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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-189**

Enclosures 1 and 2 contain the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-597, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application,* September 11, 2009

Enclosures:

1. MFN 09-672 – Response to Portion of NRC Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-189
2. MFN 09-672 – DCD Markups for RAI Number 16.2-189

cc:

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Enclosure 1

MFN 09-672

Response to Portion of NRC Request for

Additional Information Letter No. 367

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Number 16.2-189

NRC RAI 16.2-189

GEH is requested to revise the GTS by adding an LCO to explicitly require operability of (1) the safety-related IC/PCCS inner expansion pool level - low instrumentation function channels, and (2) the safety-related actuation [logic] function divisions, that actuate to open the IC/PCCS pool inner expansion pool-to-equipment pool cross-connect valves on low level in at least one inner expansion pool.

GEH is also requested to revise the GTS and bases by adding (1) a LSFT SR for these safety-related actuation [logic] function divisions, (2) appropriate action requirements for both the inner expansion pool level instrument channels and expansion pool-to-equipment pool cross-connect actuation divisions, and (3) appropriate bases for the LCO, Actions, and SRs, including the overlap of the LSFT with tests of the valve initiators on an actual or simulated automatic initiation signal.

GTS SR 3.7.1.8 verifies actuation of each of the four IC/PCCS pool inner expansion pool to equipment pool cross-connect valves on an actual or simulated automatic initiation signal. The bases of SR 3.7.1.8 state that this SR overlaps the Logic System Functional Test (LSFT) required by GTS SR 3.3.8.1.4 for DPS Function 4.a, IC/PCCS Pool Expansion Pool to Equipment Pool Cross-Connect – Actuation, IC/PCC System Pool Level - Low, to provide complete testing of the assumed safety function. However, the generic TS include no LCO or LSFT SR for the safety-related action logic function associated with the safety-related initiators on the cross-connect valves. Also, SR 3.5.4.5, which overlaps the LSFT of SR 3.3.5.4.1, does not appear to address the safety-related initiators for opening the cross-connect valves.

GEH Response

The changes summarized below, and shown in Enclosure 2, will be incorporated in DCD Revision 7.

Part 1

GEH is requested to revise the GTS by adding an LCO to explicitly require operability of (1) the safety-related IC/PCCS inner expansion pool level - low instrumentation function channels, and (2) the safety-related actuation [logic] function divisions, that actuate to open the IC/PCCS pool inner expansion pool-to-equipment pool cross-connect valves on low level in at least one inner expansion pool.

GTS 3.7.1, “Isolation Condenser/Passive Containment Cooling System (IC/PCCS) Pools,” and its associated Bases will be revised to explicitly require operability of the instrumentation channels, actuation logic divisions, and valve initiators associated with the IC/PCCS expansion pool-to-equipment pool cross-connect function. Changes will also be made to DCD Section 7.4.4.3 and the Bases for GTS 3.3.8.1, “Diverse

Protection System (DPS)," to clarify the number of initiators on each of the cross-connect valves.

Surveillance Requirements (SRs) 3.7.1.1 and 3.7.1.7 will be added to require performance of Channel Checks and Channel Functional Tests for the IC/PCCS expansion pool level instrumentation. Conforming changes to the Bases will also be made.

Part 2

GEH is also requested to revise the GTS and bases by adding (1) a LSFT SR for these safety-related actuation [logic] function divisions, (2) appropriate action requirements for both the inner expansion pool level instrument channels and expansion pool-to-equipment pool cross-connect actuation divisions, and (3) appropriate bases for the LCO, Actions, and SRs, including the overlap of the LSFT with tests of the valve initiators on an actual or simulated automatic initiation signal.

SR 3.7.1.12 will be added to GTS 3.7.1, "IC/PCCS Pools." This SR will require a Logic System Functional Test of the logic associated with the IC/PCCS expansion pool-to-equipment pool cross-connect function. This Logic System Functional Test will test the safety-related logic associated with the safety-related valve initiators. Conforming changes to the Bases will also be made.

GTS 3.7.1 Required Actions D.1 and E.1 will be added to address the inoperability of a required instrument channel or actuation logic division, respectively. Conforming changes to the Bases will also be made. Required Actions D.1 and E.1 will be given a Completion Time of 20 hours. This Completion Time is consistent with the Specification 3.3 Completion Times in that it includes a 12-hour allowance for the instrumentation channel/actuation division inoperability combined with an 8-hour allowance for IC/PCCS Pool inoperability prior to requiring that the unit be place in Mode 3.

The Bases for SR 3.7.1.10 (previously SR 3.7.1.8) will be revised to describe the overlap with the newly created Logic System Functional Test, SR 3.7.1.12.

