3.7.7, 3.7.8, 3.7.9, 3.7.10, 3.7.11, 3.8.4, 3.8.7, 3.8.9, 3.9.5, and 3.9.6 will be revised as shown in Attachment 1 to be consistent with the proposed changes identified above.

DCD Subsection 9.4.5.2.2 will be revised as shown in Attachment 1 to identify that the AAC Selector Circuit Panel Room ventilation is non-safety related.

Impact on R-COLA

The R-COLA Technical Specifications will require revision to be consistent with the DCD.

Impact on S-COLA

The S-COLA Technical Specifications will require revision to be consistent with the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

system's air handling unit is supplied with chilled water from the corresponding essential chilled water system (Section 9.2.7). Return air from the electrical room is drawn through the return air ductwork by the system's return air fans. Both air handling units are connected to a common air distribution duct through their discharge air isolation dampers.

Train pair A&B and train pair C&D, each is connected to a single air distribution system. The air distribution system is qualified in accordance with seismic category I requirements. Conditioned air is distributed to the following areas:

- Class 1E instrumentation and control (I&C) rooms
- Class 1E electrical rooms
- Class 1E uninterruptible power supply (UPS) rooms
- Class 1E Battery and battery charger rooms
- MCR/Class 1E electrical HVAC equipment rooms
- Remote shutdown console room
- Control rod drive mechanism (CRDM) cabinet room (non-safety)
- M-G set and M-G set panel rooms (non-safety)
- Leakage rate testing (LRT) room (non-safety)
- Reactor trip breaker room
- AAC selector circuit panel room (non-safety) DCD_09.02.02-87

The return air from these areas is drawn by the corresponding HVAC train through the seismic category I ductwork.

The volume of the air exhausted from battery rooms by the corresponding battery exhaust fans is sufficient to maintain the hydrogen concentration well below 1% by volume of battery room.

The safety-related in-duct heaters are provided in supply air branches to remote shutdown console room, Class 1E battery rooms, Class 1E I&C rooms and MCR/Class 1E electrical HVAC equipment rooms. These electric heaters are classified as equipment class 3 and seismic category I.

Upon the Class 1E electrical room high temperature, the chilled water control valve for the served air handling units is automatically positioned for full chilled water flow to prevent the temperature rise.

Upon the electric heating coil outlet high temperature, the electric heating coil is automatically tripped to prevent the abnormal heating.

BASES

BACKGROUND (continued)

The Class 1E Electrical Room HVAC System is a support system and provides temperature control for the Reactor Trip Breaker Rooms where the RTBs are located. The system includes electric heating coils, chilled water cooling coils, fans, filters, 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. DCD_09.02.02-87

The Class 1E Electrical Room HVAC System trains are each sized to satisfy 100% of the cooling and heating demand of two Reactor Trip Breaker Rooms. For RTBs to be OPERABLE, one of the associated Class 1E Electrical Room HVAC System trains, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, and capable of performing its support function.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (CS/RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, either RCPs or RHR loops can be used to provide forced circulation. The intent of this LCO is to provide forced flow from at least one RCP or two RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that additional paths be available to provide redundancy for decay heat removal.

Additionally, forced coolant circulation provided by at least one RCP ensures that the concentration of soluble boron in the reactor coolant is homogeneous. However, when no RCPs are operating, all isolation valves for reactor makeup water sources containing unborated water that are connected to the Reactor Coolant System (RCS) must be secured closed to prevent unplanned boron dilution of the reactor coolant. This will ensure that an inadvertent boron dilution event does not occur under reduced flow conditions where unborated water could stratify in the RCS. DCD_15.4.6-6

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. DCD_09.02.02-87

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is the removal of decay heat and transfer this heat either to the steam generator (SG) secondary side coolant via natural circulation (Ref. 1) or the component cooling water via the residual heat removal (CS/RHR) heat exchangers. While the principal means for decay heat removal is via the RHR System, the SGs via natural circulation (Ref. 1) are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary water. As long as the SG secondary side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the reactor coolant is circulated by means of four RHR loops connected to the RCS, each loop containing a CS/RHR heat exchanger, a CS/RHR pump, and appropriate flow and temperature instrumentation for control, protection, and indication. ~~Two CS/RHR pumps circulate the water through the RCS at a sufficient rate to prevent boric acid stratification.~~ DCD_15.4.6-6

The number of loops in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least two RHR loops for decay heat removal and transport. The flow provided by two RHR loops is adequate for decay heat removal. The other intent of this LCO is to require that a third path be available to provide redundancy for heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first two paths can be RHR loops that must be OPERABLE and in operation. The third path can be another OPERABLE RHR loop or maintaining two SGs with secondary side water levels ≥ 13% to provide an alternate method for decay heat removal via natural circulation (Ref. 1).

