TVA

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Timothy P. Cleary
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April 21, 2009

TVA-SQN-TS-07-05 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-001

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority (TVA)	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - TECHNICAL SPECIFICATION (TS) CHANGE NO. 07-05, "EMERGENCY CORE COOLING SYSTEM (ECCS)"

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for a TS change (TS Change 07-05) to Licenses DPR-77 and DPR-79 for SQN Units 1 and 2. The proposed TS change upgrades ECCS requirements to be more consistent with the Improved Standard TS for Westinghouse plants contained in NUREG-1431, Revision 3. The upgrade revises SQN TS Sections 3.5.2, "ECCS Subsystems – T_{avg} greater than or equal to 350°F," and 3.5.3, "ECCS Subsystems – T_{avg} less than 350°F." The proposed upgrade is considered by TVA to be a TS improvement for aligning SQN's requirements with standard industry requirements.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the change is exempt from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). The SQN Plant Operations Review Committee and the SQN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of SQN Units 1 and 2, in accordance with the proposed change, will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Tennessee State Department of Public Health.

This is not a risk informed TS change request and no TVA commitments are associated with the proposed request. TVA requests approval of this TS change by the end of November 2009.

In addition to upgrading the ECCS specifications to be consistent with the Improved Standard TS content, this change will allow for resolution of a nonconforming condition. TVA requests that the revised TS be made effective within 60 days of NRC approval.

If you have any questions about this change, please contact Beth A. Wetzel at (423) 843-7170.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 21st day of April 2009.

Sincerely,

Timothy P. Cleary

Timothy P. Cleary
Site Vice President

Enclosure:
Evaluation of the Proposed Changes

Enclosure

cc (Enclosure):

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ENCLOSURE

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNITS 1 AND 2
DOCKET NOS. 327 AND 328

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE 07-05
EVALUATION OF THE PROPOSED CHANGE

1.0. SUMMARY DESCRIPTION

TVA is submitting a proposed revision to the SQN TSs for Units 1 and 2 to upgrade Specification 3/4 5.2, "ECCS Subsystems – T_{avg} greater than or equal to 350˚F," and Specification 3/4 5.3, "ECCS Subsystems – T_{avg} less than 350˚F," to the Improved Standard TSs (ISTS) for Westinghouse plants (NUREG-1431, Revision 3). The proposed conversion provides TS improvements to SQN's current TSs and updates the current requirements to be consistent with industry standard TS requirements.

Additionally, this proposed revision resolves a non-conforming condition associated with Surveillance Requirement (SR) 4.5.2.f. SR 4.5.2.f contains specific pump discharge pressure requirements for emergency core cooling system (ECCS) quarterly minimum flow recirculation testing. The discharge pressure values for the safety injection pumps and the centrifugal charging pumps are non-conservative to ensure that the performance of the ECCS pumps is consistent with the minimum performance credited by the plant safety analyses and ASME Section XI test criteria. Although compliance with SR 4.5.2.f is being met, surveillance testing of the ECCS pumps is being performed in accordance with ASME Section XI inservice inspection requirements, in accordance with TS 4.0.5. The in-service inspection program testing acceptance criteria are based on the more rigorous performance requirements assumed in the plant safety analyses. Compliance with the inservice testing criteria ensures that the safety analyses minimum performance requirements are met. The proposed change will resolve this non-conforming condition.

2.0. DETAILED DESCRIPTION

TVA's proposed change updates SQN's current ECCS TS SR 3/4 5.2 and 3/4 5.3. The proposed change replaces the existing ECCS requirements with the ISTS requirements while retaining existing format and style of the SQN TSs. The proposed conversion includes administrative changes (i.e., title changes, editorial changes, and format changes), relocation of existing TSs information (relocation of information to the TS Bases or other licensing basis documents), and incorporation of standard TS requirements. Each of the proposed changes is described below.

TVA has evaluated each change for determining significance and impact to SQN's existing design basis and licensing basis requirements. The revisions are categorized below and are described as being more restrictive, less restrictive, or neutral.

The following provides a description of the changes associated with SQN TS 3.5.2.

1) Title Change for TS 3/4 5.2

TVA's proposed change replaces the current title ("ECCS Subsystems – T_{avg} greater than or equal to 350˚F") with the standard title ("ECCS – Operating"). The proposed change is administrative in nature and is considered neutral because it does not affect existing ECCS requirements or other related specifications. In addition to the title changes for TS 3/4 5.2, associated TS index pages are revised to reflect the title change.

2) Limiting Condition for Operation (LCO)

SQN LCO 3.5.2 currently reads as follows:

3.5.2 Two independent ECCS subsystems shall be OPERABLE with each subsystem comprised of:

a. One OPERABLE centrifugal charging pump,
b. One OPERABLE safety injection pump,
c. One OPERABLE residual heat removal heat exchanger,
d. One OPERABLE residual heat removal pump, and
e. An OPERABLE flow path capable of taking suction from the refueling water storage tank on a safety injection signal and automatically transferring suction to the containment sump during the recirculation phase of operation.

TVA's proposed change replaces the current LCO with the standard LCO language that reads:

3.5.2 Two ECCS trains shall be OPERABLE.

TVA's proposed change replaces "two independent subsystems" with the standard language "two ECCS trains." In addition, the plant components that are listed in SQN's LCO and comprise a "subsystem" are removed. The description of components is no longer part of the LCO but is relocated to the proposed ECCS TS Bases section. The components that make up a standard "ECCS train" are described in the LCO section of the standard TS Bases and comprise the same set of components that currently exist in SQN's LCO. TVA's proposed relocation of the ECCS components and the adoption of the standard language for these components remains consistent with the standard requirements. Accordingly, TVA's proposed change to the LCO provides the appropriate level of detail. Because TS Bases information is a licensee controlled document, the proposed change to the LCO is considered to be less restrictive.

The notes for LCO 3.5.2 are being revised to be consistent with NUREG-1431. Note 1 is being added to allow for up to 2 hours to perform pressure isolation valve testing per SR 4.4.6.3. This change is considered to be less restrictive. Note 2 adds the (350°F) low temperature overpressure protection (LTOP) arming temperature to the note to be consistent with standard ISTS language. This change is considered to be neutral.

The notes are:

1. In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve testing per SR 4.4.6.3.

2. In MODE 3, ECCS pumps may be made incapable of injecting to support transition into or from the APPLICABILITY of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to 4 hours or until the temperature of all RCS cold legs exceeds LTOP arming temperature (350°F) specified in the PTLR plus 25°F, whichever comes first.

3) <u>Applicability</u>

The applicability of SQN TS 3.5.2 is equivalent to the ISTS and thus there is no proposed change in applicability.

4) <u>Action</u>

The SQN TS action requirement currently reads as follows:

With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

TVA's proposed change replaces the above action with two actions that state:

a. With one or more trains inoperable, and with at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, restore the inoperable train(s) to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

b. With less than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, immediately enter LCO 3.0.3.

TVA's proposed change replaces SQN's current single action with two separate standard action requirements. In action a., language from SQN's current action (i.e., subsystem) is replaced with standard language (i.e., one or more trains). These changes to the standard requirements provide an improvement in the level of detail over SQN's current action requirement. The change to "one or more trains" expands the application of the action to include additional ECCS trains that may be determined to be inoperable. As ECCS trains involve diverse subsystems with multiple components, there may be different components, each in a different train that may be inoperable; however, the ECCS function is not lost. Consequently, when the ECCS function for a single "OPERABLE ECCS" train is available, an allowed outage time of 72 hours is applied for restoring the inoperable ECCS train. It is this clarification that provides increased flexibility in plant operations when components in opposite trains (i.e., one or more trains) are rendered inoperable. In addition to these changes, action (a) provides for plant shutdown in the event a single "OPERABLE ECCS" train cannot be rendered operable within the allowed outage time. In the ISTS, to achieve plant shutdown, the plant must be brought to Mode 3 (Hot Standby) within 6 hours and to Mode 4 (Hot Shutdown) within 12 hours (i.e., the following 6 hours). The standard shutdown time is equivalent to SQN's current shutdown time and is appropriate for the proposed action (a).

TVA's proposed change adds action (b) that provides measures for immediate entry into LCO 3.0.3 when less than 100 percent of the ECCS flow equivalent to a single "OPERABLE ECCS" train is not available. This action ensures that plant operation does not continue outside the accident analyses. This action provides an improvement over SQN's current action requirements. Accordingly, TVA considers this proposed change to be less restrictive.

5) Surveillance Requirements (SRs)

The SQN SR 4.5.2 currently is:

Each ECCS subsystem shall be demonstrated OPERABLE:

TVA's proposed change to SR 4.5.2 is:

Each ECCS train shall be demonstrated OPERABLE:

TVA's proposed change replaces the term "subsystem" with the term "train." This change, as previously discussed, is editorial in nature because the term "train" is being clearly defined in the TS Bases section. Accordingly, TVA considers this proposed change to be neutral.

TVA's propose changes to SR 4.5.2 (b) through (h) are described below:

The current SR 4.5.2.b. is:

At least once per 31 days by:

1. Verifying that the ECCS piping is full of water by venting the ECCS pump casings and accessible discharge piping high points, and

2. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

TVA's proposed change to SR 4.5.2.b states:

At least once per 31 days by:

1. Verify ECCS piping is full of water by venting the ECCS pump casings and accessible piping high points, and

2. Verify each ECCS manual, power operated and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position.

SQN's existing SR 4.5.2.b provides venting requirements for ECCS discharge piping and components. TVA is upgrading SQN SR 4.5.2.b to the ISTS requirements to address the suction piping of ECCS by deleting the word discharge from the SR. Additionally, SR 4.5.2.b.2 is being revised to adopt ISTS language. Accordingly, TVA considers these proposed changes to be more restrictive.

The current SR 4.5.2.c is:

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

   1. For all accessible areas of the containment prior to establishing CONTAINMENT INTEGRITY, and

   2. Of the areas affected within containment at the action of each containment entry when "CONTAINMENT INTEGRITY" is established.

TVA's proposed change relocates this surveillance from SQN TSs to existing plant procedures. The surveillance for performing a visual inspection when establishing containment integrity has been removed from ISTS. This surveillance is typically controlled in the nuclear industry by plant procedures that establish and maintain containment integrity. Accordingly, this SR is no longer in the ISTS for ECCS. TVA's proposed change for relocating this SR to existing plant procedures is consistent with the ISTS and TVA considers this change to be a less restrictive change.

SQN's current SR 4.5.2.d is:

d. At least once per 18 months by:

   1. Deleted.

   2. A visual inspection of the containment sump and verifying the subsystem suction inlets are not restricted by debris and that the sump components (trash rack, screens, etc.) show no evidence of structural distress or corrosion.

TVA's proposed change to SR 4.5.2.d states:

d. At least once per 18 months perform a visual inspection of the containment sump and verify the suction inlets are not restricted by debris and that the sump components (strainers, screens, etc.) show no evidence of structural distress or corrosion.

TVA proposes to revise SR 4.5.2.d to incorporate the standard SR for sump inspection. The standard surveillance provides a description of the sump components required to be visually inspected (i.e., trash racks and screens). TVA's proposed change deletes the word subsystem and replaces the term "trash racks" with "strainers." This change in terminology is editorial in nature and reflects recent plant modifications that were performed to install strainers over the opening of SQN's containment sump. SQN's containment sump was originally designed with a mesh screen framework that covered the sump opening. Following issuance of NRC Generic Letter 2004-02, plant modifications were performed to replace the screen design with a strainer design.

Note that the term "trash racks" has never been a part of SQN's sump design history. This term was used during SQN's application for full power license and was standard

TS language at that time. It may be noted that the term "screen" remains applicable within SR 4.5.2.d because the opening of the ECCS suction inlet piping (located inside the containment sump) is covered with a meshed screen and must be visually inspected. Therefore, TVA considers this change to be neutral.

The current SR 4.5.2.e is:

e. At least once per 18 months, during shutdown by:

   1. Verifying that each automatic valve in the flow path actuates to its correct position on a safety injection test signal and automatic switchover to containment sump test signal.

   2. Verifying that each of the following pumps start automatically upon receipt of a safety injection signal:

      a) Centrifugal charging pump

      b) Safety injection pump

      c) Residual heat removal pump

TVA's proposed change to SR 4.5.2.e states:

e. At least once per 18 months by:

   1. Verifying that each automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to its correct position on an actual or simulated actuation signal.

