TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

October 2, 2013

10 CFR 50.90

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

Sequoyah Nuclear Plant Units 1 & 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 & 50-328

Subject: **SEQUOYAH NUCLEAR PLANT (SQN), UNITS 1 AND 2 – PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE, "ULTIMATE HEAT SINK (UHS) TEMPERATURE LIMITATIONS SUPPORTING ALTERNATE ESSENTIAL RAW COOLING WATER (ERCW) LOOP ALIGNMENTS (TS-SQN-13-01 AND 13-02)"**

Reference: TVA letter to NRC dated September 30, 2013, "Third Status Update of Planned Actions to Facilitate Maintenance of 6.9 Kilovolt and 480 Volt Shutdown Boards at Sequoyah Nuclear Plant, Units 1 and 2".

In accordance with the provisions of 10 CFR 50.90, "Application for Amendment of License, Construction Permit, or Early Site Permit," Tennessee Valley Authority (TVA) is submitting a request for an amendment to Facility Operating License Nos. DPR-77 and DPR-79 for the Sequoyah Nuclear Plant (SQN), Units 1 and 2.

TVA is proposing changes to SQN Unit 1 and Unit 2 TS 3.7.5, "Ultimate Heat Sink," to place additional limitations on the maximum average Essential Raw Cooling Water (ERCW) system supply header water temperature during operation with one ERCW pump per loop and operation with one ERCW supply strainer per loop. In addition, the one-time limitations on Unit 1 UHS temperature and the associated License Condition requirements used for the Unit 2 steam generator replacement project are proposed to be deleted.

In the Reference letter, TVA provided an update of the efforts to permit the scheduling of preventive maintenance on SQN 6.9 Kilovolt (kV) and 480 Volt (V) Shutdown Boards for Units 1 and 2. The maintenance would be performed with one unit in Mode 5 or 6, or defueled and the other unit in Mode 1, 2, 3, or 4.

As described in the Referenced letter, several changes are needed at SQN to permit the scheduling of preventive maintenance on the Sequoyah Nuclear Plant (SQN) 6.9 Kilovolt (kV) and 480 Volt (V) Shutdown Boards. These changes include; 1) a License Amendment Request (LAR) to allow operation with one Essential Raw Cooling Water (ERCW) pump

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operable per loop, 2) a LAR to allow operation with a 6.9 kV and associated 480 V shutdown boards inoperable for seven days, 3) a plant modification to the Auxiliary Control Air System, and 4) a modification to the 125 V Direct Current System. This LAR proposes the changes that will allow operation with one ERCW pump per loop.

The enclosure provides a description of the proposed changes, technical evaluation of the proposed changes, regulatory evaluation, and a discussion of environmental considerations. Attachments 1 and 2 to the enclosure provide the existing TS and Bases pages marked-up to show the proposed changes. Attachments 3 and 4 to the enclosure provide the existing TS and Bases pages retyped with the proposed changes incorporated. The Bases pages are being provided for information only.

TVA requests approval of this TS change by October 10, 2014.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

The SQN Plant Operations Review Committee has reviewed this proposed change and determined that operation of SQN 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 and the enclosure to the Tennessee Department of Environment and Conservation.

There are no regulatory commitments associated with this submittal.

If there are any questions or if additional information is needed, please contact Mr. Clyde Mackaman at 423-751-2834.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 2nd day of October 2013.

Respectfully,

J.W. Shea
Vice President, Nuclear Licensing

Enclosure:
Evaluation of the Proposed Change

cc: See Page 2

cc (Enclosure):

NRC Regional Administrator – Region II
NRC Resident Inspector – Sequoyah Nuclear Plant
Director, Division of Radiological Health – Tennessee State Department of Environment and Conservation

September 30, 2013

10 CFR 50.4

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327 and 50-328

Subject: **Third Status Update of Planned Actions to Facilitate Maintenance of 6.9 Kilovolt and 480 Volt Shutdown Boards at Sequoyah Nuclear Plant, Units 1 and 2**

References:

1. Letter from TVA to NRC, "Planned Actions to Facilitate Planned Maintenance of 6.9 Kilovolt and 480 Volt Shutdown Boards at Sequoyah Nuclear Plant, Units 1 and 2," dated July 17, 2012 [ML12202A011]