Part 3

GTS SR 3.7.1.8 verifies actuation of each of the four IC/PCCS pool inner expansion pool to equipment pool cross-connect valves on an actual or simulated automatic initiation signal. The bases of SR 3.7.1.8 state that this SR overlaps the Logic System Functional Test (LSFT) required by GTS SR 3.3.8.1.4 for DPS Function 4.a, IC/PCCS Pool Expansion Pool to Equipment Pool Cross-Connect – Actuation, IC/PCC System Pool Level - Low, to provide complete testing of the assumed safety function. However, the generic TS include no LCO or LSFT SR for the safety-related action logic function associated with the safety-related initiators on the cross-connect valves. Also, SR

3.5.4.5, which overlaps the LSFT of SR 3.3.5.4.1, does not appear to address the safety-related initiators for opening the cross-connect valves.

As described above, GTS 3.7.1 will be revised to address the safety-related actuation logic and SR 3.7.1.12 will be added to require performance of a Logic System Functional Test for the IC/PCCS expansion pool-to-equipment pool cross-connect function. This Logic System Functional Test will test the safety-related logic associated with the safety-related valve initiators.

SR 3.5.4.5 does not test any feature of the IC/PCCS expansion pool-to-equipment pool cross-connect function. The cross-connect function safety-related initiators are fully tested via existing SR 3.7.1.10 (previously SR 3.7.1.8), which overlaps with newly created SR 3.7.1.12.

DCD Impact

DCD Chapters 7, 16, and 16B will be revised as shown in Enclosure 2.

Enclosure 2

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DCD Markups for

RAI Number 16.2-189

operation or isolation of each of the four separate isolation condenser trains as shown in Figure 7.4-3. The actuating logic and actuator power for the inner isolation valves for the four ICS trains are on two safety-related 120 VAC divisional UPS (Refer to Subsection 8.3.1.1.3) different from the two divisional power sources for the outer isolation valves.

ICs are initiated by two-out-of-four logic in the four divisions of SSLC/ESF inter-divisional signals are isolated at the source and transmitted using optical fiber. Each of the four IC equipment trains can be initiated by either DPS or any one of three SSLC/ESF divisions and their associated safety-related power source. Consequently, the loss of two of the four safety-related power supplies does not result in the loss of any one ICS equipment train. However, second and third sources of safety-related power are provided to operate the ICS automatic venting system during long-term ICS operation; otherwise the manually controlled backup venting system, which uses one of the divisional power sources starting the ICS, can be used for long-term operation.

If the three safety-related power supplies used to start an individual ICS equipment train fail, then the ICS would automatically start, because of the "fail open" actuation of the condensate return bypass valves upon loss of electrical power to the solenoids controlling its nitrogen-actuated valves.

The ICS is initiated automatically as part of the ECCS to provide additional liquid inventory to mitigate LOCA events. The signals that initiate ICS operation are:

- High reactor pressure;
- Low reactor water level (Level 2) with time delay;
- Low reactor water level (Level 1);
- Loss of power generation buses (loss of feedwater flow) in reactor run mode;
- MSIV position indication (indicating closure) whenever the Reactor Mode Switch is in the Run position; and
- Operator manual initiation.

The operator is able to stop any individual ICS equipment train whenever the RPV pressure is below a reset value overriding the ICS automatic actuation signal following MSIV closure.

The IC/PCCS pool has four safety-related level sensors in each IC/PCCS inner expansion pool. These level sensors are part of the Fuel and Auxiliary Pool Cooling System (FAPCS). Each IC/PCCS inner expansion pool is connected to the equipment storage pool by two cross-connect valves in parallel where one valve is a pneumatic operated valve with an accumulator and two load drivers per initiator (actuation similar to Figure 7.4-3) and the other is a squib valve with three load drivers per initiator (actuation similar to Figure 7.3-2) Each valve has four initiators (three divisional initiators and one DPS initiator [see Section 7.8]). These valves open when a low water level condition is detected in either of the IC/PCCS inner expansion pools to provide makeup water for the first 72 hours of design basis events. The residual heat removal function of the safety-related ICS is further backed up by the safety-related ESF combination of ADS, PCCS, and GDCS; by the nonsafety-related RWCU/SDC loops; or by the makeup function of the CRD system operating in conjunction with safety relief valves and the suppression pool cooling systems.