   2. Verifying that each ECCS pump starts automatically on an actual or simulated actuation signal.

TVA's proposed change to SR 4.5.2.e adds ISTS language that provides clarification to SQN's existing SR.

The first proposed change removes the language "during shutdown" from the 18 month frequency description. The standard Bases states the reasons for performing surveillances during plant shutdown conditions. Consequently, this level of detail is not necessary for inclusion in the TSs and is removed. Changes to the Bases are controlled in accordance with administrative controls and 10 CFR 50.59 that ensure that any changes are appropriately reviewed. Accordingly, this proposed change is considered less restrictive.

The second proposed change is to SR 4.5.2.e.1 and involves the addition of ISTS language; "that is not locked, sealed, or otherwise secured." Addition of this phrase is an improvement that defines those ECCS valves in the flow path that must be verified to actuate to their correct post-accident position. In addition, it may be noted that the addition of this phrase provides consistency with other portions of the SQN TSs (i.e., Containment, Section 6.0) that already utilize the standard language. The addition of ISTS language does not alter the selection of automatic ECCS valves required to be verified by SQN's SR. The population of valves within the flow path remains unchanged. Accordingly, TVA considers the addition of this ISTS language to be an improvement that is neutral.

The third change provides a revision to SQN SR 4.5.2.e.1 that incorporates ISTS language associated with the ECCS actuation signal. The ISTS language verifies that each ECCS automatic valve in the flow path actuates to the correct position on an “actual” or “simulated actuation signal.” SQN’s SR 4.5.2.e.1 accomplishes actuation of ECCS by initiating a manual safety injection signal. This is accomplished through manual hand switches in the main control room. In conjunction with the safety injection signal, SQN’s SR calls for initiation of a containment swap-over signal to verify that certain automatic ECCS valves realign from the refueling water storage tank (RWST) to the containment sump. The containment swap-over signal is initiated by actuation of bistables in the instrument racks that make up the proper logic for initiation of this signal. TVA considers the proposed change to be neutral because the test methodology remains unchanged for actuation of an ECCS signal.

The fourth change provides a revision to SQN SR 4.5.2.e.2 that incorporates ISTS language associated with the ECCS automatic start and eliminates the pump listing. TVA considers the proposed change to be neutral because the test methodology remains unchanged for the ECCS pumps.

The current SQN SR 4.5.2.f is:

f. By verifying that each of the following pumps develops the indicated discharge pressure on recirculation flow when tested pursuant to Specification 4.0.5:

1.	Centrifugal charging pump	Greater than or equal to 2400 psig
2.	Safety Injection pump	Greater than or equal to 1407 psig
3.	Residual heat removal pump	Greater than or equal to 165 psig

TVA’s proposed change to SR 4.5.2.f states:

f. By verifying that each ECCS pump’s developed head at the test flow point is greater than or equal to the required developed head when tested in accordance with the Inservice Test Program of Specification 4.0.5.

TVA’s proposed upgrade to SR 4.5.2.f is an improvement that provides consistency with the ISTS. The proposed change eliminates the listing of ECCS pumps with their associated discharge pressures and the specific requirement to test the ECCS pumps on recirculation flow (miniflow). TVA’s proposed change adopts the standard SR for pump testing at the test flow point that is greater than or equal to the required developed head. Pump performance may be verified with more accuracy at the required developed head or at higher flows. As such, TVA’s proposed change allows the American Society of Mechanical Engineers (ASME) Inservice Test (IST) Program to determine and specify the test methods and flow(s) required to verify pump performance. Accordingly, the current list of ECCS pumps with their associated discharge pressures is relocated from the TSs to SQN’s IST Program as referenced in SQN TS 4.0.5. TVA considers the proposed change to be less restrictive.

SQN's current SR 4.5.2.g is:

g. By verifying the correct position of each mechanical stop for the following ECCS throttle valves:

1. Within 4 hours following action of each valve stroking operation or maintenance on the valve when the ECCS subsystems are required to be OPERABLE.

2. At least once per 18 months.

Charging Pump Injection Throttle Valves	Safety Injection Cold Leg Throttle Valves	Safety Injection Hot Leg Throttle Valves
1. 63-582	1. 63-550	1. 63-542
2. 63-583	2. 63-552	2. 63-544
3. 63-584	3. 63-554	3. 63-546
4. 63-585	4. 63-556	4. 63-548

TVA's proposed change to SR 4.5.2.g states:

g. At least once per 18 months verify the correct position of each mechanical stop for the following ECCS throttle valves.

Charging Pump Injection Throttle Valves	Safety Injection Cold Leg Throttle Valves	Safety Injection Hot Leg Throttle Valves
1. 63-582	1. 63-550	1. 63-542
2. 63-583	2. 63-552	2. 63-544
3. 63-584	3. 63-554	3. 63-546
4. 63-585	4. 63-556	4. 63-548

TVA's proposed change relocates SQN SR 4.5.2.g.1 to plant procedures. The requirement for verifying ECCS throttle valve stop position after valve stroking or maintenance is to be governed by plant procedures consistent with ISTS. At SQN, the ECCS throttle valves are manual needle valves that are locked in position and do not realign on a safety injection signal. As such, it is sufficient to control these valves via maintenance procedures and the locked valve program. In the ISTS, post-maintenance test requirements have been removed from the TSs. Plant procedures govern the restoration of plant equipment after maintenance and must specify the appropriate post-maintenance testing. TVA considers this proposed change to be less restrictive.

TVA's current SR 4.5.2.h is:

h. By performing a flow balance test during shutdown following action of modifications to the ECCS subsystem that alter the subsystem flow characteristics and verifying the following flow rates:

1. For safety injection pump lines with a single pump running:

    a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 443 gpm, and

    b. The total pump flow rate is less than or equal to 675 gpm.

2. For centrifugal charging pump lines with a single pump running:

    a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 309 gpm, and

    b. The total pump flow rate is less than or equal to 555 gpm.

3. For all four cold leg injection lines with a single RHR pump running a flow rate greater than or equal to 3931 gpm.

TVA's proposed change relocates SQN SR 4.5.2.h to plant procedures. The requirement for performing a flow balance test following ECCS modifications is no longer required as part of the ISTS and is relocated from SQN's TSs. The proposed change is consistent with ISTS in that post-maintenance testing is more appropriately governed by plant procedures. The restoration of equipment after maintenance is specified by the appropriate post-maintenance test procedure. Accordingly, TVA considers the proposed change to be less restrictive.

TVA's proposed changes to SQN TS 3.5.3 are summarized below:

1) Title Change for TS 3/4 5.3

TVA's proposed change replaces the current title ("ECCS Subsystems – T_{avg} less than 350˚F") with the standard title ("ECCS – Shutdown"). The proposed change is administrative in nature and does not affect existing ECCS requirements or other related specifications. In addition, associated TS index pages are revised to reflect the title change for TS 3/4.5.3.

2) Limiting Condition for Operation (LCO)

SQN's current LCO 3.5.3 reads as follows:

As a minimum one ECCS subsystem comprised of the following shall be OPERABLE:

a. One OPERABLE centrifugal charging pump,
b. One OPERABLE residual heat removal heat exchanger,
c. One OPERABLE residual heat removal pump, and
d. An OPERABLE flow path capable of taking suction from the refueling water storage tank upon being manually realigned and automatically transferring suction to the containment sump during the recirculation phase of operation.

TVA's proposed change replaces the current LCO with the standard LCO language that states:

3.5.3 One ECCS train shall be OPERABLE.

TVA's proposed revision to the LCO remains consistent with ISTS requirements for ECCS. For SQN, as with the standard, only one train of ECCS is required in Mode 4 such that single failure is not considered. A train of ECCS consists of a centrifugal charging subsystem and an residual heat removal (RHR) subsystem. Due to the stable conditions associated with Mode 4, and the reduced probability of occurrence of a Design Basis Accident (DBA), SQN's ECCS operational requirements are reduced for this mode of plant operation. It is noted that full ECCS capability may not be available and manual operator action may be utilized to initiate ECCS, as required. This is discussed in Section 6.3.1.4 of the SQN Updated Final Safety Analysis Report (UFSAR). Manual actuation of ECCS is recognized by the ISTS in the applicable Safety Analyses section of the standard Bases. Accordingly, TVA's proposed change is considered acceptable for conversion to standard requirements. TVA considers the proposed change to be neutral.

The note for LCO 3.5.3 is being added to be consistent with NUREG-1431. The note for the LCO is "An RHR train may be considered OPERABLE during alignment and operation for decay heat removal if capable of being manually realigned to the ECCS mode of operation." This change is considered to be neutral.

3) Applicability

The applicability of SQN TS 3.5.3 is equivalent to the ISTS and thus there is no proposed change in applicability.

4) Action

The SQN TS action requirements currently are:

a. With no ECCS subsystem OPERABLE because of the inoperability of either the centrifugal charging pump or the flow path from the refueling water storage tank, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours. LCO 3.0.4.b is not applicable.

b. With no ECCS subsystem OPERABLE because of the inoperability of either the residual heat removal heat exchanger or residual heat removal pump, restore at least one ECCS subsystem to OPERABLE status or maintain the Reactor Coolant System T_{avg} less than 350˚F by use of alternate heat removal methods.

TVA's proposed change replaces the current action requirements with the following standard action requirements:

a. With the required ECCS residual heat removal (RHR) subsystem inoperable, immediately initiate action to restore required ECCS RHR subsystem to OPERABLE status.

b. With the required ECCS centrifugal charging subsystem inoperable, within one hour, restore required ECCS centrifugal charging subsystem to OPERABLE status, or be in COLD SHUTDOWN within the next 24 hours.

TVA's proposed change adopts ISTS action requirements and language that address either of two conditions; an inoperable RHR subsystem or an inoperable centrifugal charging subsystem. For the condition involving an inoperable RHR subsystem (SQN's current action [b]), the standard incorporates immediate action for restoring a required RHR subsystem. This change is considered a TS improvement that provides a level of urgency for ensuring prompt action is taken to restore required cooling capacity. In addition, SQN's current action (b) provides an option for "maintaining the Reactor Coolant System T_{avg} less than 350˚F by use of alternative heat removal methods," if at least one ECCS subsystem is not restored. TVA's proposed change removes this option from the action requirement. Although this option is no longer part of the action, TVA's proposed change adopts the ISTS Bases for ECCS 3.5.3 (refer to Bases Section A.1) that describes the option to the operator for an alternate method of heat removal (i.e., use of steam generators). Accordingly, TVA's proposed change to SQN's action (b) provides the level of detail consistent with standard requirements.

TVA's proposed change to SQN's current action (a) adopts the equivalent actions provided by the standard action requirements. The action requires the operator to restore the required centrifugal charging subsystem to operable status within 1 hour. In addition, provisions for plant shutdown to Mode 5 are changed to have the action time of 24 hours. This provision provides an additional 3 hours to be in Mode 5 and is consistent with ISTS. Accordingly, TVA's proposed changes to the actions provide improvements over existing action requirements and are considered less restrictive.

The note for the ACTIONS is "LCO 3.0.4b is not applicable to ECCS centrifugal charging subsystem." The note is being relocated from the specific action to a note that applies to the action and is consistent with standard formatting.

A second note being added is "The required ECCS residual heat removal (RHR) subsystem may be inoperable for up to 1 hour for surveillance testing of valves provided that alternate heat removal methods are available via the steam generators to maintain reactor coolant system T_{avg} less than 350 degrees F and provided that the required subsystem is capable of being manually realigned to the ECCS mode of operation."

The second note was added to allow the required ECCS RHR subsystem to be inoperable because of surveillance testing of RCS pressure isolation valve leakage. This allows testing while RCS pressure is sufficient to obtain valid leakage data and following valve closure for RHR decay heat removal path. The condition requiring alternate heat removal methods ensures that the RCS heatup rate can be controlled to prevent Mode 3 entry and thereby ensure that the reduced ECCS operational requirements are maintained. The condition requiring manual realignment capability ensures that in the unlikely event of a DBA during the one hour of surveillance testing, the RHR subsystem can be placed in ECCS recirculation mode when required to mitigate the event. This note for LCO 3.5.3.a is consistent with TVA's Watts Bar TSs.

The relocation of the note concerning LCO 3.0.4 applicability and the note allowing one hour for surveillance testing are considered to be neutral.