The 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. DCD_15.4.6-6

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 DCD_09.02.02-87

BACKGROUND (continued)

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. DCD_09.02.02-87

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 ~~RHR loops provide this circulation.~~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 only provided by the RHR pumps. DCD_15.4.6-6

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least two of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or two SGs with secondary side water level ≥ 13%. Two RHR loops provide sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is two SGs with their secondary side water levels ≥ 13%. Should one of the operating RHR loops fail, the SGs could be used to remove the decay heat via natural circulation.

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. This LCO allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be immediately restored following the planned actions. DCD_15.4.6-6

Note 1 permits all CS/RHR pumps to be removed from operation ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests designed to validate various accident analyses values. One of the tests performed during the startup testing program is the validation of rod drop times during cold conditions, both with and without flow. The no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. The Note permits stopping of the pumps in order to perform this test

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 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 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. DCD_15.4.6-6

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

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. DCD_09.02.02-87

BACKGROUND (continued)

The Safeguards Component Area HVAC System is a support system that provides temperature control for the SI Pump 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 SIS train 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. DCD_09.02.02-87

The four SIS trains are located in the four quadrants surrounding the Containment Vessel. A dedicated line from the RWSP penetrates through the Containment Vessel in each quadrant to the suction of the SI pump train located in the Reactor Building and associated with that quadrant. Each SI pump discharges through a direct injection throttle valve to a DVI nozzle on the reactor vessel. Each SIS train flow path is completely independent of the other three trains.

During low temperature conditions in the RCS, limitations are placed on the maximum number of SI pumps that may be OPERABLE. Refer to the Bases for LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for the basis of these requirements.

The SI pumps are actuated upon receipt of an ECCS actuation signal. The actuation of safeguard loads is accomplished in a programmed time sequence. If offsite power is available, the safeguard loads start immediately in the programmed sequence. If offsite power is not available, the Engineered Safety Feature (ESF) buses shed normal operating loads and are connected to the Class 1E gas turbine generators (GTGs). Safeguard loads are then actuated in the programmed time sequence. The time delay associated with Class 1E GTG starting, sequenced loading, and pump starting determines the time required before pumped flow is available to the core following a LOCA.

The active SIS components, along with the passive accumulators and the RWSP covered in LCO 3.5.1, "Accumulators," and LCO 3.5.4, "Refueling Water Storage Pit (RWSP)," provide the cooling water necessary to meet GDC 35 (Ref. 1).

BASES

BACKGROUND (continued)

The Containment Spray System is actuated either automatically by a High-3 containment pressure signal or manually. An automatic actuation opens the containment spray pump discharge valves and starts the containment spray pumps. A manual actuation of the Containment Spray System requires the operator to actuate two separate switches on the main control board to begin the same sequence. The Containment Spray System maintains an equilibrium temperature between the containment atmosphere and RWSP water.

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 CSS train 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. DCD_09.02.02-87

B 3.7 PLANT SYSTEMS

B 3.7.5 Emergency Feedwater System (EFWS)

BASES

BACKGROUND

The EFWS automatically supplies feedwater to the steam generators to remove decay heat from the Reactor Coolant System upon the loss of normal feedwater supply. The EFW pumps take suction through separate and independent suction lines from one of the two EFW pits (LCO 3.7.6) and pumps to the steam generator secondary side via separate and independent connections to the main feedwater (MFW) piping outside containment. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the main steam safety valves (MSSVs) (LCO 3.7.1) or main steam depressurization valves (MSDVs) (LCO 3.7.4).

The EFWS consists of two motor driven EFW pumps and two turbine driven pumps configured into four trains. Each motor driven pump provides 50% of EFW flow capacity, and each turbine driven pump provides 50% of the required capacity to the steam generators, as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system. Each motor driven EFW pump is powered from an independent Class 1E power supply. Each turbine driven EFW pump receives steam from two main steam lines upstream of the main steam isolation valves. Each of the steam feed lines will supply 100% of the requirements of the turbine driven EFW pump.

The Emergency Feedwater Pump Area HVAC System is a support system that provides temperature control for the EFW Pump Areas, and includes electric heating coils, cooling coils, fans, filters, 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 EFW pump required to be OPERABLE, the associated train of Emergency Feedwater Pump 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. DCD_09.02.02-87

During normal plant operation (without on-line maintenance (OLM)), all EFW pump discharge cross-connect line isolation valves are closed. Each one of the four EFW pumps is able to supply feedwater separately to each steam generator. During OLM, all the EFW pump discharge cross-connect line isolation valves are opened. Each EFW pump is able to supply feedwater to all steam generators.