3.7 PLANT SYSTEMS

3.7.1 Isolation Condenser/Passive Containment Cooling System (IC/PCCS) Pools

LCO 3.7.1 The IC/PCCS pools shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or both IC/PCCS expansion pools with one ~~-~~equipment pool ~~isolation~~cross-connect valve Diverse Protection System (DPS) initiator inoperable.	A.1 Restore DPS initiator(s) to OPERABLE status.	Prior to entering MODE 2 or 4 from MODE 5
B. One or both IC/PCCS expansion pools with both equipment pool ~~isolation~~cross-connect valve DPS initiators inoperable.	B.1 Restore DPS initiator(s) to OPERABLE status.	30 days
C. One or both IC/PCCS expansion pools with one equipment pool connection line inoperable for reasons other than Condition A.	C.1 Restore IC/PCCS expansion pool-to-equipment pool line(s) to OPERABLE status.	30 days
D. One required IC/PCCS expansion pool level instrumentation channel inoperable.	D.1 Restore required channel to OPERABLE status.	20 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One required IC/PCCS expansion pool-to-equipment pool cross-connect actuation logic division inoperable.	E.1 Restore required division to OPERABLE status.	20 hours
~~D~~F. IC/PCCS pool inoperable for reasons other than Condition A, B, ~~or~~ C, D, or E.	~~D~~F.1 Restore IC/PCCS pools to OPERABLE status.	8 hours
~~E~~G. Required Action and associated Completion Time of Condition A, B, C, D, E, or F not met.	~~E~~G.1 Be in MODE 3. AND ~~E~~G.2 Be in MODE 5.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.1.1	Perform CHANNEL CHECK on each required IC/PCCS expansion pool level instrumentation channel.	12 hours
SR 3.7.1.~~1~~2	Verify water levels in the IC/PCCS expansion pools are ≥ 4.8 meters (15.75 feet).	24 hours
SR 3.7.1.~~2~~3	---------- **- NOTE -** Not required to be met in MODES 3 and 4. ---------- Verify water levels in the equipment pool and reactor well are ≥ 6.7 meters (22.0 feet).	24 hours

SURVEILLANCE		FREQUENCY
SR 3.7.1.43	Verify average water temperature in available IC/PCCS pools is ≤ 43.3°C (110°F).	24 hours
SR 3.7.1.54	Verify supply pressure to each IC/PCCS expansion pool-to-equipment pool cross-connect valve accumulator is ≥ 0.62 MPaG (90 psig).	31 days
SR 3.7.1.65	---------- **- NOTE -** Not required to be met for one initiator intermittently disabled under administrative controls. ---------- Verify continuity of DPS initiator and ~~one~~ two safety-related initiators associated with DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating~~.~~," for each IC/PCCS expansion pool-to-equipment pool cross-connect valve.	31 days
SR 3.7.1.7	Perform CHANNEL FUNCTIONAL TEST on each required IC/PCCS expansion pool level instrumentation channel.	31 days
SR 3.7.1.86	Verify the manual isolation valve on each expansion pool-to-equipment pool line and between each IC/PCCS expansion pool partition is locked open.	24 months
SR 3.7.1.97	---------- **- NOTE -** Not required to be met in MODES 3 and 4. ---------- Verify the reactor well-to-equipment pool gate is not installed.	24 months

SURVEILLANCE		FREQUENCY
SR 3.7.1.10~~8~~	---------- **- NOTES -** 1. Valve actuation may be excluded. 2. Not required to be met in MODES 3 and 4. ---------- Verify each IC/PCCS expansion pool-to-equipment pool cross-connect valve actuates on an actual or simulated automatic initiation signal.	24 months
SR 3.7.1.11~~9~~	Perform CHANNEL CALIBRATION ~~of~~ on each required IC/PCCS expansion pool level instrumentation channel~~s~~ consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.7.1.12	Perform LOGIC SYSTEM FUNCTIONAL TEST on each required division of the IC/PCCS expansion pool-to-equipment pool cross-connect actuation logic.	24 months
SR 3.7.1.13~~10~~	Verify each IC/PCCS pool subcompartment has an unobstructed path through moisture separator to the atmosphere.	10 years

BASES

BACKGROUND (continued)

For the ADS SRV opening function, three of the four solenoids on each SRV are powered by three of the four divisional safety-related power sources in the Safety System Logic and Control Engineered Safety Features (SSLC/ESF) ADS described in the Bases for LCO 3.3.5.1 and LCO 3.3.5.2. A fourth solenoid on each SRV is powered by the nonsafety-related load group, with the trip logic controlled by DPS. All ten SRVs in the ADS are controlled by the DPS through the fourth solenoid on each valve.

For the ADS DPV opening function, one of the four squib initiators on each DPV is controlled by and connected to the nonsafety-related DPS logic. The other three solenoids are controlled by the SSLC/ESF ADS logic described in the Bases for LCO 3.3.5.1 and LCO 3.3.5.2. It takes three simultaneous DPS trip signals in a triple redundant logic path to initiate the squib valve opening.