5) Surveillance Requirement (SR)

The current SQN SR 4.5.3 is:

The ECCS subsystem shall be demonstrated OPERABLE per the applicable Surveillance Requirements of 4.5.2.

TVA's proposed change states:

The ECCS train shall be demonstrated OPERABLE per the following applicable Surveillance Requirements of 4.5.2: 4.5.2.b.1, 4.5.2.d, 4.5.2.f, 4.5.2.g.

The proposed change is administrative in nature and does not affect existing TS ECCS requirements or other related specifications. The change replaces subsystem with train and defines the applicable SRs of 4.5.2. TVA's proposed change is considered acceptable for conversion to standard requirements. TVA considers the proposed change to be neutral.

In summary, TVA's proposed changes remain consistent with the requirements provided by Specifications 3.5.2 and 3.5.3 of NUREG-1431, Revision 3. A proposed TS markup of the changes is provided in Attachment 1. In addition, associated revisions proposed for the TS Bases sections are provided in Attachment 2.

3.0 TECHNICAL EVALUATION

The ECCS at SQN consists of three separate subsystems: centrifugal charging (CC) (high head), SI (intermediate head) and RHR (low head). Each of these subsystems consists of two independent and redundant 100 percent capacity trains.

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a) Loss of coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system,
b) Rod ejection accident
c) Loss of secondary coolant event, including uncontrolled steam release or loss of feedwater, and
d) Steam generator tube rupture (SGTR).

The analyses and acceptance criteria for the consequences of each of these accidents is described in the respective accident analyses sections of the SQN UFSAR, Chapter 15. The analysis specified by 10 CFR 50.46 "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors," is presented in Section 15.4.1 and shows compliance with the acceptance criteria; that is,

1. The calculated peak fuel element clad temperature provides margin to the requirement of 2200°F, based on an F_q value of 2.32.

2. The amount of fuel element cladding that reacts chemically with water or steam does not exceed 1 percent of the total amount of zirconium alloy in the reactor.

3. The clad temperature transient is terminated at a time when the core geometry is still amenable to cooling. The clad oxidation limits of 17 percent are not exceeded during or after quenching, and,

4. The core temperature is reduced and decay heat is removed for an extended period of time, as required by the long-lived radioactivity remaining in the core.

In addition to compliance with 10 CFR 50.46, the SQN ECCS is designed to comply with General Design Criteria 35 of the 10 CFR 50, Appendix A and is discussed in Section 3.1 of the SQN UFSAR. Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities are provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure. It is noted that during plant shutdown conditions, full ECCS capability may not be available. Operator action is utilized to initiate ECCS as required. The manual action is consistent with the ISTS for ECCS and is described in the standard ECCS TS Bases for ECCS (refer to the Applicable Safety Analysis portion of Bases Section 3.5.3).

The SQN ECCS TSs were developed from standard requirements available in the early 1980s at the time SQN received approval for a full power license. SQN's ECCS TSs have provided the operability requirements for ECCS components during plant operation (Modes 1, 2, and 3) and during plant shutdown (Mode 4). The current TS for plant operation (TS 3/4.5.2) entitled "ECCS SUBSYSTEMS – T_{avg} greater than or equal to 350°F," requires two independent ECCS subsystems OPERABLE with each subsystem comprised of the following components:

1) one OPERABLE centrifugal charging pump
2) one OPERABLE safety injection pump
3) one OPERABLE RHR heat exchanger
4) one OPERABLE RHR pump
5) an OPERABLE flow path capable of taking suction from the RWST on a SI signal and automatically transferring suction to the containment sump during the recirculation phase of operation.

Similarly, SQN's current TS for plant shutdown (TS 3/4.5.3), entitled "ECCS SUBSYSTEMS – T_{avg} less than 350˚F," requires as a minimum, one ECCS subsystem to be "OPERABLE." The same components listed in the LCO for TS 3/4.5.2 are required for TS 3/4.5.3 with the exception of item 2 above (one OPERABLE safety injection pump) that is not required for Mode 4.

TVA's proposed upgrade of SQN's ECCS specifications provides equivalent operability requirements for SQN's ECCS components. TVA has evaluated SQN's ECCS design and licensing basis against the proposed ECCS TS changes and has determined that the proposed changes provide an overall improvement to SQN TSs with continued assurance that SQN's ECCS satisfies existing operability requirements for SQN's ECCS components. In addition, SQN's ECCS design requirements remain in compliance with 10 CFR 50, Appendix A, and 10 CFR 50.46.

4.0 REGULATORY EVALUATION

TVA is proposing to update the current TS requirements of SQN TS 3/4.5.2, entitled "ECCS SUBSYSTEMS – T_{avg} greater than or equal to 350˚F" and TS 3/4.5.3 entitled "ECCS SUBSYSTEMS – T_{avg} less than 350˚F." TVA's proposed change will provide a general TS improvement that standardizes the existing requirements for SQN's ECCS.

TVA has concluded that operation of SQN Units 1 and 2 in accordance with the proposed change to SQN TSs 3/4.5.2 and 3/4.5.3 does not involve a significant hazards consideration. TVA's conclusion is based on its evaluation, in accordance with 10 CFR 50.91(a)(1), of the three standards set forth in 10 CFR 50.92(c).

4.1 Applicable Regulatory Requirements/Criteria

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The Commission's regulatory requirements related to the content of the TSs are contained in Title 10, Code of Federal Regulations (10 CFR), Section 50.36. The TS requirements in 10 CFR 50.36 include the following categories: (1) safety limits, limiting safety systems settings and control settings, (2) limiting conditions for operation, (3) surveillance requirements (SRs), (4) design features, and (5) administrative controls. Regulatory requirements associated with SQN's emergency core cooling system (ECCS) are based on 10 CFR 50.46 and General Design Criteria (GDC) 35 of Appendix A from 10 CFR 50. The ECCS is designed in accordance with accepted engineered safety feature design practices.

As stated in 10 CFR 50.59(c)(1)(i), a licensee is required to submit a license amendment pursuant to 10 CFR 50.90 if a change to the TSs is required. Furthermore, the requirements of 10 CFR 50.59 necessitate that U.S. Nuclear Regulatory Commission (NRC) approve the TS changes before the changes are implemented. TVA's submittal meets the requirements of 10 CFR 50.59(c)(1)(i) and 10 CFR 50.90.

4.2 Precedent

TVA's proposed change is similar in nature to previous license amendments that were approved for Vogtle and Catawba Nuclear Plants by NRC letters dated September 25, 1996, and September 30, 1998, respectively. The license amendments for Vogtle and Catawba modified their respective TSs to upgrade the ECCS requirements to the ISTS requirements provided in NUREG-1431.

4.3 Significant Hazards Consideration

1. The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

   TVA's proposed change is not considered to be a significant departure from the current requirements and is considered an upgrade for Sequoyah Nuclear Plant's (SQN's) emergency core cooling system (ECCS) technical specification (TS) requirements. The ECCS is qualified and designed to provide core cooling and negative reactivity to ensure the reactor core is protected in the event of a loss of coolant accident (LOCA), rod ejection accident, loss of secondary coolant accident, and steam generator tube rupture (SGTR). The proposed change does not alter qualification or design features associated with SQN's ECCS. The probability of occurrence of an accident is not increased as the changes do not affect the system's capability for performing ECCS operation during injection, cold leg recirculation, and hot leg recirculation. The proposed changes continue to ensure that SQN's ECCS satisfies 10 CFR 50.46 and

10 CFR 50, Appendix A requirements. Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

   The possibility for a new or different kind of accident from any accident previously evaluated does not exist as a result of the proposed changes. The upgrade of SQN TSs to industry Improved Standard TS (ISTS) requirements provide an overall improvement and ensures that SQN's ECCS is capable of performing the design functions under accident conditions. The system design associated with injection, cold leg recirculation, and hot leg recirculation, remain unchanged. Accordingly, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed amendment does not involve a significant reduction in a margin of safety.

   The proposed upgrade of SQN's ECCS TSs to the ISTS does not affect existing safety margins. The system requirements continue to require that ECCS components are operable for plant operation (Modes 1, 2, and 3) and during plant shutdown (Mode 4). In addition, the proposed change does not increase the risk for an accident because no physical changes to the plant are being made and design features associated with ECCS continue to satisfy 10 CFR 50.46 requirements. Accordingly, TVA concludes that the margin of safety has not been reduced.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed change does not involve a significant hazards consideration, a significant change in the types of or significant increase in the amounts of any effluents that may be released offsite, or a significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b) and TVA's environmental review process, an environmental assessment of the proposed change is not required.

ATTACHMENT 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE
MARKED PAGES

I. AFFECTED PAGE LIST

Unit 1	Unit 2
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Index Page XIII	Index Page XIII
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II. MARKED PAGES

See attached.

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

BASES

SECTION PAGE

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LIMITING CONDITION FOR OPERATION

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Delete page and repaginate the section

- Operating

EMERGENCY CORE COOLING SYSTEMS (ECCS)

3/4.5.2 ECCS SUBSYSTEMS - T_{avg} Greater Than or Equal to 350°F

trains

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent ECCS subsystems shall be OPERABLE.* with each subsystem comprised of:

a. One OPERABLE centrifugal charging pump,

b. One OPERABLE safety injection pump,

c. One OPERABLE residual heat removal heat exchanger,

d. One OPERABLE residual heat removal pump, and

e. An OPERABLE flow path capable of taking suction from the refueling water storage tank on a safety injection signal and automatically transferring suction to the containment sump during the recirculation phase of operation.

APPLICABILITY: MODES 1, 2 and 3.

and with at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available,

ACTION:

or more trains

a. With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

train(s)

train

SURVEILLANCE REQUIREMENTS

4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:

a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:

b. With less than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, immediately enter LCO 3.0.3.

---NOTES---

1. In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve testing per SR 4.4.6.3.
2. In MODE 3, ECCS pumps may be made incapable of injecting to support transition into or from the APPLICABILITY of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to 4 hours or until the temperature of all RCS cold legs exceeds LTOP arming temperature (350°F) specified in the PTLR plus 25°F, whichever comes first.

* In MODE 3, ECCS pumps may be made incapable of injecting to support transition into or from the APPLICABILITY of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to four hours or until the temperature of all RCS cold legs exceeds LTOP arming temperature specified in the PTLR plus 25°F, whichever comes first.

Valve Number	Valve Function	Valve Position
a. FCV-63-1	RHR Suction from RWST	open
b. FCV-63-22	SIS Discharge to Common Piping	open

b. At least once per 31 days by:

1. Verifying that the ECCS piping is full of water by venting the ECCS pump casings and accessible discharge piping high points, and

2. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

valve

and

ECCS

the

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

1. For all accessible areas of the containment prior to establishing CONTAINMENT INTEGRITY, and

2. Of the areas affected within containment at the completion of each containment entry when CONTAINMENT INTEGRITY is established.

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d. At least once per 18 months by:

1. Deleted.

perform a

strainers

2. A visual inspection of the containment sump and verifying that the subsystem suction inlets are not restricted by debris and that the sump components (trash racks, screens, etc.) show no evidence of structural distress or corrosion.

e. At least once per 18 months, during shutdown, by:

1. Verifying that each automatic valve in the flow path actuates to its correct position on a safety injection test signal and automatic switchover to containment sump test signal.

that is not locked, sealed or otherwise secured in position,

an actual or simulated actuation signal.

Move SR to previous page

on an actual or simulated actuation signal.

2. Verifying that each ~~of the following pumps start~~ automatically ~~upon receipt of a safety injection signal:~~

ECCS pump starts

~~a) Centrifugal charging pump~~

~~b) Safety injection pump~~

~~c) Residual heat removal pump~~

f. By verifying that each of the following pumps develops the indicated discharge pressure on recirculation flow when tested pursuant to Specification 4.0.5:

1.	Centrifugal charging pump	Greater than or equal to 2400 psig
2.	Safety Injection pump	Greater than or equal to 1407 psig
3.	Residual heat removal pump	Greater than or equal to 165 psig

g. ~~By~~ verify~~ing~~ the correct position of each mechanical stop for the following E~~mergency~~ C~~ore~~ C~~ooling System~~ throttle valves:

1. Within 4 hours following completion of each valve stroking operation or maintenance on the valve when the ECCS subsystems are required to be OPERABLE.