B 3.7 PLANT SYSTEMS

B 3.7.7 Component Cooling Water (CCW) System

BASES

BACKGROUND

The CCW System provides a heat sink for the removal of process and operating heat from safety related components during a Design Basis Accident (DBA) or transient. During normal operation, the CCW System also provides this function for various nonessential components, as well as the spent fuel storage pool. The CCW System serves as a barrier to the release of radioactive byproducts between potentially radioactive systems and the Essential Service Water System, and thus to the environment.

A typical CCW System is arranged as four independent, 50% capacity cooling loops, and has isolatable nonsafety related components. Each safety related train includes one 50% capacity pump, connection to one of the two surge tanks, a 50% capacity heat exchanger, piping, valves, and instrumentation. Each safety related train is powered from a separate bus. The surge tanks in the system provide pump trip protective functions to ensure that sufficient net positive suction head is available. The pump in each train is automatically started on receipt of a safety injection signal, and all nonessential components are isolated.

The Safety Related Component Area HVAC System is a support system that provides temperature control for the CCW Pump Areas, and includes electric heating coils, cooling coils, fans, 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 CCW train required to be OPERABLE, the associated train of Safety Related 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. DCD_09.02.02-87

Additional information on the design and operation of the system, along with a list of the components served, is presented in Chapter 9 (Ref. 1). The principal safety related function of the CCW System is the removal of decay heat from the reactor via the Containment Spray/Residual Heat Removal (CS/RHR) System. This may be during a normal or post accident cooldown and shutdown. CCWS cooling to the four RCP seal thermal barriers is used for all operating modes (including accident and safe shutdown) to preclude a RCP seal LOCA in the event that CVCS is unavailable to provide required flow to the RCP seal via seal injection. Manual alignment of RCP thermal barrier cooling is achieved via the CCWS RCP cross-tie valves from the MCR in the event two CCWS trains are unavailable to supply CCWS to a pair of RCP thermal barriers. DCD_09.02.02-84

B 3.7 PLANT SYSTEMS

B 3.7.8 Essential Service Water System (ESWS)

BASES

BACKGROUND

The ESWS provides a heat sink for the removal of process and operating heat from safety related components during a Design Basis Accident (DBA) or transient. During normal operation, and a normal shutdown, the ESWS also provides this function for various safety related and nonsafety related components. The safety related function is covered by this LCO.

The ESWS consists of four separate, safety related, cooling water trains. Each train consists of one 50% capacity pump, one component cooling water (CCW) heat exchanger, one essential chiller unit, piping, valves, instrumentation, and two types of strainers. The pumps and valves are remote and manually aligned, except in the unlikely event of a loss of coolant accident (LOCA). The pumps aligned to the critical loops are automatically started upon receipt of a safety injection signal, and all essential valves are aligned to their post accident positions.

Additional information about the design and operation of the ESWS, along with a list of the components served, is presented in Chapter 9 (Ref. 1). The principal safety related function of the ESWS is the removal of decay heat from the reactor via the CCW System.

[[The Safety Related Component Area HVAC System is a support system that provides temperature control for the ESW Pump Areas, and includes electric heating coils, cooling coils, fans, and instrumentation and controls necessary to perform the support function. The ESWS is a support system and provides cooling water to the essential chiller unit. The Essential Chilled Water System (ECWS) is a support system and provides chilled water to the air handling unit cooling coil. For each ESW train required to be OPERABLE, the associated train of Safety Related Component Area HVAC System, including its associated train of the ECWS and ESWS, must be in operation, or available to operate on demand, and capable of performing its related support function.]] DCD_09.02.02-87

B 3.7 PLANT SYSTEMS

B 3.7.9 Ultimate Heat Sink (UHS)

BASES

BACKGROUND

The UHS provides a heat sink for processing and operating heat from safety related components during a transient or accident, as well as during normal operation. This is done by utilizing the Essential Service Water System (ESWS) and the Component Cooling Water (CCWS) system.

[[The UHS consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train. Each cooling tower consists of two cells with one fan per cell. The combined inventory of three of the four UHS basins provides a 30-day storage capacity as discussed in FSAR Chapter 9 (Ref. 1). Each unit is provided with its own independent UHS with no cross connection between the two units.]] The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident.