2. Letter from TVA to NRC, "Status Update of Planned Actions to Facilitate Maintenance of 6.9 Kilovolt and 480 Volt Shutdown Boards at Sequoyah Nuclear Plant, Units 1 and 2," dated October 26, 2012 [ML12307A111]

3. Letter from TVA to NRC, "Second Status Update of Planned Actions to Facilitate Maintenance of 6.9 Kilovolt and 480 Volt Shutdown Boards at Sequoyah Nuclear Plant, Units 1 and 2," dated March 28, 2013 [ML13092A103]

In the Reference 1 letter, Tennessee Valley Authority (TVA) committed to provide an update to the Nuclear Regulatory Commission (NRC) of the status of the efforts to permit the scheduling of preventive maintenance on the Sequoyah Nuclear Plant (SQN) 6.9 Kilovolt (kV) and 480 Volt (V) Shutdown Boards for Units 1 and 2 with one unit in Mode 5 or 6 or defueled and the other unit in Mode 1, 2, 3, or 4. The update was to include a projection of the submittal of the SQN Improved Technical Specifications (ITS) application and the status of associated modification design efforts. TVA provided the status update on October 26, 2012 (Reference 2).

The Reference 2 and 3 letters included similar commitments and provided corresponding status updates of the planned SQN ITS application and associated modifications, and submittal of an Ultimate Heat Sink (UHS) license amendment request (LAR) needed to support the shutdown board preventive maintenance effort.

ENCLOSURE
TS-SQN-13-01 and 13-02

ENCLOSURE
TS-SQN-13-01 and 13-02

Evaluation of Proposed Change

Subject: **Ultimate Heat Sink (UHS) Temperature Limitations Supporting Alternate Essential Raw Cooling Water (ERCW) Loop Alignments.**

ATTACHMENTS

1. Proposed Technical Specifications and Operating License Page Markups
2. Proposed TS Bases Page Markups (for information only)
3. Proposed Retyped Technical Specifications and Operating License Pages
4. Proposed Retyped TS Bases Pages (for information only)

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Operating License Nos. DPR-77 and DPR-79 for Sequoyah Nuclear Plant (SQN), Units 1 and 2.

The proposed changes would place additional temperature limitations on the Ultimate Heat Sink (UHS) Technical Specification (TS) Limiting Condition for Operation (LCO) 3.7.5, with associated required actions, to support maintenance on plant components without requiring a dual unit shutdown.

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

Changes to SQN Unit 1 and Unit 2 TS 3.7.5, "Ultimate Heat Sink," are proposed to place additional limitations on the maximum average Essential Raw Cooling Water (ERCW) system supply header water temperature when specific conditions exist. In addition, the one-time limitations on Unit 1 UHS temperature and the associated License Condition requirements used for the Unit 2 steam generator replacement project are proposed to be deleted.

Specifically, TS LCO 3.7.5 will be revised and new Actions and Surveillance Requirements added as follows.

<u>LCO 3.7.5 changes</u>

SQN Unit 1 and Unit 2 currently have different requirements for LCO 3.7.5. This difference is due to a one-time TS change approved in September 2012 for SQN Unit 1 to allow for replacement of the Unit 2 steam generators (Reference 1).

The current Unit 1 LCO 3.7.5 states:

3.7.5 The ultimate heat sink shall be OPERABLE with:

a. A minimum water level at or above elevation 674 feet mean sea level USGS datum, and

b. An average ERCW supply header water temperature of less than or equal to 87°F, when the ERCW System is <u>not</u> in the alignment to support large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project, and

c. An average ERCW supply header water temperature of less than or equal to 74°F, when the ERCW System is in the alignment to support large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project.

While the current Unit 2 LCO 3.7.5 states:

3.7.5 The ultimate heat sink shall be OPERABLE with:

a. A minimum water level at or above elevation 674 feet mean sea level USGS datum, and

b, An average ERCW supply header water temperature of less than or equal to 87°F.

TVA is proposing to change LCO 3.7.5 for Unit 1 and Unit 2, consistent with Improved Standard Technical Specifications (NUREG-1431), such that it states:

LCO 3.7.5 The ultimate heat sink shall be OPERABLE.

(Note: the specifics associated with UHS level and temperature limitations are proposed to be relocated to the surveillance requirements, consistent with NUREG-1431.)