~~2.~~ At least once per 18 months,

Charging Pump Injection Throttle Valves	Safety Injection Cold Leg Throttle Valves	Safety Injection Hot Leg Throttle Valves
Valve Number	Valve Number	Valve Number
1. 63 - 582	1. 63 - 550	1. 63-542
2. 63 - 583	2. 63 - 552	2. 63-544
3. 63 - 584	3. 63 - 554	3. 63-546
4. 63 - 585	4. 63 - 556	4. 63-548

f. By verifying that each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head when tested in accordance with the Inservice Testing Program of Specification 4.0.5.

SURVEILLANCE REQUIREMENTS (Continued)

h. By performing a flow balance test during shutdown following completion of modifications to the ECCS subsystem that alter the subsystem flow characteristics and verifying the following flow rates:

1. For safety injection pump lines with a single pump running:

   a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 443 gpm, and

   b. The total pump flow rate is less than or equal to 675 gpm.

2. For centrifugal charging pump lines with a single pump running:

   a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 309 gpm, and

   b. The total pump flow rate is less than or equal to 555 gpm.

3. For all four cold leg injection lines with a single RHR pump running a flow rate greater than or equal to 3931 gpm.

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EMERGENCY CORE COOLING SYSTEMS (ECCS)

– Shutdown

3/4.5.3 ECCS ~~SUBSYSTEMS - T_{avg} Less Than 350°F~~

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train

LIMITING CONDITION FOR OPERATION

One

3.5.3 ~~As a minimum, one~~ ECCS ~~subsystem comprised of the following~~ shall be OPERABLE~~:~~.

~~a. One OPERABLE centrifugal charging pump,~~

~~b. One OPERABLE residual heat removal heat exchanger,~~

~~c. One OPERABLE residual heat removal pump, and~~

~~d. An OPERABLE flow path capable of taking suction from the refueling water storage tank upon being manually realigned and automatically transferring suction to the containment sump during the recirculation phase of operation.~~

APPLICABILITY: MODE 4.

ACTION:

~~a. With no ECCS subsystem OPERABLE because of the inoperability of either the centrifugal charging pump or the flow path from the refueling water storage tank, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours. LCO 3.0.4.b is not applicable.~~

~~b. With no ECCS subsystem OPERABLE because of the inoperability of either the residual heat removal heat exchanger or residual heat removal pump, restore at least one ECCS subsystem to OPERABLE status or maintain the Reactor Coolant System T_{avg} less than 350°F by use of alternate heat removal methods.~~

a. With the required ECCS residual heat removal (RHR) subsystem inoperable, immediately initiate action to restore required ECCS RHR subsystem to OPERABLE status.

b. With the required ECCS centrifugal charging subsystem inoperable, within one hour, restore required ECCS centrifugal charging subsystem to OPERABLE status, or be in COLD SHUTDOWN within 24 hours.

---NOTE---

1) LCO 3.0.4b is not applicable to ECCS centrifugal charging subsystem.

2) The required ECCS residual heat removal (RHR) subsystem may be inoperable for up to 1 hour for surveillance testing of valves provided that alternate heat removal methods are available via the steam generators to maintain reactor coolant system Tavg less than 350°F and provided that the required subsystem is capable of being manually realigned to the ECCS mode of operation.

---NOTE---

An RHR train may be considered OPERABLE during alignment and operation for decay heat removal if capable of being manually realigned to the ECCS mode of operation.

---

train

4.5.3 The ECCS ~~subsystem~~ shall be demonstrated OPERABLE per the applicable Surveillance Requirements of 4.5.2:

SR 4.5.2.b.1
SR 4.5.2.d
SR 4.5.2.f
SR 4.5.2.g

following

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3/4.5.4 DELETED

LIMITING CONDITION FOR OPERATION

This Specification is deleted.

3/4.5.5 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

3.5.5 The refueling water storage tank (RWST) shall be OPERABLE with:

a. A contained borated water volume of between 370,000 and 375,000 gallons,

b. A boron concentration of between 2500 and 2700 ppm of boron,

c. A minimum solution temperature of 60°F, and

d. A maximum solution temperature of 105°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the RWST inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.5 The RWST shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the contained borated water volume in the tank, and

2. Verifying the boron concentration of the water.

b. At least once per 24 hours by verifying the RWST temperature.

EMERGENCY CORE COOLING SYSTEMS (ECCS)

3/4.5.6 SEAL INJECTION FLOW

LIMITING CONDITION FOR OPERATION

3.5.6 Reactor coolant pump seal injection flow shall be within the limits of Figure 3.5.6-1.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

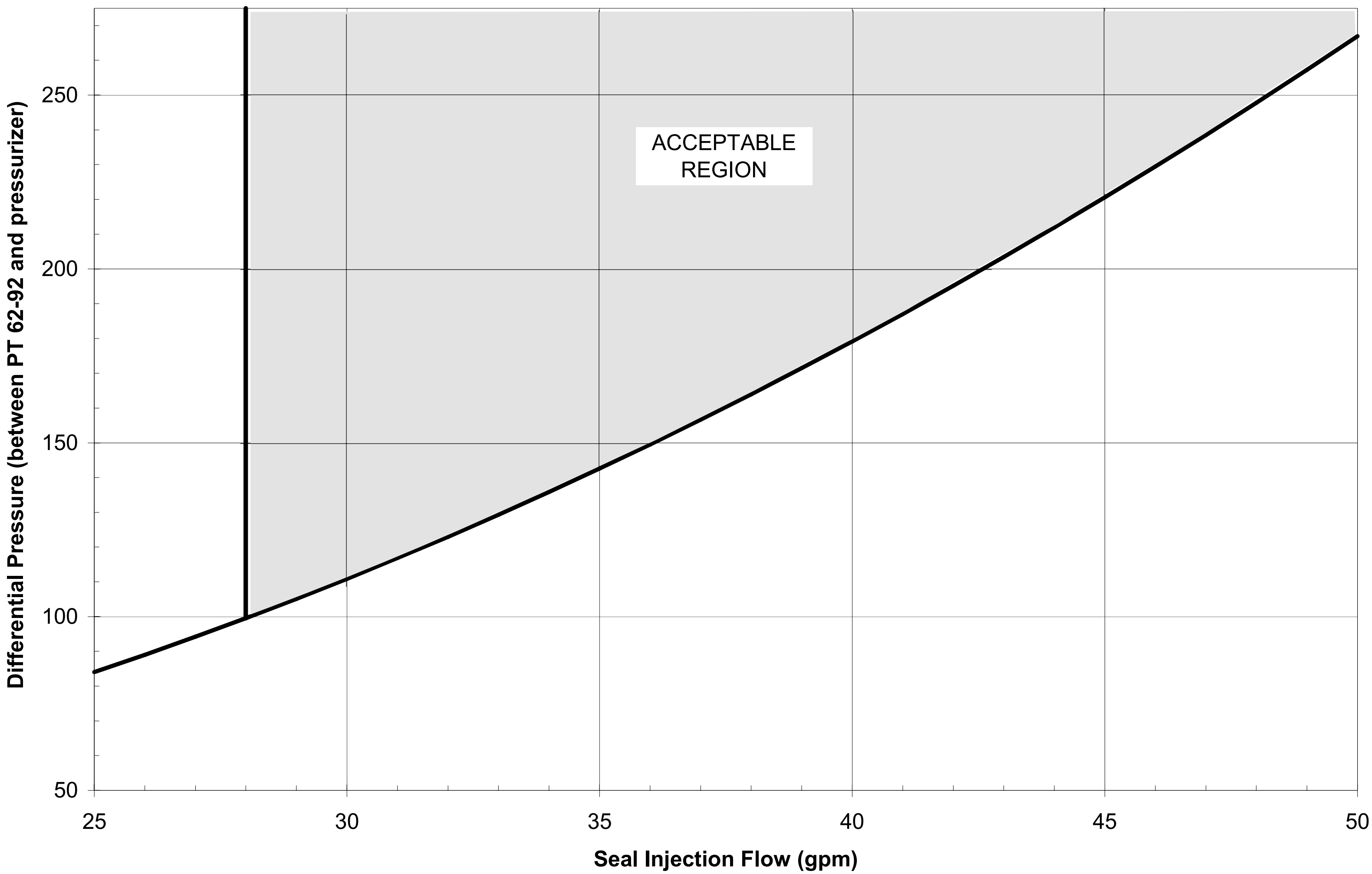
With reactor coolant pump seal injection flow not within limits, adjust manual seal injection throttle valves to give a flow within limit in accordance with Surveillance Requirement 4.5.6 within 4 hours. Otherwise, be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

SURVEILLANCE REQUIREMENTS

4.5.6 At least once per 31 days* verify manual seal injection throttle valves are adjusted to give a flow within the emergency core cooling system safety analysis limits in Figure 3.5.6-1.

*This surveillance is not required to be performed until 4 hours after the reactor coolant system pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig.

FIGURE 3.5.6-1
Seal Injection Flow Limits



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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

SECTION PAGE

3/4.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3/4.6 CONTAINMENT SYSTEMS

BASES

SECTION PAGE

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LIMITING CONDITION FOR OPERATION

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Delete page and repaginate the section

– Operating

EMERGENCY CORE COOLING SYSTEMS

3/4.5.2 ECCS SUBSYSTEMS - T_{avg} Greater Than or Equal to 350°F

trains

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent emergency core cooling system (ECCS) subsystems shall be OPERABLE. with each subsystem comprised of:

a. One OPERABLE centrifugal charging pump,

b. One OPERABLE safety injection pump,

c. One OPERABLE residual heat removal heat exchanger,

d. One OPERABLE residual heat removal pump, and

e. An OPERABLE flow path capable of taking suction from the refueling water storage tank on a safety injection signal and automatically transferring suction to the containment sump during the recirculation phase of operation.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

or more trains

and with at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available,

a. With one ECCS subsystem inoperable, restore the inoperable subsystem to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

train(s)

train

SURVEILLANCE REQUIREMENTS

4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:

a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:

b. With less than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, immediately enter LCO 3.0.3.

-----NOTES-----

1. In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve testing per SR 4.4.6.3.
2. In MODE 3, ECCS pumps may be made incapable of injecting to support transition into or from the APPLICABILITY of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to 4 hours or until the temperature of all RCS cold legs exceeds LTOP arming temperature (350°F) specified in the PTLR plus 25°F, whichever comes first.

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* In MODE 3, ECCS pumps may be made incapable of injecting to support transition into or from the APPLICABILITY of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to four hours or until the temperature of all RCS cold legs exceeds LTOP arming temperature specified in the PTLR plus 25°F, whichever comes first.

Valve Number	Valve Function	Valve Position
a. FCV-63-1	RHR Suction from RWST	open
b. FCV-63-22	SIS Discharge to Common Piping	open

ECCS

and

the

valve

b. At least once per 31 days by:

1. Verifying that the ECCS piping is full of water by venting the ECCS pump casings and accessible discharge piping high points, and

2. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

1. For all accessible areas of the containment prior to establishing CONTAINMENT INTEGRITY, and

2. Of the areas affected within containment at the completion of each containment entry when CONTAINMENT INTEGRITY is established.

Deleted

d. At least once per 18 months by:

perform a

1. DELETED.

strainers

2. A visual inspection of the containment sump and verifying that the subsystem suction inlets are not restricted by debris and that the sump components (trash racks, screens, etc.) show no evidence of structural distress or corrosion.

e. At least once per 18 months, during shutdown, by:

1. Verifying that each automatic valve in the flow path actuates to its correct position on a safety injection test signal and automatic switchover to containment sump test signal.

that is not locked, sealed or otherwise secured in position,

an actual or simulated actuation signal.

on an actual or simulated actuation signal.