The logic application for the GDCS squib valves from the DPS is similar to that of the DPV logic application described above. For the GDCS squib valve-opening function, one of the four squib initiators on each GDCS valve is controlled by and connected to the nonsafety-related DPS logic. The DPS logic requires three simultaneous GDCS trip initiation signals to initiate a GDCS squib valve opening.

The DPS also performs selected containment isolation functions as part of the diverse ESF function using two-out-of-four sensor logic and two-out-of-three processing logic. The containment isolation functions performed by DPS include closure of the Reactor Water Cleanup and Shutdown Cooling (RWCU/SDC) isolation valves on Reactor Water Cleanup/Shutdown Cooling System Differential Mass Flow - High.

The DPS also opens equalizing valves between the equipment storage pool and the Isolation Condenser/Passive Containment Cooling System (IC/PCCS) expansion pools when a low level condition is detected in either of the IC/PCCS inner expansion pools. Each IC/PCCS pool is connected to the equipment storage pool by two cross-connect valves in parallel where one valve is a pneumatic operated valve with an accumulator and the other is a squib valve. Each expansion pool-to-equipment pool cross-connect~~isolation~~ squib valve is equipped with four~~three~~ squib initiators. The expansion pool-to-equipment pool cross-connect~~isolation~~ pneumatic valves are equipped with four~~three~~ solenoid valves (i.e., initiators). A signal to any of the four~~three~~ initiators will actuate the valve. One of the four~~three~~ initiators on each valve is actuated by DPS.

B 3.7 PLANT SYSTEMS

B 3.7.1 Isolation Condenser/Passive Containment Cooling System (IC/PCCS) Pools

BASES

BACKGROUND

The Ultimate Heat Sink (UHS) is the IC/PCCS Pools that transfer heat from the Isolation Condenser System (ICS) and the PCCS to the atmosphere (Ref. 1). The ICS removes heat from the Reactor Coolant System (RCS) following RCS isolation, a loss of feedwater or a Loss of Coolant Accident (LOCA). The PCCS removes heat from the containment following a LOCA or any transient that releases heat to the containment.

The IC/PCCS pools are located above and outside the containment boundary, directly above the drywell top slab. The condenser module associated with each ICS train and PCCS condenser is submerged in a separate subcompartment of the IC/PCCS pools. Subcompartments (i.e., pools) P3A, P3B, P3C, and P3D contain the condenser modules for the ICS trains. Subcompartments P4A, P4B, P4C, P3D, P4E, and P4F contain the condenser modules for the PCCS condensers.

Heat from the ICS and PCCS condensers is transferred to water in the associated subcompartment causing the water in the subcompartment to boil. Following reactor pressure vessel (RPV) isolation or a LOCA, subcompartment water temperature could rise to about 102°C (216°F). The steam formed will be non-radioactive and have a slight positive pressure. The steam from each subcompartment collects in the common air/steam space above the subcompartments and IC/PCCS pools. The steam is then released to the atmosphere through two large-diameter discharge vents located on opposite sides of the expansion pools. A moisture separator is installed at the entrance to the discharge vent lines to preclude excessive moisture carryover and loss of IC/PCCS pool water. No forced circulation equipment is required for operation (Refs. 2 and 3).

To support decay heat removal for 72 hours without operator action, water must be supplied to the ICS and PCCS subcompartments to replace the water lost by boiling. This water is supplied from the two IC/PCCS expansion pools, the equipment pool, and the reactor well pool.

Each ICS and PCCS subcompartment is connected to its associated expansion pool by a manually operated valve located below the water level, which allows makeup water from the expansion pool to flow into the bottom of the subcompartment. The subcompartment isolation valves are

BASES

BACKGROUND (continued)

normally locked open so that the full inventory of the associated expansion pool is available to any subcompartment. The subcompartment isolation valves can be closed to isolate a subcompartment allowing it to be emptied for maintenance of the condenser.

In addition to the ICS and PCCS subcompartments, each expansion pool is partitioned into three parts. Manually operated valves, which are normally locked open, separate each partition.

The equipment pool is connected to the reactor well pool through the reactor well gate, which is not installed during normal plant operation. By connecting the equipment pool and reactor well pool to the expansion pools, the volume of water available to the ICS and PCCS subcompartments is sufficient to support decay heat removal for 72 hours without operator action or the need to replenish the water in the expansion pools.