<u>LCO 3.7.5 Surveillance Requirement changes</u>

Current Unit 1 and Unit 2 Surveillance Requirements state:

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying the average ERCW supply header temperature and water level to be within their limits.

TVA is proposing to change the Unit 1 and Unit 2 Surveillance Requirements to state:

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying:

a. The *UHS* water level is ≥ *674 feet mean sea level USGS datum, and*

b. The average ERCW supply header water temperature is:

1) ≤ [81°F Unit 1] [79°F Unit 2] with any ERCW loop aligned to support one pump per loop OPERABILITY and only one ERCW pump OPERABLE on that loop, or

2) < 83°F with one ERCW System supply strainer and two ERCW pumps OPERABLE on that loop, or

3) ≤ 87°F with two ERCW supply strainers and two ERCW pumps OPERABLE per loop.

LCO 3.7.5 Action Changes

LCO 3.7.5 Actions are proposed to be changed to add Actions for when the added UHS temperature limitations are exceeded. The specific changes are:

Current Unit 1 and Unit 2 Actions state:

> With the requirements of the above specification not satisfied, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

TVA is proposing to change the Actions to state:

a. *With the average ERCW supply header water temperature > [81°F for Unit 1] [79°F for Unit 2] and ≤ 87°F, and any ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump is OPERABLE on that loop, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.*

b. *With the average ERCW supply header water temperature ≥ 83°F and ≤ 87°F, and one ERCW supply strainer inoperable on one or more loops, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.*

c. With the *UHS not within limits for reasons other than ACTION a or ACTION b,* be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

Mark-ups of the affected TS pages are provided in Attachment 1. Corresponding changes will also be made to the TS Bases. Mark-ups of these proposed TS Bases changes are provided in Attachment 2 for information only.

In addition, License Condition C(30), Steam Generator Replacement Project, supporting the one-time TS change recently approved for SQN Unit 1 to allow for replacement of the Unit 2 steam generators is proposed to be deleted along with the TS requirements. Mark-ups of this proposed change are also provided in Attachment 1 with retyped pages in Attachment 3.

2.2 Condition Intended to Resolve

As discussed in a letter to NRC dated July 17, 2012, TVA evaluated actions that would be required to facilitate the scheduling of maintenance activities on the 6.9 Kilovolt (kV) and 480 Volt (V) shutdown boards in the electrical distribution system at SQN. As further discussed in a letter dated October 26, 2012, TVA determined that both design changes and physical modifications to the facility as well as changes to certain SQN technical specification requirements are needed to facilitate the specific maintenance activities. TVA's objective is to facilitate cleaning and inspection of the 6.9 kV shutdown board and associated 480v shutdown boards without requiring a dual unit shutdown.

In the October 26, 2012 letter, as further discussed in a letter dated March 28, 2013, and a letter dated September 30, 2013, TVA indicated that, as part of a combination of plant modifications and technical specification changes to facilitate the shutdown board maintenance activities, changes to Technical Specifications 3.7.5, "Ultimate Heat Sink," would be developed. The changes to TS 3.7.5 are in the form of changes to the Essential Raw Cooling Water System and are the subject of this License Amendment Request.

Changes to TS 3.7.5 are needed because taking one 6.9 kV shutdown board out of service to perform maintenance affects both units. SQN TS 3.8.2.1 for Unit 1 and Unit 2 requires all four 6.9 kV shutdown boards to be operable. With an inoperable 6.9 kV shutdown board TS 3.8.2.1 Action a for Unit 1 and Unit 2 allows eight hours to restore inoperable boards to an operable status, or be in at least Hot Standby within six hours and Cold Shutdown within the following 30 hours. Eight hours is not adequate to safely clean and inspect a shutdown board and perform corrective maintenance. In addition, an inoperable 6.9 kV shutdown board renders one of two required ERCW pumps per loop inoperable. In this condition TS allows 72 hours to return the pump to an operable status, also inadequate to clean the shutdown boards.

With regard to the ERCW system, each 6.9 kV shutdown board is aligned to power two ERCW pumps. A selector switch determines which of the two associated ERCW pumps the 6.9 kV shutdown board is supporting for operability. Current SQN TSs require two ERCW pumps to be operable per loop, with two loops required for each unit. Consequently, this requires all four EDG supported ERCW pumps to be operable, and thus all four 6.9 kV shutdown boards must be operable to support the ERCW pump TS requirement.