ECCS pump starts

2. Verifying that each ~~of the following pumps start~~ automatically ~~upon receipt of a safety injection signal~~:

~~a) Centrifugal charging pump~~

~~b) Safety injection pump~~

~~c) Residual heat removal pump~~

~~f. By verifying that each of the following pumps develops the indicated discharge pressure on recirculation flow when tested pursuant to Specification 4.0.5:~~

~~1.~~	~~Centrifugal charging pump~~	~~Greater than or equal to 2400 psig~~
~~2.~~	~~Safety Injection pump~~	~~Greater than or equal to 1407 psig~~
~~3.~~	~~Residual heat removal pump~~	~~Greater than or equal to 165 psig~~

g. ~~By~~ verify~~ing~~ the correct position of each mechanical stop for the following ECCS throttle valves:

~~1. Within 4 hours following completion of each valve stroking operation or maintenance on the valve when the ECCS subsystems are required to be OPERABLE.~~

~~2.~~ At least once per 18 months,

Charging Pump Injection Throttle Valves	Safety Injection Cold Leg Throttle Valves	Safety Injection Hot Leg Throttle Valves
Valve Number	Valve Number	Valve Number
1. 63 - 582	1. 63 - 550	1. 63-542
2. 63 - 583	2. 63 - 552	2. 63-544
3. 63 - 584	3. 63 - 554	3. 63-546
4. 63 - 585	4. 63 - 556	4. 63-548

f. By verifying that each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head when tested in accordance with the Inservice Testing Program of Specification 4.0.5.

SURVEILLANCE REQUIREMENTS (Continued)

h. By performing a flow balance test during shutdown following completion of modifications to the ECCS subsystem that alter the subsystem flow characteristics and verifying the following flow rates:

1. For safety injection pump lines with a single pump running:

   a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 443 gpm, and

   b. The total pump flow rate is less than or equal to 675 gpm.

2. For centrifugal charging pump lines with a single pump running:

   a. The sum of the injection line flow rates, excluding the highest flow rate is greater than or equal to 309 gpm, and

   b. The total pump flow rate is less than or equal to 555 gpm.

3. For all four cold leg injection lines with a single RHR pump running a flow rate greater than or equal to 3931 gpm.

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Shutdown

3/4.5.3 ECCS SUBSYSTEMS - T_{avg} LESS THAN 350°F

train

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One

LIMITING CONDITION FOR OPERATION

3.5.3 As a minimum, one ECCS subsystem comprised of the following shall be OPERABLE: .

a. One OPERABLE centrifugal charging pump,

b. One OPERABLE residual heat removal heat exchanger,

c. One OPERABLE residual heat removal pump, and

d. An OPERABLE flow path capable of taking suction from the refueling water storage tank upon being manually realigned and automatically transferring suction to the containment sump during the recirculation phase of operation.

APPLICABILITY: MODE 4.

ACTION:

a. With no ECCS subsystem OPERABLE because of the inoperability of either the centrifugal charging pump or the flow path from the refueling water storage tank, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours. LCO 3.0.4.b is not applicable.

b. With no ECCS subsystem OPERABLE because of the inoperability of either the residual heat removal heat exchanger or residual heat removal pump, restore at least one ECCS subsystem to OPERABLE status or maintain the Reactor Coolant System T_{avg} less than 350°F by use of alternate heat removal methods.

a. With the required ECCS residual heat removal (RHR) subsystem inoperable, immediately initiate action to restore required ECCS RHR subsystem to OPERABLE status.

b. With the required ECCS centrifugal charging subsystem inoperable, within one hour, restore required ECCS centrifugal charging subsystem to OPERABLE status, or be in COLD SHUTDOWN within 24 hours.

---NOTE---

1) LCO 3.0.4b is not applicable to ECCS centrifugal charging subsystem.

2) The required ECCS residual heat removal (RHR) subsystem may be inoperable for up to 1 hour for surveillance testing of valves provided that alternate heat removal methods are available via the steam generators to maintain reactor coolant system T_{avg} less than 350°F and provided that the required subsystem is capable of being manually realigned to the ECCS mode of operation.

---NOTE---

An RHR train may be considered OPERABLE during alignment and operation for decay heat removal if capable of being manually realigned to the ECCS mode of operation.

train

SURVEILLANCE REQUIREMENTS

4.5.3 The ECCS ~~subsystem~~ shall be demonstrated OPERABLE per the applicable Surveillance Requirements of 4.5.2:

SR 4.5.2.b.1
SR 4.5.2.d
SR 4.5.2.f
SR 4.5.2.g

following

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3/4.5.4 DELETED

LIMITING CONDITION FOR OPERATION

This Specification is deleted.

3/4.5.5 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

3.5.5 The refueling water storage tank (RWST) shall be OPERABLE with:

a. A contained borated water volume of between 370,000 and 375,000 gallons,

b. A boron concentration of between 2500 and 2700 ppm of boron,

c. A minimum solution temperature of 60°F, and

d. A maximum solution temperature of 105°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the RWST inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.5 The RWST shall be demonstrated OPERABLE:

a. At least once per 7 days by:

    1. Verifying the contained borated water volume in the tank, and

    2. Verifying the boron concentration of the water.

b. At least once per 24 hours by verifying the RWST temperature.

3/4.5.6 SEAL INJECTION FLOW

LIMITING CONDITION FOR OPERATION

3.5.6 Reactor coolant pump seal injection flow shall be within the limits of Figure 3.5.6-1.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

With reactor coolant pump seal injection flow not within limits, adjust manual seal injection throttle valves to give a flow within limit in accordance with Surveillance Requirement 4.5.6 within 4 hours. Otherwise, be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

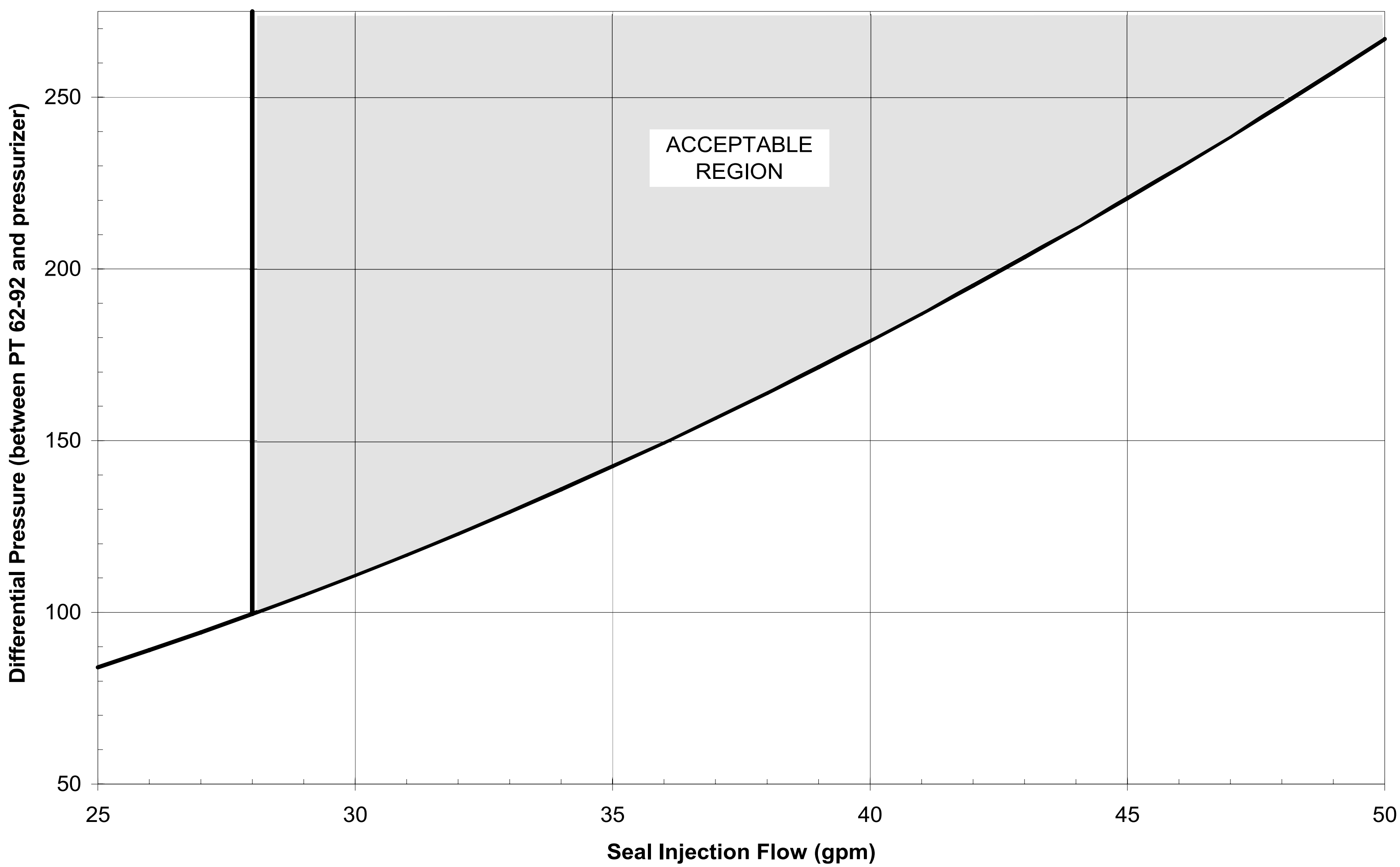
SURVEILLANCE REQUIREMENTS

4.5.6 At least once per 31 days* verify manual seal injection throttle valves are adjusted to give a flow within the emergency core cooling system safety analysis limits in Figure 3.5.6-1.

* This surveillance is not required to be performed until 4 hours after the reactor coolant system pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig.

FIGURE 3.5.6-1

Seal Injection Flow Limits



R250

ATTACHMENT 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

PROPOSED TECHNICAL SPECIFICATION (TS)
BASES PAGES

I. AFFECTED PAGE LIST

Unit 1	Unit 2
B 3/4 5-1	B 3/4 5-1
B 3/4 5-2	B 3/4 5-2
B 3/4 5-3	B 3/4 5-3
B 3/4 5-4	B 3/4 5-4
B 3/4 5-5	B 3/4 5-5
B 3/4 5-6	B 3/4 5-6
B 3/4 5-7	B 3/4 5-7

II. MARKED PAGES

See attached.

INSERT A and renumber the pages

3/4.5.1 ACCUMULATORS

The OPERABILITY of each cold leg injection accumulator ensures that a sufficient volume of borated water will be immediately forced into the reactor core in the event that the RCS pressure falls below the specified pressure of the accumulators. For the cold leg injection accumulators, this condition occurs in the event of a large or small rupture.

The limits on accumulator volume, boron concentration and pressure ensure that the assumptions used for accumulator injection in the safety analysis are met. The limits in the specification for accumulator nitrogen cover pressure and volume are operating limits and include instrument uncertainty. The analysis limits bound the operational limits with instrument uncertainty applied. The minimum boron concentration ensures that the reactor core will remain subcritical during the post-LOCA (loss of coolant accident) recirculation phase based upon the cold leg accumulators' contribution to the post-LOCA sump mixture concentration.

The accumulator power operated isolation valves are considered to be "operating bypasses" in the context of IEEE Std. 279-1971, which requires that bypasses of a protective function be removed automatically whenever permissive conditions are not met. In addition, as these accumulator isolation valves fail to meet single failure criteria, removal of power to the valves is required.

The limits for operation with an accumulator inoperable for any reason except boron concentration not within limits minimizes the time exposure of the plant to a LOCA event occurring concurrent with failure of an additional accumulator which may result in unacceptable peak cladding temperatures. Under these conditions, the full capability of one accumulator is not available and prompt action is required to place the reactor in a mode where this capability is not required. The 24 hours allowed to restore an inoperable accumulator to OPERABLE status is justified in Westinghouse Commercial Atomic Power (WCAP)-15049-A, Revision 1, dated April 1999. For an accumulator inoperable due to boron concentration not within limits, the limits for operation allow 72 hours to return boron concentration to within limits. This is based on the availability of ECCS water not being affected and an insignificant effect on core subcriticality during reflood because boiling of ECCS water in the core concentrates boron in the saturated liquid.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

As indicated in the footnote for 3/4.5.2, operation in MODE 3 with ECCS trains made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, “Low Temperature Overpressure Protection (LTOP) System,“ is necessary for plants with an LTOP arming temperature at or near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be rendered incapable of injecting at and below the LTOP arming temperature. When this temperature is at or near the MODE 3 boundary temperature, time is needed to make pumps incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pumps to OPERABLE status on exiting the LTOP Applicability.

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

A note to Action a prohibits the application of LCO 3.0.4.b to an inoperable ECCS centrifugal charging pump or flow path from the refueling water storage tank when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS centrifugal charging pump or flow path from the refueling water storage tank and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

3/4.5.4 BORON INJECTION SYSTEM

This specification was deleted.

Move to next page

3/4.5.5 REFUELING WATER STORAGE TANK

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.

Additionally, the OPERABILITY of the RWST as part of the ECCS ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by RCS cooldown.