The equipment pool and reactor well pool are normally isolated from the expansion pools because the equipment pool and reactor well are maintained at a higher water level than the expansion pools. Each of the two expansion pools is connected to the equipment pool by two piping connections. One connection to each expansion pool is isolated by a squib-actuated cross-connect valve and the other connection is isolated by a fail-as-is double acting pneumatic piston cross-connect valve. Each connection also includes a manually operated valve, which is normally locked open. Opening one piping connection from the equipment pool to each expansion pool provides the required makeup from the equipment pool to the expansion pools.

The Safety System Logic and Control/Engineered Safety Features (SSLC/ESF) System controls the initiation signals and logic for the opening of the IC/PCCS expansion pool-to-equipment pool cross-connect valves. SSLC/ESF is a four division, separated protection logic system designed to provide a very high degree of assurance to both ensure initiation when required and prevent inadvertent initiation. The input and output trip determination is based upon a two-out-of-four logic arrangement. Each division of SSLC/ESF is configured such that all functions (e.g., the digital trip module (DTM) function and voter logic unit (VLU) function) are implemented in triply redundant processors to support the requirement that single divisional failures cannot result in inadvertent actuation.

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BACKGROUND (continued)

Four separate instrument channels are used to monitor each IC/PCCS inner expansion pool level. Signals from sensors are multiplexed at the divisional level and the triply redundant sensor data is then transmitted to the SSLC/ESF triply redundant digital trip module (DTM) function for setpoint comparison. The output of each divisional DTM function (a trip/no-trip condition) is routed to all four divisional triply redundant VLU functions such that each divisional VLU function receives input from each of the four divisional DTM functions.

For maintenance purposes and added reliability, each DTM function has a division of sensors bypass such that all instruments in that division will be bypassed in the trip logic at the VLU functions. Thus, each VLU function will be making its trip decision on a two-out-of-three logic basis for each variable. It is possible for only one division of sensors bypass condition to be in effect at any time.

The processed trip signal from its own division and trip signals from the other three divisions are processed in the triply redundant VLU function for two-out-of-four voting. All four of the IC/PCCS expansion pool-to-equipment pool cross-connect valves receive an open signal on low level in either inner expansion pool.

~~Four level instrument channels monitor each IC/PCCS expansion pool and initiate an opening signal to all four of the expansion pool-to-equipment pool isolation valves on low level in either expansion pool.~~

Each expansion pool-to-equipment pool cross-connect~~isolation~~ squib valve is equipped with ~~three~~four squib initiators. Each expansion pool-to-equipment pool cross-connect~~isolation~~ pneumatic valve is equipped with ~~three~~four solenoid valves (i.e., initiators). A signal to any of the ~~three~~four initiators will actuate the associated cross-connect valve. ~~As such, at least two of the three initiators in each valve will be associated with divisions required by LCO 3.8.6, "Distribution Systems - Operating."~~ ~~Two~~Three of the ~~three~~four initiators on each valve are actuated by ~~Safety-Related Distributed Control and Information System (Q-DCIS)~~SSLC/ESF. As such, at least two of the three safety-related initiators on each valve will be associated with divisions required by LCO 3.8.6, "Distribution Systems - Operating." The ~~third~~fourth initiator is actuated by the Diverse Protection System (DPS), which is designed to mitigate digital protection system common mode failures.

Cooling and clean up of IC/PCCS pool water is performed by Fuel and Auxiliary Pools Cooling System (FAPCS). The FAPCS includes a

separate subsystem with its own pump, heat exchanger, and water treatment unit that is dedicated for cooling and cleaning of the IC/PCCS pools to prevent radioactive contamination of the IC/PCCS pools. The FAPCS includes flow paths for post-accident make-up water transfer, from the fire protection system and off-site water supply sources to the IC/PCCS pools (Ref. 1).

APPLICABLE SAFETY ANALYSES

In the event of a LOCA, the passive PCCS is required to maintain the containment peak pressure and temperature below design limits for at least 72 hours after the LOCA without operator action (Ref. 3).

In the event of reactor isolation or a station blackout, the ICS must maintain the reactor coolant system pressure and temperature below design limits and remove core decay heat for at least 72 hours after reactor isolation without operator action (Ref. 2).

The IC/PCCS pools are also needed as a heat sink for the ICS condensers when ICS is used as a backup to the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) System for decay heat removal when shutdown.

The IC/PCCS pools satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the IC/PCCS pools are OPERABLE. Operability requires the IC/PCCS pools be maintained within specified limits for minimum level and maximum average temperature.