To allow for the cleaning of a 6.9 kV shutdown board, reliance on the ERCW pump, supported by the out of service 6.9 kV shutdown board, needs to be eliminated.

In addition, this proposed change is intended to allow maintenance on ERCW system supply strainers without entering TS Actions for both units while in Modes 1, 2, 3, or 4. An evaluation has shown that by placing the ERCW system in a specific configuration, all accident analysis criteria are satisfied if the UHS temperature is further limited. By stating the configuration and limiting UHS temperature, this proposed LAR avoids the need to shutdown both units to perform the maintenance.

TVA is planning to reflect the changes associated with this proposed LAR in a future submittal for conversion of SQN TS to improved Standard Technical Specification (ITS) format, using NUREG 1431, Revision 4.0 as the conversion's model.

3.0 BACKGROUND

As described in the SQN updated Final Safety Analysis Report (UFSAR) and NRC Regulatory Guide 1.27 (RG 1.27) The UHS for a nuclear plant is that complex of water sources, including associated retaining structures, and any canals or conduits connecting the sources with, but not including, the intake structures of the nuclear reactor units, used to remove waste heat from the plant. The UHS is designed to perform two principal safety functions: (1) dissipation of residual and auxiliary heat after reactor shutdown, and (2) dissipation of residual and auxiliary heat after an accident. The UHS for SQN is the Tennessee River and achieves these functions through the ERCW system. The UHS is required to be operable in Operating Modes 1, 2, 3, and 4 in accordance with TS Section 3.7.5. If the UHS function cannot be satisfied, unit shutdown is required in accordance with the associated action times.

As stated in SQN UFSAR Section 9.2.5, the UHS was designed to comply with the regulatory positions in Nuclear Regulatory Commission (NRC) Regulatory Guide 1.27, Revision 0, dated March 23, 1972, as follows:

1. The UHS should be capable of providing sufficient cooling for at least 30 days (a) to permit simultaneous safe shutdown and cooldown of all nuclear reactor units that it serves, and maintain them in a safe shutdown condition, and (b) in the event of an accident in one unit, to permit control of that accident safely and permit simultaneous safe shutdown and cooldown of the remaining units and maintain them in a safe shutdown condition. Procedures for assuring a continued capability after 30 days should be available.

2. The UHS should be capable of withstanding the effects of the most severe natural phenomena associated with this location, other applicable site-related events, reasonably probable combinations of less severe phenomena or events where this is appropriate to provide a consistent level of conservatism, and a single failure of man-made structural features without loss of the capability specified in Regulatory Position 1 above.

3. The UHS should consist of at least two sources of water, including their retaining structures, each with the capability to perform the safety function specified in Regulatory Position 1 above unless it can be demonstrated that there is an extremely low probability of losing the capability of a single source. There should be at least two canals or conduits connecting the source(s) with the intake structures of the nuclear power units, unless it can be demonstrated that there is extremely low probability that a single canal can fail entirely from natural phenomena. All water sources and their associated canals or conduits should be highly reliable and should be separated and protected such that failure of any one will not induce failure of any other.

4. The TSs for the plant should include actions to be taken in the event that conditions threaten partial loss of the capability of the ultimate heat sink or if it temporarily does not satisfy Regulatory Positions 1 and 3 above during operation.

No changes are made nor proposed to the capability or capacity of the UHS or ERCW pumps. SQN UFSAR Section 9.2.5.2 describes how TVA satisfies the Regulatory Guide 1.27 requirements as follows for SQN Units 1 and 2.

1. The cooling water requirements for the most demanding accident shutdown and cooldown of the plant's reactors are presented in [SQN UFSAR] subsection 9.2.2. The adequacy of the Tennessee River to provide this amount of water, and therefore to satisfy regulatory position (1), is confirmed in [SQN UFSAR] subsections 2.4.11.1 and 2.4.11.3.