The basic performance requirements are that an adequate inventory of cooling water be available for [[30]] days without makeup, and that the design basis temperatures of safety-related equipment not be exceeded. [[Each UHS basin provides 33-1/3 percent of the combined inventory for the 30-day storage capacity to satisfy the short-term recommendation of Regulatory Guide 1.27 (Ref. 2). There is one safety-related UHS transfer pump per UHS basin which is used to transfer water between the UHS basins.]]

The [[stored]] water level provides adequate net positive suction head (NPSH) to the ESW pump during a 30-day period of operation following the design basis LOCA or safe shutdown with LOOP scenario without makeup.

[[The Safety Related Component Area HVAC System is a support system that provides temperature control for the UHS Transfer Pump Areas, and includes electric heating coils, cooling coils, fans, and instrumentation and controls necessary to perform the support function. The ESWS is a support system and provides cooling water to the essential chiller unit. The Essential Chilled Water System (ECWS) is a support system and provides chilled water to the air handling unit cooling coil. For each UHS Transfer Pump required to be OPERABLE, the associated train of Safety Related Component Area HVAC System, including its associated train of the ECWS and ESWS, must be in operation, or available to operate on demand, and capable of performing its related support function.]] DCD_09.02.02-87

Additional information on the design and operation of the system, along with a list of components served, can be found in Reference 1.

BASES

BACKGROUND (continued)

[The air entering the CRE is continuously monitored by radiation and toxic gas detectors. One detector output above the setpoint will cause actuation of the pressurization mode or isolation mode, as required. The actions of the isolation mode are more restrictive, and will override the actions of the pressurization mode].

A single train of MCREFS operating at a flow ≤~~1200~~600 cfm will pressurize the CRE to about 0.125 inches water gauge relative to external areas adjacent to the CRE boundary. The MCRVS operation in maintaining the CRE habitable is discussed in Chapter 9, Subsection 9.4.1 (Ref. 2). DCD_09.04.01-28 S01

Redundant supply and recirculation trains provide the required filtration should an excessive pressure drop develop across the other filter train. Normally open isolation dampers are arranged in series pairs so that the failure of one damper to shut will not result in a breach of isolation. The MCREFS is designed in accordance with Seismic Category I requirements.

Two trains of MCRATCS will provide the required temperature control to maintain the control room between 73°F and 78°F. The MCRVS operation in maintaining the control room temperature is discussed in Chapter 9, Section 9.4.1 (Ref. 2).

In order for the MCRATCS train to be considered OPERABLE, the associated train of Essential Chilled Water System must be in operation and capable of performing its related support function to provide chilled water flow to the air handling unit cooling coil upon demand. The Essential Service Water System supports operation of the essential chiller, and the associated train of the Essential Service Water System must also be in operation. DCD_09.02.02-87

The CRE habitability is maintained by limiting the inleakage of potentially contaminated air into the CRE. The potential leakage paths for the CRE include the control room enclosure (e.g., walls, penetrations, floor, ceilings, joints, etc.) and other potential paths such as pressurized ductwork from other HVAC systems, pressurized air systems (e.g., instrument air) or isolated HVAC intakes.

~~The periodic surveillance pressurization tests verify the integrity of the CRE with respect to potentially contaminated adjacent areas. It does not verify filtered inleakage internal to the filtration units and ductwork nor does it verify unfiltered inleakage from internal pressurized sources (e.g., instrument air). These sources of inleakage are addressed separately from TS surveillances.~~ DCD_09.04.01-28 S01

The MCRVS is designed to maintain a habitable environment in the CRE for 30 days of continuous occupancy after a Design Basis Accident (DBA) without exceeding a 5 rem total effective dose equivalent (TEDE).

BASES

BACKGROUND (continued)

The Safety Related Component Area HVAC System is a support system that provides temperature control for the Annulus Emergency Exhaust Filtration Unit Area, and includes electric heating coils, cooling coils, fans, 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 annulus emergency exhaust system train required to be OPERABLE, the associated train of Safety Related Component Area HVAC System, including one of its two associated trains 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. DCD_09.02.02-87

The annulus emergency exhaust system is discussed in Subsection 6.5.1 and Subsection 9.4.5 (Refs. 1 and 2 respectively).

APPLICABLE SAFETY ANALYSES

The annulus emergency exhaust system design basis is SAFETY established by the large break loss of coolant accident (LOCA). The system evaluation assumes a passive failure outside containment, such as valve packing leakage during a Design Basis Accident (DBA). The system evaluation also assumes a passive failure of the ECCS outside containment, such as an SI pump seal leakage. In such a case, the system restricts the radioactive release to within the 10 CFR 50.34 (Ref. 4) limits, or the NRC staff approved licensing basis (e.g., a specified fraction of 10 CFR 50.34 limits). The analysis of the effects and consequences of a large break LOCA are presented in Chapter 15, Subsection 15.6.5.5 (Ref. 3). The annulus emergency exhaust system also actuates following a small break LOCA to clean up releases of smaller leaks, such as from valve stem packing.