The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 7.5 and 9.5 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

3/4.5.6 SEAL INJECTION FLOW

BACKGROUND

The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the centrifugal charging pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during safety injection.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis establishes the minimum flow for the ECCS pumps. The centrifugal charging pumps are also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head at the design point for the centrifugal charging pumps. The steam generator tube rupture and main steam line break event analyses also credit the centrifugal charging pumps, but are not limiting in their design. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

This LCO ensures that seal injection flow will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the centrifugal charging pumps will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory. Seal injection flow satisfies Criterion 2 of the NRC Policy Statement.

LCO

The intent of the LCO limit on seal injection flow is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the injection points (Ref. 2).

The LCO is not strictly a flow limit, but rather a flow limit based on a flow line resistance. In order to establish the proper flow line resistance, a pressure and flow must be known. The flow line resistance is established by adjusting the RCP seal injection needle valves to provide a total seal injection flow in the acceptable region of Technical Specification Figure 3.5.6-1. The centrifugal charging pump discharge header pressure remains essentially constant through all the applicable MODES of this LCO. A reduction in RCS pressure would result in more flow being diverted to the RCP seal injection line than at normal operating pressure. The valve settings established at the prescribed centrifugal charging pump discharge header pressure result in a conservative valve position should RCS pressure decrease. The flow limits established by Technical Specification Figure 3.5.6-1 are consistent with the accident analysis.

The limits on seal injection flow must be met to render the ECCS OPERABLE. If these conditions are not met, the ECCS flow will not be as assumed in the accident analyses.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in these MODES. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

ACTION

With the seal injection flow exceeding its limit, the amount of charging flow available to the RCS may be reduced. Under this condition, action must be taken to restore the flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The action time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore seal injection flow within limits. This time is conservative with respect to the action times of other ECCS LCOs; it is based on operating experience and is sufficient for taking corrective actions by operations personnel.

When the actions cannot be completed within the required action time, a controlled shutdown must be initiated. The action time of 6 hours for reaching MODE 3 from MODE 1 is a reasonable time for a controlled shutdown, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators. Continuing the plant shutdown from MODE 3, an additional 6 hours is a reasonable time, based on operating experience and normal cooldown rates, to reach MODE 4, where this LCO is no longer applicable.

SURVEILLANCE REQUIREMENTS

Surveillance 4.5.6

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow within the limit ensures that proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The differential pressure that is above the reference minimum value is established between the charging header (PT 62-92) and the RCS, and total seal injection flow is verified to be within the limits determined in accordance with the ECCS safety analysis (Ref. 3). The seal water injection flow limits are shown in Technical Specification Figure 3.5.6-1. The frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve surveillance frequencies. The frequency has proven to be acceptable through operating experience.

The requirements for charging flow vary widely according to plant status and configuration. When charging flow is adjusted, the positions of the air-operated valves, which control charging flow, are

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adjusted to balance the flows through the charging header and through the seal injection header to ensure that the seal injection flow to the RCPs is maintained between 8 and 13 gpm per pump. The reference minimum differential pressure across the seal injection needle valves ensures that regardless of the varied settings of the charging flow control valves that are required to support optimum charging flow, a reference test condition can be established to ensure that flows across the needle valves are within the safety analysis. The values in the safety analysis for this reference set of conditions are calculated based on conditions during power operation and they are correlated to the minimum ECCS flow to be maintained under the most limiting accident conditions.

As noted, the surveillance is not required to be performed until 4 hours after the RCS pressure has stabilized within a ± 20 psig range of normal operating pressure. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the surveillance is timely. Performance of this surveillance within the 4-hour allowance is required to maintain compliance with the provisions of Specification 4.0.3.

REFERENCES

1. FSAR, Chapter 6.3 “Emergency Core Cooling System” and Chapter 15.0 “Accident Analysis”.

2. 10 CFR 50.46.

3. Westinghouse Electric Company Calculation CN-FSE-99-48

INSERT A

B 3/4.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

B 3/4.5.2 ECCS – Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system,

b. Rod ejection accident,

c. Loss of secondary coolant event, including uncontrolled steam release or loss of feedwater, and

d. Steam generator tube rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are three phases of ECCS operation: injection, cold leg recirculation, and hot leg recirculation. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and the containment sumps have enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to the containment sump for cold leg recirculation. After approximately 5.5 hours, the ECCS flow is shifted to the hot leg recirculation phase to provide a backflush, which would reduce the boiling in the top of the core and any resulting boron precipitation.

The ECCS consists of separate subsystems: centrifugal charging (high head), safety injection (SI) (intermediate head), and residual heat removal (RHR) (low head). Each subsystem consists of two redundant, 100 percent capacity trains. The ECCS accumulators and the RWST are also part of the ECCS, but are not considered part of an ECCS flow path as described by this limiting condition for operation (LCO).

BASES

BACKGROUND (continued)

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described in this LCO. The major components of each subsystem are the centrifugal charging pumps, the RHR pumps, heat exchangers, and the SI pumps. Each of the three subsystems consists of two 100 percent capacity trains that are interconnected and redundant such that either train is capable of supplying 100 percent of the flow required to mitigate the accident consequences. This interconnecting and redundant subsystem design provides the operators with the ability to utilize components from opposite trains to achieve the required 100 percent flow to the core.

During the injection phase of LOCA recovery, a suction header supplies water from the RWST to the ECCS pumps. Separate piping supplies each subsystem and each train within the subsystem. The discharge from the centrifugal charging pumps combines prior to entering the boron injection tank (BIT) and then divides again into four supply lines, each of which feeds the injection line to one RCS cold leg. The discharge from the SI and RHR pumps divides and feeds an injection line to each of the RCS cold legs. Control valves are set to balance the flow to the RCS. This balance ensures sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.

For LOCAs that are too small to depressurize the RCS below the shutoff head of the SI pumps, the centrifugal charging pumps supply water until the RCS pressure decreases below the SI pump shutoff head. During this period, the steam generators are used to provide part of the core cooling function.

During the recirculation phase of LOCA recovery, RHR pump suction is transferred to the containment sump. The RHR pumps then supply the other ECCS pumps. Initially, recirculation is through the same paths as the injection phase. Subsequently, recirculation alternates injection between the hot and cold legs.

The centrifugal charging subsystem of the ECCS also functions to supply borated water to the reactor core following increased heat removal events, such as a main steam line break (MSLB). The limiting design conditions occur when the negative moderator temperature coefficient is highly negative, such as at the end of each cycle.

BASES

BACKGROUND (continued)

During low temperature conditions in the RCS, limitations are placed on the maximum number of ECCS 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 ECCS subsystems are actuated upon receipt of an SI 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 emergency diesel generators (EDGs). Safeguard loads are then actuated in the programmed time sequence. The time delay associated with diesel starting, sequenced loading, and pump starting determines the time required before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1.1, "Accumulators," and LCO 3.5.5, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet General Design Criteria (GDC) 35 (Reference. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 2), will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F,

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation,

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react,

d. Core is maintained in a coolable geometry, and

e. Adequate long-term core cooling capability is maintained.

The LCO also limits the potential for a post-trip return to power following an MSLB event and ensures that containment temperature limits are met.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Each ECCS subsystem is taken credit for in a large break LOCA event at full power (Refs. 3 and 4). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The centrifugal charging pumps and SI pumps are credited in a small break LOCA event. This event establishes the flow and discharge head at the design point for the centrifugal charging pumps. The SGTR and MSLB events also credit the centrifugal charging pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

a. A large break LOCA event, with loss of offsite power and a single failure disabling one ECCS train, and

b. A small break LOCA event, with a loss of offsite power and a single failure disabling one ECCS train.

During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding during large breaks or control rod insertion for small breaks. Following depressurization, emergency cooling water is injected into the cold legs, flows into the downcomer, fills the lower plenum, and refloods the core.

The effects on containment mass and energy releases are accounted for in appropriate analyses (Refs. 3 and 4). The LCO ensures that an ECCS train will deliver sufficient water to match boil off rates soon enough to minimize the consequences of the core being uncovered following a large LOCA. It also ensures that the centrifugal charging and SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the centrifugal charging pump delivers sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

In MODES 1, 2, and 3, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

BASES

LCO (continued)

In MODES 1, 2, and 3, an ECCS train consists of a centrifugal charging subsystem, an SI subsystem, and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and automatically transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to supply its flow to the RCS hot and cold legs.

The flow path for each train must maintain its designed independence to ensure that no single failure can disable both ECCS trains.

As indicated in Note 1, the SI flow paths may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 4.4.6.3. The flow path is readily restorable from the control room.

As indicated in Note 2, operation in MODE 3 with ECCS trains made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is necessary for plants with an LTOP arming temperature at or near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be rendered incapable of injecting at and below the LTOP arming temperature. When this temperature is at or near the MODE 3 boundary temperature, time is needed to make pumps incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pumps to OPERABLE status on exiting the LTOP Applicability.

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, large break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The centrifugal charging pump performance is based on a small break LOCA, which establishes the pump performance curve and has less dependence on power. The SI pump performance requirements are based on a small break LOCA. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

BASES

APPLICABILITY (continued)

This LCO is only applicable in MODE 3 and above. Below MODE 3, the SI signal setpoint is manually bypassed by operator control, and system functional requirements are relaxed as described in LCO 3.5.3, "ECCS - Shutdown."

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.1.4, "RCS Cold Shutdown." MODE 6 core cooling requirements are addressed by LCO 3.9.8.1, "Residual Heat Removal and Coolant Circulation, All Water Levels" and LCO 3.9.8.2, "Residual Heat Removal and Coolant Circulation, Low Water Level."

ACTIONS

Action a.

With one or more trains inoperable and at least 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72-hour restoration time is based on an NRC reliability evaluation (Ref. 5) and is a reasonable time for repair of many ECCS components.

An ECCS train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an EDG can disable one ECCS train until power is restored. A reliability analysis (Ref. 5) has shown that the impact of having one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

BASES

ACTIONS (continued)

Reference 6 describes situations in which one component, such as an RHR crossover valve, can disable both ECCS trains. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.

If the inoperable trains cannot be returned to OPERABLE status within the associated action time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and MODE 4 within the following 6 hours. The shutdown times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Action b.

Action (a) is applicable with one or more trains inoperable. The allowed outage time is based on the assumption that at least 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train is available. With less than 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train available, the facility is in a condition outside of the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 4.5.2.a

Verification of proper valve position ensures that the flow path from the ECCS pumps to the RCS is maintained. Misalignment of these valves could render both ECCS trains inoperable. Securing these valves in position by removal of power or by key locking the control in the correct position ensures that they cannot change position as a result of an active failure or be inadvertently misaligned. These valves are of the type, described in Reference 6, that can disable the function of both ECCS trains and invalidate the accident analyses. A 12 hour frequency is considered reasonable in view of other administrative controls that will ensure a mispositioned valve is unlikely.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 4.5.2.b

With the exception of the operating centrifugal charging pump, the ECCS pumps are normally in a standby, nonoperating mode. As such, flow path piping has the potential to develop voids and pockets of entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling. The 31 day frequency takes into consideration the gradual nature of gas accumulation in the ECCS piping and the procedural controls governing system operation.

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve will automatically reposition within the proper stroke time. This surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day frequency is appropriate because the valves are operated under administrative control, and an improper valve position would only affect a single train. This frequency has been shown to be acceptable through operating experience.

SR 4.5.2.c

Deleted

SR 4.5.2.d

Periodic inspections of the containment sump suction inlet ensure that it is unrestricted and stays in proper operating condition. The 18 month frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage, on the need to have access to the location, and because of the potential for an unplanned transient if the surveillance were performed with the reactor at power. This frequency has been found to be sufficient to detect abnormal degradation and is confirmed by operating experience.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 4.5.2.e

These surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SI signal and that each ECCS pump starts on receipt of an actual or simulated SI signal. This surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month frequency is based on the need to perform these surveillances under the conditions that apply during a plant outage and the potential for unplanned plant transients if the surveillances were performed with the reactor at power. The 18 month frequency is acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment. The actuation logic is tested as part of ESF Actuation System testing, and equipment performance is monitored as part of the Inservice Testing Program of Specification 4.0.5.

SR 4.5.2.f

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by the ASME Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code). This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. This verifies that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. Surveillance test requirements are specified in the Inservice Testing Program of Specification 4.0.5. The Inservice Test Program provides the activities and frequencies necessary to satisfy the requirements.