To ensure that the total volume of water in the IC/PCCS pools is available to the ICS and PCCS condensers, manual isolation valves between the partitions within each expansion pool and between the equipment pool and each expansion pool must be locked open. Cross-connect~~Isolation~~ valves between the equipment pool and the expansion pools must open automatically on a low water level signal from either expansion pool. Additionally, the reactor well gate, which connects the reactor well to the equipment pool, must be removed.

OPERABILITY of the expansion pool-to-equipment pool cross-connect function ~~isolation valves~~ requires OPERABILITY of three channels of ~~the~~safety-related IC/PCCS expansion pool level instrumentation in each pool and three safety-related actuation logic divisions. OPERABILITY of an instrumentation channel requires OPERABILITY of the instrumentation from the input variable sensor through the DTM function. Each

BASES

instrumentation channel must have its setpoint in accordance with Specification 5.5.11, “Setpoint Control Program (SCP).” OPERABILITY of an actuation logic division requires OPERABILITY of the circuitry from the output of the DTM function through the VLU function, the timers, and the load drivers.

LCO (continued)

OPERABILITY of each expansion pool-to-equipment pool squib ~~isolation~~cross-connect valve and pneumatic ~~isolation~~cross-connect valve requires OPERABILITY of the DPS initiator and two safety-related initiators.

The required safety-related channels, divisions, and initiators are those associated with ~~a~~the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating."

OPERABILITY of the instrumentation and actuation logic associated with the DPS initiators is addressed by LCO 3.3.8.1, “Diverse Protection System (DPS).”

APPLICABILITY

The IC/PCCS pools are required to be OPERABLE in MODES 1, 2, 3, and 4 because the PCCS and ICS could be required to respond to an event that caused pressurization and heat up of containment or the ICS could be required to respond to an RPV isolation.

Requirements for the IC/PCCS expansion pools in MODE 5 are determined by the requirements of LCO 3.5.5, "Isolation Condenser System (ICS) - Shutdown."

ACTIONS

A.1

This Condition applies when one or both expansion pools have one equipment pool cross-connect~~isolation~~ valve DPS initiator inoperable. In this Condition, required safety-related initiators will actuate the expansion pool-to-equipment pool cross-connect valves needed to support decay heat removal for 72 hours without operator action concurrent with any additional single failure, including digital protection system common mode failures.

In this Condition, the inoperable expansion pool-to-equipment pool DPS initiators must be restored to OPERABLE status the next time the plant is placed in MODE 5 (i.e., prior to entering MODE 2 or MODE 4 from MODE 5). This Completion Time is acceptable because the remaining DPS initiator and the required safety-related initiators will actuate the minimum number of expansion pool-to-equipment pool cross-connect valves required to support decay heat removal for 72 hours concurrent with any additional single failure.

ACTIONS (continued)

B.1

This Condition applies when one or both expansion pools have both equipment pool cross-connect~~isolation~~ valve DPS initiators inoperable. In this Condition, required safety-related initiators will actuate the minimum expansion pool-to-equipment pool cross-connect valves assumed in the design basis analysis concurrent with any additional single failure. However, design features intended to mitigate the possibility of digital protection system common mode failures are not available.

In this Condition, at least one DPS initiator in each affected expansion pool must be restored to OPERABLE status within 30 days. This Completion Time is acceptable because the required safety-related initiators will actuate the minimum number of expansion pool-to-equipment pool cross-connect valves required to support decay heat removal for 72 hours without operator action concurrent with any additional single failure.

C.1

This Condition applies when one or both IC/PCCS expansion pools have one equipment pool connection line inoperable for reasons other than Condition A. In this Condition, failure of an additional expansion pool-to-equipment pool connection~~isolation~~ line could result in the need for operator action to re-fill the IC/PCCS pool in less than 72 hours following any event that requires either PCCS or ICS for decay heat removal.

In this Condition, the expansion pool-to-equipment pool connection line(s) must be restored to OPERABLE status within 30 days. This Completion Time is acceptable based on engineering judgment considering that substantial decay heat removal capacity would remain available even if an additional expansion pool-to-equipment pool connection line failed and the low probability of a failure of an additional expansion pool-to-equipment pool connection line failure in conjunction with an event that requires either PCCS or ICS for decay heat removal.

ACTIONS (continued)

D.1

With one required IC/PCCS expansion pool level instrumentation channel inoperable, the affected required channel must be restored to OPERABLE status within 20 hours. In this Condition, actuation trip capability is maintained but a single failure cannot be accommodated.

The 20-hour Completion Time is acceptable based on engineering judgment considering the redundancy of the instrumentation design and the low probability of an event requiring actuation of the expansion pool-to-equipment pool cross-connect during this period.