2. Under the most adverse events expected at the site or a reasonable combination of less severe events and any single failure of a man-made feature, the sink is designed to retain its capability to perform the specified safety functions. The most severe natural phenomena (including flood, drought, tornado, wind, and earthquake)

conceivable to occur at this site are discussed in [SQN UFSAR] Chapter 2. The new ERCW pumping station provides ERCW for both normal and emergency plant conditions. With the new ERCW station in operation, the sink's safety functions are insured for all of the plant design basis events, including those extreme natural phenomenon credible to occur at this site.

As stated previously, the ERCW pumps are protected from the design basis flood(*), including the effects of wind waves; therefore they will be capable of functioning in all flood conditions up to and including the design basis flood (see [SQN UFSAR] subsection 9.2.2). The water intake to the ERCW pumping station and the area outside the station intake were dredged to form a channel that will provide free access to the river. The channel was dredged to a sufficient width eliminating the possibility of channel blockage due to an earth- or mudslide. The channel will be monitored and dredged as required to maintain free access to the river. Therefore, adequate water will be available to the ERCW pumps at all times, including the loss of downstream dam for any reason. The unlikely occurrence of the [safe shutdown earthquake] SSE could significantly affect the sink only by causing failure of the downstream dam and/or upstream dams. For the resulting low and/or high water event, water will be available to the intake at all times. A seismically induced disturbance of the rock surfaces could only block a small percentage of the intake channel due to its highly conservative width. Also, a tornado cannot interrupt the ERCW supply to the station.

For an evaluation of barge impact and explosion hazards see [SQN UFSAR] subsection 2.2.3.

TVA regulation of the Tennessee River is such that a drought will not challenge the UHS's capability as required in regulatory position 1; this is historically confirmed by the data in [SQN UFSAR] subsection 2.4.11.3.

The sink is designed to withstand a 95 mph basic wind or the most severe tornado, including the associated missile spectrum, without loss of the capability to provide an adequate supply of cooling water to the Essential Raw Cooling Water System.

The most severe combination of events considered credible to the heat sink would be the simultaneous occurrence of the SSE, and loss of downstream dams with a water temperature at 87°F. Under this extreme situation, the sink retains the capability of regulatory position (1). The sink provides water to the ERCW system as described in [SQN UFSAR] Section 9.2.2.

Refer to [SQN UFSAR] subsection 2.4.11.6 for additional discussion of the requirements for maintaining sink dependability.

(*) Based on recent reanalysis of the probable maximum flood (PMF) elevation, TVA has submitted a request for a license amendment seeking approval to revise the SQN Units 1 and 2 Updated Final Safety Analysis Report (UFSAR) to adopt a revised hydrologic analysis for SQN Units 1 and 2 (TAC Nos. ME9238 and ME9239) (Reference 6). The ERCW pumps continue to be protected from the revised design basis flood.

3. The Tennessee River is the common supply for all plant cooling water requirements. Total interruption of this supply is incredible. Additionally, the integrity of the river's dams is not essential for safe reactor shutdown and cooldown.

4. The limiting conditions and surveillance requirements for the ERCW System are given in the SQN Technical Specifications. The limiting conditions for the plant's flood protection program are given in SQN Technical Requirements Manual.

4.0 TECHNICAL EVALUATION

4.1 System Description

4.1.1 Ultimate Heat Sink

The UHS is that complex of water sources, including associated retaining structures, and any canals or conduits connecting the sources with, but not including, the intake structures of the nuclear reactor units, used to remove waste heat from the plant. The UHS is designed to perform two principal safety functions: (1) dissipation of residual and auxiliary heat after reactor shutdown, and (2) dissipation of residual and auxiliary heat after an accident. The UHS achieves these functions through the ERCW system by providing the heat sink function for the ERCW system.

The UHS for SQN is the Tennessee River and is required to be operable in Operating Modes 1, 2, 3, and 4, in accordance with TS Section 3.7.5. If the UHS function cannot be satisfied, unit shutdown is required in accordance with the associated action statements and completion times. No changes are made nor proposed to the capability or capacity of the UHS.