SR 4.5.2.g

Realignment of valves in the flow path on an SI signal is necessary for proper ECCS performance. These valves have stops to allow proper positioning for restricted flow to a ruptured cold leg, ensuring that the other cold legs receive at least the required minimum flow. This surveillance is not required for plants with flow limiting orifices. The 18 month frequency is based on the same reasons as those stated in SR 3.5.2.d and SR 3.5.2.e.

BASES

REFERENCES

1. 10 CFR 50, Appendix A, GDC 35.
2. 10 CFR 50.46.
3. FSAR, Section 6.3.
4. FSAR, Chapter 15, "Accident Analysis."
5. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.
6. IE Information Notice No. 87-01.

B 3/4.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

B 3/4.5.3 ECCS – Shutdown

BASES

BACKGROUND

The Background section for Bases 3.5.2, "ECCS - Operating," is applicable to these Bases, with the following modifications. In MODE 4, the required ECCS train consists of two separate subsystems: centrifugal charging (high head) and residual heat removal (RHR) (low head).

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the refueling water storage tank (RWST) can be injected into the Reactor Coolant System (RCS) following the accidents described in Bases 3.5.2.

APPLICABLE SAFETY ANALYSES

The Applicable Safety Analyses section of Bases 3.5.2 also applies to this Bases section.

Due to the stable conditions associated with operation in MODE 4 and the reduced probability of occurrence of a Design Basis Accident (DBA), the ECCS operational requirements are reduced. It is understood in these reductions that certain automatic safety injection (SI) actuation is not available. In this MODE, sufficient time exists for manual actuation of the required ECCS to mitigate the consequences of a DBA.

Only one train of ECCS is required for MODE 4. This requirement dictates that single failures are not considered during this MODE of operation. The ECCS trains satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

In MODE 4, one of the two independent (and redundant) ECCS trains is required to be OPERABLE to ensure that sufficient ECCS flow is available to the core following a DBA.

In MODE 4, an ECCS train consists of a centrifugal charging subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST and transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to deliver its flow to the RCS hot and cold legs.

BASES

LCO (continued)

This LCO is modified by a Note that allows an RHR train to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4.

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2.

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.1.4, "Reactor Coolant System Cold Shutdown." MODE 6 core cooling requirements are addressed by LCO 3.9.8.1 “Residual Heat Removal and Coolant Circulation - All Water Levels,” and LCO 3.9.8.2 “Residual Heat Removal and Coolant Circulation - Low Water Level.”

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable ECCS high head subsystem when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS high head subsystem and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A second Note allows the required ECCS RHR subsystem to be inoperable because of surveillance testing of RCS pressure isolation valve leakage (FCV-74-1 and FCV-74-2). This allows testing while RCS pressure is high enough to obtain valid leakage data and following valve closure for RHR decay heat removal path. The condition requiring alternate heat removal methods ensures that the RCS heatup rate can be controlled to prevent MODE 3 entry and thereby ensure that the reduced ECCS operational requirements are maintained. The condition requiring manual realignment capability, FCV-74-1 and FCV-74-2 can be opened from the main control room ensures that in the unlikely event of a DBA during the one hour of surveillance testing, the RHR subsystem can be placed in ECCS recirculation mode when required to mitigate the event.

BASES

ACTIONS (continued)

Action a.

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss of coolant accident or to continue a cooldown using the RHR pumps and heat exchangers. The action time of immediately to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must continue until the inoperable RHR loop components can be restored to operation so that decay heat removal is continuous.

With both RHR pumps and heat exchangers inoperable, it would be unwise to require the plant to go to MODE 5, where the only available heat removal system is the RHR. Therefore, the appropriate action is to initiate measures to restore one ECCS RHR subsystem and to continue the actions until the subsystem is restored to OPERABLE status.

Action b.

With no ECCS high head subsystem OPERABLE, due to the inoperability of the centrifugal charging pump or flow path from the RWST, the plant is not prepared to provide high pressure response to Design Basis Events requiring SI. The 1 hour action time to restore at least one ECCS high head subsystem to OPERABLE status ensures that prompt action is taken to provide the required cooling capacity or to initiate actions to place the plant in MODE 5, where an ECCS train is not required.

When Action b cannot be completed within the required action time, within one hour, a controlled shutdown should be initiated. Twenty four hours is a reasonable time, based on operating experience, to reach MODE 5 in an orderly manner and without challenging plant systems or operators.

SURVEILLANCE REQUIREMENTS

SR 4.5.3

The applicable Surveillance descriptions from Bases 3.5.2 apply.

REFERENCES

The applicable references from Bases 3.5.2 apply.

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3/4.5.1 ACCUMULATORS

The OPERABILITY of each cold leg injection accumulator ensures that a sufficient volume of borated water will be immediately forced into the reactor core in the event the RCS pressure falls below the pressure of the accumulators. For the cold leg injection accumulators this condition occurs in the event of a large or small rupture.

The limits on accumulator volume, boron concentration, and pressure ensure that the assumptions used for accumulator injection in the safety analysis are met. The limits in the specification for accumulator nitrogen cover pressure and volume are operating limits and include instrument uncertainty. The analysis limits bound the operational limits with instrument uncertainty applied. The minimum boron concentration ensures that the reactor core will remain subcritical during the post-LOCA (loss of coolant accident) recirculation phase based upon the cold accumulators' contribution to the post-LOCA sump mixture concentration.

The accumulator power operated isolation valves are considered to be "operating bypasses" in the context of IEEE Std. 279-1971, which requires that bypasses of a protective function be removed automatically whenever permissive conditions are not met. In addition, as these accumulator isolation valves fail to meet single failure criteria, removal of power to the valves is required.

The limits for operation with an accumulator inoperable for any reason except boron concentration not within limits minimizes the time exposure of the plant to a LOCA event occurring concurrent with failure of an additional accumulator which may result in unacceptable peak cladding temperatures. Under these conditions, the full capability of one accumulator is not available and prompt action is required to place the reactor in a mode where this capability is not required. The 24 hours allowed to restore an inoperable accumulator to OPERABLE status is justified in Westinghouse Commercial Atomic Power (WCAP)-15049-A, Revision 1, dated April 1999. For an accumulator inoperable due to boron concentration not within limits, the limits for operation allow 72 hours to return boron concentration to within limits. This is based on the availability of ECCS water not being affected and an insignificant effect on core subcriticality during reflood because boiling of ECCS water in the core concentrates boron in the saturated liquid.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double-ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long-term core cooling capability in the recirculation mode during the accident recovery period.

As indicated in the footnote for 3/4.5.2, operation in MODE 3 with ECCS trains made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, “Low Temperature Overpressure Protection (LTOP) System,“ is necessary for plants with an LTOP arming temperature at or near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be

ECCS SUBSYSTEMS (Continued)

rendered incapable of injecting at and below the LTOP arming temperature. When this temperature is at or near the MODE 3 boundary temperature, time is needed to make pumps incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pumps to OPERABLE status on exiting the LTOP Applicability.

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

A note to Action a prohibits the application of LCO 3.0.4.b to an inoperable ECCS centrifugal charging pump or flow path from the refueling water storage tank when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS centrifugal charging pump or flow path from the refueling water storage tank and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

3/4.5.4 BORON INJECTION SYSTEM

This Specification was deleted.

3/4.5.5 REFUELING WATER STORAGE TANK

The OPERABILITY of the refueling water storage tank (RWST), as part of the ECCS, ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation-cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses. Additionally, the OPERABILITY of the RWST, as part of the ECCS, ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by RCS cooldown.

The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 7.5 and 9.5 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

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3/4.5.6 SEAL INJECTION FLOW

BACKGROUND

The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the centrifugal charging pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during safety injection.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis establishes the minimum flow for the ECCS pumps. The centrifugal charging pumps are also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head at the design point for the centrifugal charging pumps. The steam generator tube rupture and main steam line break event analyses also credit the centrifugal charging pumps, but are not limiting in their design. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

This LCO ensures that seal injection flow will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the centrifugal charging pumps will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory. Seal injection flow satisfies Criterion 2 of the NRC Policy Statement.

LCO

The intent of the LCO limit on seal injection flow is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the injection points (Ref. 2).

The LCO is not strictly a flow limit, but rather a flow limit based on a flow line resistance. In order to establish the proper flow line resistance, a pressure and flow must be known. The flow line resistance is established by adjusting the RCP seal injection needle valves to provide a total seal injection flow in the acceptable region of Technical Specification Figure 3.5.6-1. The centrifugal charging pump discharge header pressure remains essentially constant through all the applicable MODES of this LCO. A reduction in RCS pressure would result in more flow being diverted to the RCP seal injection line than at normal operating pressure. The valve settings established at the prescribed centrifugal charging pump discharge header pressure result in a conservative valve position should RCS pressure decrease. The flow limits established by Technical Specification Figure 3.5.6-1 are consistent with the accident analysis.

The limits on seal injection flow must be met to render the ECCS OPERABLE. If these conditions are not met, the ECCS flow will not be as assumed in the accident analyses.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in these MODES. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

ACTION

With the seal injection flow exceeding its limit, the amount of charging flow available to the RCS may be reduced. Under this condition, action must be taken to restore the flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The action time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore seal injection flow within limits. This time is conservative with respect to the action times of other ECCS LCOs; it is based on operating experience and is sufficient for taking corrective actions by operations personnel.

When the actions cannot be completed within the required action time, a controlled shutdown must be initiated. The action time of 6 hours for reaching MODE 3 from MODE 1 is a reasonable time for a controlled shutdown, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators. Continuing the plant shutdown from MODE 3, an additional 6 hours is a reasonable time, based on operating experience and normal cooldown rates, to reach MODE 4, where this LCO is no longer applicable.

SURVEILLANCE REQUIREMENTS

Surveillance 4.5.6

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow within the limit ensures that proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The differential pressure that is above the reference minimum value is established between the charging header (PT 62-92) and the RCS, and total seal injection flow is verified to be within the limits determined in accordance with the ECCS safety analysis (Ref. 3). The seal water injection flow limits are shown in Technical Specification Figure 3.5.6-1. The frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve surveillance frequencies. The frequency has proven to be acceptable through operating experience.

The requirements for charging flow vary widely according to plant status and configuration. When charging flow is adjusted, the positions of the air-operated valves, which control charging flow, are

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adjusted to balance the flows through the charging header and through the seal injection header to ensure that the seal injection flow to the RCPs is maintained between 8 and 13 gpm per pump. The reference minimum differential pressure across the seal injection needle valves ensures that regardless of the varied settings of the charging flow control valves that are required to support optimum charging flow, a reference test condition can be established to ensure that flows across the needle valves are within the safety analysis. The values in the safety analysis for this reference set of conditions are calculated based on conditions during power operation and they are correlated to the minimum ECCS flow to be maintained under the most limiting accident conditions.

As noted, the surveillance is not required to be performed until 4 hours after the RCS pressure has stabilized within a ± 20 psig range of normal operating pressure. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the surveillance is timely. Performance of this surveillance within the 4-hour allowance is required to maintain compliance with the provisions of Specification 4.0.3.

REFERENCES

1. FSAR, Chapter 6.3 “Emergency Core Cooling System” and Chapter 15.0 “Accident Analysis.”

2. 10 CFR 50.46.

3. Westinghouse Electric Company Calculation CN-FSE-99-48

INSERT A

B 3/4.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

B 3/4.5.2 ECCS – Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system,

b. Rod ejection accident,

c. Loss of secondary coolant event, including uncontrolled steam release or loss of feedwater, and

d. Steam generator tube rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are three phases of ECCS operation: injection, cold leg recirculation, and hot leg recirculation. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and the containment sumps have enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to the containment sump for cold leg recirculation. After approximately 5.5 hours, the ECCS flow is shifted to the hot leg recirculation phase to provide a backflush, which would reduce the boiling in the top of the core and any resulting boron precipitation.

The ECCS consists of separate subsystems: centrifugal charging (high head), safety injection (SI) (intermediate head), and residual heat removal (RHR) (low head). Each subsystem consists of two redundant, 100 percent capacity trains. The ECCS accumulators and the RWST are also part of the ECCS, but are not considered part of an ECCS flow path as described by this limiting condition for operation (LCO).