Alternatively, if the instrumentation channel cannot be restored to OPERABLE status, Condition G must be entered and its Required Action taken when the Completion Time of Required Action D.1 expires.

It should be noted that if more than one required instrumentation channel is inoperable, then the cross-connect may not actuate as required; therefore, the IC/PCCS Pools must be declared inoperable and Condition F must be entered.

E.1

Condition E exists when one required IC/PCCS expansion pool-to-equipment pool cross-connect actuation division is inoperable. In this Condition, actuation trip capability is maintained but a single failure cannot be accommodated. The 20-hour Completion Time is acceptable based on engineering judgment considering the redundancy of the actuation design and the low probability of an event requiring cross-connect actuation during this period.

Alternatively, if the actuation division cannot be restored to OPERABLE status, Condition G must be entered and its Required Action taken when the Completion Time of Required Action E.1 expires.

It should be noted that if more than one required actuation division is inoperable, then the cross-connect may not actuate as required; therefore, the IC/PCCS Pools must be declared inoperable and Condition F must be entered.

BASES

~~D~~F.1

If the IC/PCCS pool is inoperable for reasons other than Condition A, B, ~~or~~ C, D, or E, then the ICS and PCCS may not be capable of performing their required safety function and the initial conditions used in the analyses in References 2 and 3 may not be met. Required Action ~~D~~F.1 requires that the IC/PCCS pools be restored within 8 hours. The Completion Time of 8 hours is acceptable based on the remaining heat removal capability of the IC/PCCS pools and the alternate methods for providing makeup to the IC/PCCS pools.

ACTIONS (continued)

~~E~~G.1 and ~~E~~G.2

If the Required Action and associated Completion Time of Condition A, B, C, ~~or~~ D, E, or F is not met, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and to MODE 5 within 36 hours. The Completion Times are reasonable, based on plant design, to reach required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of the IC/PCCS expansion pool level instrumentation has not occurred.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

BASES

The Surveillance Frequency is based upon operating experience that demonstrates channel failure is rare. The CHANNEL CHECK every 12 hours supplements less formal, but more frequent checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.21 and SR 3.7.1.32

This SR requires verification every 24 hours that the water levels in each expansion pool and the water level in the equipment pool or reactor well are within specified limits. These levels are necessary to ensure that the volume of water in the IC/PCCS pools is sufficient to support decay heat removal via the ICS and/or the PCCS for 72 hours without the need to replenish the water in the expansion pools. The 24 hour frequency is acceptable because abnormal water levels are identified by alarms and indication in the control room.

SR 3.7.1.32 is modified by a Note that specifies that this SR is not required to be met in MODES 3 and 4. Considering the reduced decay heat loads following events initiated after the reactor is shut down, isolation of these pools from the IC/PCCS expansion pools when in Modes 3 and 4 will not result in a significant reduction in the 72 hours assumed available to provide makeup to the IC/PCCS pools.

SR 3.7.1.43

This SR requires verification every 24 hours that the bulk average temperature of the available IC/PCCS pools is ≤ 43.3°C (110°F). The bulk average temperature is calculated based on the volume and temperature of the water in the expansion pools, the connected ICS and PCCS subcompartments (isolated subcompartments are addressed in LCO 3.5.4, "Isolation Condenser System (ICS) - Operating" and LCO 3.6.1.7, "Passive Containment Cooling System (PCCS)," respectively), the equipment pool, and the reactor well. The water volume in any isolated subcompartments, or the equipment pool when inoperabilities render it unavailable, are not averaged to meet the requirements of SR 3.7.1.43. This value for the average temperature of the IC/PCCS pools is an assumption in the analyses described in References 2 and 3 that determined that the heat sink capacity of the IC/PCCS pools is sufficient to support decay heat removal for 72 hours without the need to replenish the water in the expansion pools. The 24-hour frequency is acceptable because operators will be promptly alerted to abnormal water temperatures by alarms and indication in the control room.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.54

This SR requires periodic verification that the supply pressure to the expansion pool-to-equipment pool pneumatic cross-connectisolation valve accumulators (i.e., Instrument Air System (IAS)) is greater than or equal to the specified limit. An accumulator on each expansion pool-to-equipment pool pneumatic cross-connectisolation valve provides pneumatic pressure for valve actuation. The 31-day Frequency is acceptable because IAS low-pressure alarms provide prompt notification of an abnormal pressure in the IAS.

SR 3.7.1.65

This SR requires a periodic verification of the continuity of the DPS initiator and onetwo safety-related initiators associated with DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating," for each expansion pool-to-equipment pool cross-connectisolation valve.