Either a complete loss of function or excessive LEAKAGE may result in less efficient removal of any gaseous or particulate material released to the penetration areas and the ECCS pump rooms following a LOCA.

The annulus emergency exhaust system satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BACKGROUND (continued)

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in Subsection 8.3.2 (Ref 4). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The batteries for Train A, B, C, and D dc electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 108 V.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 60 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.17 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.07 Vpc corresponds to a total float voltage output of 124.2 V for a 60 cell battery.

Each Train A, B, C, and D dc electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in Subsection 8.3.2 (Ref. 4).

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

The Class 1E Electrical Room HVAC System is a support system and provides temperature control and battery room exhaust for the Class 1E Battery and Battery Charger Rooms where the dc electrical power subsystems are located. The system includes electric heating coils, chilled water cooling coils, fans, filters, 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. DCD_09.02.02-87

BASES

BACKGROUND (continued)

The Class 1E Electrical Room HVAC System consists of four redundant trains, each sized to satisfy 100% of the cooling and heating demand of two Class 1E Battery and Battery Charger Rooms. Class 1E Electrical Room HVAC train A or B can provide cooling and heating for both A and B Class 1E Battery and Battery Charger Rooms, and train C or D can provide cooling and heating for both C and D Class 1E Battery and Battery Charger Rooms. For each dc electrical power subsystem train required to be OPERABLE, one of the associated Class 1E Electrical Room HVAC System trains, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, and capable of performing its related support function. DCD_09.02.02-87

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g., following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Anticipated Operational Occurrence (AOO) and Postulated Accident (PA) analyses in Chapter 6 (Ref. 5) and Chapter 15 (Ref. 6), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The dc electrical power systems provide normal and emergency dc electrical power for the Class 1E GTGs, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the dc sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the dc sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite ac power or all onsite ac power and

b. A worst-case single failure.

The dc sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters - Operating

BASES

BACKGROUND

The inverters are the preferred source of power for the ac vital buses because of the stability and reliability they achieve. The function of the inverter is to provide ac electrical power to the vital buses. The inverters can be powered from an internal ac source/rectifier or from the station battery. The station battery provides an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in Subsection 8.3.1 (Ref. 1).

The Class 1E Electrical Room HVAC System is a support system and provides temperature control for the Class 1E UPS Rooms where the inverters are located. The system includes electric heating coils, chilled water cooling coils, fans, filters, 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. DCD_09.02.02-87

The Class 1E Electrical Room HVAC System consists of four redundant trains, each sized to satisfy 100% of the cooling and heating demand of two Class 1E UPS Rooms. Class 1E Electrical Room HVAC train A or B can provide cooling and heating for both A and B Class 1E UPS Rooms, and train C or D can provide cooling and heating for both C and D Class 1E UPS Rooms. For each inverter required to be OPERABLE, one of the associated Class 1E Electrical Room HVAC System trains, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, and capable of performing its related support function.

BASES

BACKGROUND (continued)

The list of all required dc and vital ac distribution buses are presented in Table B 3.8.9-1. Specific details on inverters and their operating characteristics are found in Chapter 8 (Ref. 4).

The Class 1E Electrical Room HVAC System is a support system and provides temperature control for the Class 1E Electrical Rooms where the ac, dc, and ac vital bus electrical power distribution subsystems are located. The system includes electric heating coils, chilled water cooling coils, fans, filters, 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. DCD_09.02.02-87

The Class 1E Electrical Room HVAC System consists of four redundant trains, each sized to satisfy 100% of the cooling and heating demand of two Class 1E Electrical Rooms. Class 1E Electrical Room HVAC train A or B can provide cooling and heating for both A and B Class 1E Electrical Rooms, and train C or D can provide cooling and heating for both C and D Class 1E Electrical Rooms. For each ac, dc, and ac vital bus electrical power distribution subsystem train required to be OPERABLE, one of the associated Class 1E Electrical Room HVAC System trains, including its associated train of the Essential Chilled Water System and Essential Service Water System, must be in operation, and capable of performing its related support function.

B 3.9 REFUELING OPERATIONS

B 3.9.5 Residual Heat Removal (RHR) and Coolant Circulation - High 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 exchanger(s), 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 or 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 line(s). Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

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. DCD_09.02.02-87

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.

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. DCD_09.02.02-87