BASES

BACKGROUND (continued)

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described in this LCO. The major components of each subsystem are the centrifugal charging pumps, the RHR pumps, heat exchangers, and the SI pumps. Each of the three subsystems consists of two 100 percent capacity trains that are interconnected and redundant such that either train is capable of supplying 100 percent of the flow required to mitigate the accident consequences. This interconnecting and redundant subsystem design provides the operators with the ability to utilize components from opposite trains to achieve the required 100 percent flow to the core.

During the injection phase of LOCA recovery, a suction header supplies water from the RWST to the ECCS pumps. Separate piping supplies each subsystem and each train within the subsystem. The discharge from the centrifugal charging pumps combines prior to entering the boron injection tank (BIT) and then divides again into four supply lines, each of which feeds the injection line to one RCS cold leg. The discharge from the SI and RHR pumps divides and feeds an injection line to each of the RCS cold legs. Control valves are set to balance the flow to the RCS. This balance ensures sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.

For LOCAs that are too small to depressurize the RCS below the shutoff head of the SI pumps, the centrifugal charging pumps supply water until the RCS pressure decreases below the SI pump shutoff head. During this period, the steam generators are used to provide part of the core cooling function.

During the recirculation phase of LOCA recovery, RHR pump suction is transferred to the containment sump. The RHR pumps then supply the other ECCS pumps. Initially, recirculation is through the same paths as the injection phase. Subsequently, recirculation alternates injection between the hot and cold legs.

The centrifugal charging subsystem of the ECCS also functions to supply borated water to the reactor core following increased heat removal events, such as a main steam line break (MSLB). The limiting design conditions occur when the negative moderator temperature coefficient is highly negative, such as at the end of each cycle.

BASES

BACKGROUND (continued)

During low temperature conditions in the RCS, limitations are placed on the maximum number of ECCS 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 ECCS subsystems are actuated upon receipt of an SI 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 emergency diesel generators (EDGs). Safeguard loads are then actuated in the programmed time sequence. The time delay associated with diesel starting, sequenced loading, and pump starting determines the time required before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1.1, "Accumulators," and LCO 3.5.5, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet General Design Criteria (GDC) 35 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 2), will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F,

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation,

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react,

d. Core is maintained in a coolable geometry, and

e. Adequate long-term core cooling capability is maintained.

The LCO also limits the potential for a post-trip return to power following an MSLB event and ensures that containment temperature limits are met.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Each ECCS subsystem is taken credit for in a large break LOCA event at full power (Refs. 3 and 4). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The centrifugal charging pumps and SI pumps are credited in a small break LOCA event. This event establishes the flow and discharge head at the design point for the centrifugal charging pumps. The SGTR and MSLB events also credit the centrifugal charging pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

a. A large break LOCA event, with loss of offsite power and a single failure disabling one ECCS train, and

b. A small break LOCA event, with a loss of offsite power and a single failure disabling one ECCS train.

During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding during large breaks or control rod insertion for small breaks. Following depressurization, emergency cooling water is injected into the cold legs, flows into the downcomer, fills the lower plenum, and refloods the core.

The effects on containment mass and energy releases are accounted for in appropriate analyses (Refs. 3 and 4). The LCO ensures that an ECCS train will deliver sufficient water to match boil off rates soon enough to minimize the consequences of the core being uncovered following a large LOCA. It also ensures that the centrifugal charging and SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the centrifugal charging pump delivers sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

In MODES 1, 2, and 3, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

BASES

LCO (continued)

In MODES 1, 2, and 3, an ECCS train consists of a centrifugal charging subsystem, an SI subsystem, and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and automatically transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to supply its flow to the RCS hot and cold legs.

The flow path for each train must maintain its designed independence to ensure that no single failure can disable both ECCS trains.

As indicated in Note 1, the SI flow paths may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 4.4.6.3. The flow path is readily restorable from the control room.

As indicated in Note 2, operation in MODE 3 with ECCS trains made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is necessary for plants with an LTOP arming temperature at or near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be rendered incapable of injecting at and below the LTOP arming temperature. When this temperature is at or near the MODE 3 boundary temperature, time is needed to make pumps incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pumps to OPERABLE status on exiting the LTOP Applicability.

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, large break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The centrifugal charging pump performance is based on a small break LOCA, which establishes the pump performance curve and has less dependence on power. The SI pump performance requirements are based on a small break LOCA. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

BASES

APPLICABILITY (continued)

This LCO is only applicable in MODE 3 and above. Below MODE 3, the SI signal setpoint is manually bypassed by operator control, and system functional requirements are relaxed as described in LCO 3.5.3, "ECCS - Shutdown."

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.1.4, "RCS Cold Shutdown." MODE 6 core cooling requirements are addressed by LCO 3.9.8.1, "Residual Heat Removal and Coolant Circulation, All Water Levels" and LCO 3.9.8.2, "Residual Heat Removal and Coolant Circulation, Low Water Level."

ACTIONS

Action a.

With one or more trains inoperable and at least 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72-hour restoration time is based on an NRC reliability evaluation (Ref. 5) and is a reasonable time for repair of many ECCS components.

An ECCS train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an EDG can disable one ECCS train until power is restored. A reliability analysis (Ref. 5) has shown that the impact of having one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

BASES

ACTIONS (continued)

Reference 6 describes situations in which one component, such as an RHR crossover valve, can disable both ECCS trains. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.

If the inoperable trains cannot be returned to OPERABLE status within the associated action time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and MODE 4 within the following 6 hours. The shutdown times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Action b.

Action (a) is applicable with one or more trains inoperable. The allowed outage time is based on the assumption that at least 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train is available. With less than 100 percent of the ECCS flow equivalent to a single OPERABLE ECCS train available, the facility is in a condition outside of the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 4.5.2.a

Verification of proper valve position ensures that the flow path from the ECCS pumps to the RCS is maintained. Misalignment of these valves could render both ECCS trains inoperable. Securing these valves in position by removal of power or by key locking the control in the correct position ensures that they cannot change position as a result of an active failure or be inadvertently misaligned. These valves are of the type, described in Reference 6, that can disable the function of both ECCS trains and invalidate the accident analyses. A 12 hour frequency is considered reasonable in view of other administrative controls that will ensure a mispositioned valve is unlikely.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 4.5.2.b

With the exception of the operating centrifugal charging pump, the ECCS pumps are normally in a standby, nonoperating mode. As such, flow path piping has the potential to develop voids and pockets of entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling. The 31 day frequency takes into consideration the gradual nature of gas accumulation in the ECCS piping and the procedural controls governing system operation.

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve will automatically reposition within the proper stroke time. This surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day frequency is appropriate because the valves are operated under administrative control, and an improper valve position would only affect a single train. This frequency has been shown to be acceptable through operating experience.

SR 4.5.2.c

Deleted

SR 4.5.2.d

Periodic inspections of the containment sump suction inlet ensure that it is unrestricted and stays in proper operating condition. The 18 month frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage, on the need to have access to the location, and because of the potential for an unplanned transient if the surveillance were performed with the reactor at power. This frequency has been found to be sufficient to detect abnormal degradation and is confirmed by operating experience.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 4.5.2.e

These surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SI signal and that each ECCS pump starts on receipt of an actual or simulated SI signal. This surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month frequency is based on the need to perform these surveillances under the conditions that apply during a plant outage and the potential for unplanned plant transients if the surveillances were performed with the reactor at power. The 18 month frequency is acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment. The actuation logic is tested as part of ESF Actuation System testing, and equipment performance is monitored as part of the Inservice Testing Program of Specification 4.0.5.

SR 4.5.2.f

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by the ASME Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code). This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. This verifies that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. Surveillance test requirements are specified in the Inservice Testing Program of Specification 4.0.5. The Inservice Test Program provides the activities and frequencies necessary to satisfy the requirements.

SR 4.5.2.g

Realignment of valves in the flow path on an SI signal is necessary for proper ECCS performance. These valves have stops to allow proper positioning for restricted flow to a ruptured cold leg, ensuring that the other cold legs receive at least the required minimum flow. This surveillance is not required for plants with flow limiting orifices. The 18 month frequency is based on the same reasons as those stated in SR 3.5.2.d and SR 3.5.2.e.

BASES

REFERENCES

1. 10 CFR 50, Appendix A, GDC 35.
2. 10 CFR 50.46.
3. FSAR, Section 6.3.
4. FSAR, Chapter 15, "Accident Analysis."
5. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.
6. IE Information Notice No. 87-01.

B 3/4.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

B 3/4.5.3 ECCS – Shutdown

BASES

BACKGROUND

The Background section for Bases 3.5.2, "ECCS - Operating," is applicable to these Bases, with the following modifications. In MODE 4, the required ECCS train consists of two separate subsystems: centrifugal charging (high head) and residual heat removal (RHR) (low head).

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the refueling water storage tank (RWST) can be injected into the Reactor Coolant System (RCS) following the accidents described in Bases 3.5.2.

APPLICABLE SAFETY ANALYSES

The Applicable Safety Analyses section of Bases 3.5.2 also applies to this Bases section.

Due to the stable conditions associated with operation in MODE 4 and the reduced probability of occurrence of a Design Basis Accident (DBA), the ECCS operational requirements are reduced. It is understood in these reductions that certain automatic safety injection (SI) actuation is not available. In this MODE, sufficient time exists for manual actuation of the required ECCS to mitigate the consequences of a DBA.

Only one train of ECCS is required for MODE 4. This requirement dictates that single failures are not considered during this MODE of operation. The ECCS trains satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

In MODE 4, one of the two independent (and redundant) ECCS trains is required to be OPERABLE to ensure that sufficient ECCS flow is available to the core following a DBA.

In MODE 4, an ECCS train consists of a centrifugal charging subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST and transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to deliver its flow to the RCS hot and cold legs.

LCO (continued)

This LCO is modified by a Note that allows an RHR train to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4.

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2.

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.1.4, "Reactor Coolant System Cold Shutdown." MODE 6 core cooling requirements are addressed by LCO 3.9.8.1 “Residual Heat Removal and Coolant Circulation - All Water Levels,” and LCO 3.9.8.2 “Residual Heat Removal and Coolant Circulation - Low Water Level.”

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable ECCS high head subsystem when entering MODE 4. There is an increased risk associated with entering MODE 4 from MODE 5 with an inoperable ECCS high head subsystem and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A second Note allows the required ECCS RHR subsystem to be inoperable because of surveillance testing of RCS pressure isolation valve leakage (FCV-74-1 and FCV-74-2). This allows testing while RCS pressure is high enough to obtain valid leakage data and following valve closure for RHR decay heat removal path. The condition requiring alternate heat removal methods ensures that the RCS heatup rate can be controlled to prevent MODE 3 entry and thereby ensure that the reduced ECCS operational requirements are maintained. The condition requiring manual realignment capability, FCV-74-1 and FCV-74-2 can be opened from the main control room, ensures that in the unlikely event of a Design Basis Accident during the one hour of surveillance testing, the RHR subsystem can be placed in ECCS recirculation mode when required to mitigate the event.

ACTIONS (continued)

Action a.

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss of coolant accident or to continue a cooldown using the RHR pumps and heat exchangers. The action time of immediately to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must continue until the inoperable RHR loop components can be restored to operation so that decay heat removal is continuous.

With both RHR pumps and heat exchangers inoperable, it would be unwise to require the plant to go to MODE 5, where the only available heat removal system is the RHR. Therefore, the appropriate action is to initiate measures to restore one ECCS RHR subsystem and to continue the actions until the subsystem is restored to OPERABLE status.

Action b.

With no ECCS high head subsystem OPERABLE, due to the inoperability of the centrifugal charging pump or flow path from the RWST, the plant is not prepared to provide high pressure response to Design Basis Events requiring SI. The 1 hour action time to restore at least one ECCS high head subsystem to OPERABLE status ensures that prompt action is taken to provide the required cooling capacity or to initiate actions to place the plant in MODE 5, where an ECCS train is not required.

When Action b. cannot be completed within the required action time, within one hour, a controlled shutdown should be initiated. Twenty four hours is a reasonable time, based on operating experience, to reach MODE 5 in an orderly manner and without challenging plant systems or operators.

SURVEILLANCE REQUIREMENTS

SR 4.5.3

The applicable Surveillance descriptions from Bases 3.5.2 apply.

REFERENCES

The applicable references from Bases 3.5.2 apply.