The 31-day Frequency is acceptable because either of the expansion pool-to-equipment pool lines for each expansion pool is capable of performing the required function. Additionally, an alarm will provide prompt notification of loss of circuit continuity for the required initiators in each expansion pool-to-equipment pool cross-connect valve.

This SR is modified by a Note that continuity is not required to be met for one required initiator intermittently disabled under administrative controls. This allows the continuity monitor to be tested and allows surveillance and maintenance with the assurance that the valve will not be opened inadvertently.

SR 3.7.1.7

A CHANNEL FUNCTIONAL TEST is performed on each required IC/PCCS expansion pool level instrumentation channel to ensure the entire channel will perform the intended function. This test ensures a complete CHANNEL FUNCTIONAL TEST of required instrument channels from the sensor input through the DTM function.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

The Frequency of 31 days is based on the reliability of the instrumentation channels.

SR 3.7.1.8~~6~~

This SR requires verification every 24 months that the manual isolation valve on each expansion pool-to-equipment pool line and between each IC/PCCS expansion pool partition is locked open. This SR is needed to ensure that the full volume of water in each expansion pool is available to the ICS and PCCS subcompartments. If this SR is not met, the ICS and PCCS may not be capable of performing their design functions. The 24-month Frequency for this SR is based on engineering judgment and is acceptable because the manual isolation valves between the IC/PCCS pool partitions are locked open and maintained in their correct position under administrative controls.

SR 3.7.1.9~~7~~

This SR requires verification every 24 months that the reactor well-to-equipment pool gate is not installed. This SR is necessary to ensure that the volume of water in the reactor well is available to the ICS and/or the PCCS condensers. The volume of water in the reactor well is needed to support decay heat removal for 72 hours without the need to replenish the water in the expansion pools. The 24-month frequency is acceptable because installation of the reactor well-to-equipment pool gate is a significant change in plant status that would not occur without the cognizance of the operators.

This SR is modified by a Note that specifies that this SR is not required to be met in MODES 3 and 4. Considering the reduced decay heat loads following events initiated after the reactor is shutdown, isolation of this pool from the IC/PCCS expansion pools when in Modes 3 and 4 will not result in a significant reduction in the 72 hours assumed available to provide makeup to the IC/PCCS pools.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.108

This SR requires verification every 24 months that each cross-connectisolation valve between the IC/PCCS expansion pools and the equipment pool actuates on an actual or simulated automatic initiation signal. At least one of the two cross-connect valves that isolate each expansion pool from the equipment pool must be open to ensure that the volume of water in the equipment pool and the reactor well is available to the ICS and/or the PCCS condenser. The volume of water in the reactor well and the equipment pool is needed to support decay heat removal for 72 hours without the need to replenish the water in the expansion pools. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.7.1.12 and LCO 3.3.8.1 overlaps this SR to provide complete testing of the assumed safety function.

This 24-month Frequency is consistent with the normal refueling interval. This interval will allow the SR to be performed during a plant outage. This SR is modified by a Note that excludes valve actuation as a requirement for this SR to be met. This is acceptable because the valves are subject to the Inservice Test Program.

This SR is modified by a Note that specifies that this SR not required to be met in MODES 3 and 4. Considering the reduced decay heat loads following events initiated after the reactor is shutdown, isolation of this pool from the IC/PCCS expansion pools when in Modes 3 and 4 will not result in a significant reduction in the 72 hours assumed available to provide makeup to the IC/PCCS pools.

SR 3.7.1.119

This SR requires a CHANNEL CALIBRATION of IC/PCCS expansion pool level instrumentation channels that actuate the expansion pool-to-equipment pool squib cross-connectisolation valves and pneumatic cross-connectisolation valves. CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameters within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to the required nominal trip setpoint within the "as-left tolerance" to account for instrument drifts between successive calibrations consistent with the methods and assumptions required by the Setpoint Control Program. The Frequency is based upon the assumption of a 24-month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.1.12

This SR requires performance of a LOGIC SYSTEM FUNCTIONAL TEST for the logic associated with automatic opening of the IC/PCCS expansion pool-to-equipment pool cross-connect valves. The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required logic for a specific division.

The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.7.1.13~~10~~

This SR requires verification every 10 years that each ICS and PCCS pool subcompartment has an unobstructed path for steam release through moisture separator to the atmosphere. This SR is needed to ensure that steam formed in the ICS and PCCS subcompartments will be properly vented to the atmosphere. The Frequency is based on engineering judgment and the simplicity of the design. This Frequency is acceptable because the flow path from the ICS subcompartments to the expansions pool area and through the moisture separators will be verified whenever the ICS is used.

REFERENCES

1. Chapter 9.
2. Chapter 5.
3. Chapter 6.