The SQN site comprises approximately 525 acres on a peninsula on the western shore of Chickamauga Lake at Tennessee River Mile 484.5. Chickamauga Dam, 13.5 miles downstream, affects water surface elevations at SQN. The maximum normal full lake elevation is 683.0 feet, the minimum normal lake elevation is 675.0 feet, and the minimum lake elevation limit in TSs is 674 feet. Actual lake level is seasonally adjusted, maintaining approximately 676 feet during the winter season increasing to approximately 682.5 feet during the other seasons. At the maximum normal full lake elevation the reservoir is 58.9 miles long on the Tennessee River and 32 miles long on the Hiwassee River, covering an area of 35,400 acres, with a volume of 628,000 acre-feet. The reservoir has an average width of nearly 1 mile, ranging from 700 feet to 1.7 miles. At SQN, the reservoir is about 3,000 feet wide with depths ranging between 12 feet and 50 feet at normal lake elevation. Based upon discharge records since construction of Chickamauga Dam in 1940, the average daily stream flow at the plant is 32,600 cubic feet per second (cfs). The estimated minimum river flow requirement for the ERCW system is only 45 cfs.

4.1.2 Essential Raw Cooling Water

The ERCW is a two-train (two-loop) system with each train having the capability to provide the maximum required cooling water requirement for both units under any credible plant condition. These ERCW trains are sufficiently independent to guarantee the availability of at least one train at any time. The system has been analyzed for "worst case" heat loads under combinations of maximum river water temperature, design basis accident conditions, normal cooldown requirements, power train failures, etc. for both units. Based on these analyses, sharing of the ERCW system by the two nuclear units does not introduce factors that prevent the system from performing its required function for plant design basis conditions. Sufficient pump capacity is included to provide design cooling water flows under all conditions and the system is arranged in such a way that even loss of a complete header or one supply source can be isolated in a manner that does not challenge plant safety.

To meet current operability requirements for ERCW loops the following must be met;

1. at least two operable ERCW pumps per train (with one pump fed from each shutdown board),
2. the operable ERCW pumps must be selected on Blackout Start Selector Switches, and
3. the Traveling screen and screen wash pump (SWP) for operable ERCW pumps must be functional as attendant equipment.

The ERCW system draws water directly from the Tennessee River (Chickamauga Lake). The ERCW pumping station is located within the plant intake skimmer structure, and has direct communication with the main river channel for all reservoir levels including loss of the Chickamauga Dam. The ERCW headers are crosstied downstream of the ERCW pumps and can be crosstied downstream of the ERCW supply strainers, referred to as yard header crossties (refer to Figure 1).

The ERCW system has eight pumps (four pumps per train), four traveling water screens, four screen wash pumps, and four supply strainers located within the ERCW pumping station; and associated piping and valves as shown in UFSAR Figures 9.2.2-1 through 9.2.2-5. The minimum combined safety requirements for one "accident" unit and one "non-accident" unit, or two "non-accident" units, are met by only two pumps on one plant train, when the ERCW system is aligned in its normal configuration. The A and B ERCW trains each have a maximum of two pumps that can be considered operable because only one of the two pumps powered from each of the four 6.9 kV shutdown boards can be aligned to be repowered by an Emergency Diesel Generator (EDG) on loss of offsite power. Total loss of either train or the loss of an entire plant emergency power train will not prevent safe shutdown of either unit under any credible plant condition. Thus, sharing of the ERCW does not compromise safety.

With one unit shutdown and the Reactor Coolant System (RCS) temperature < 200 degrees Fahrenheit (°F), minimum combined safety requirements for one "accident" unit and one "non-accident" unit, or two "non-accident" units, are met by only one pump on one plant train when the ERCW system is aligned as delineated in the proposed TS Bases.

The ERCW system is designed to supply water to the following essential components:

- Component cooling heat exchangers (HXs)
- Containment spray HXs
- EDGs HXs
- Emergency makeup for steam generators via the Auxiliary Feedwater (AFW) System

- Emergency makeup for Component Cooling System (CCS)
- Control Building Air-Conditioning Systems
- Auxiliary Building space coolers (for engineered safety features (ESF) equipment)
- Containment Ventilation System coolers
- Auxiliary control air compressors
- Reactor coolant pump (RCP) motor coolers
- Control rod drive (CRD) ventilation coolers
- Spent fuel pit (SFP) HXs*
- Sample HXs*
- RCP thermal barriers*
- Ice machine refrigeration condensers*
- Residual heat removal (RHR) HXs*
- Station air compressors (alternate supply)

  *Provided with ERCW only during flood above elevation 705.5 feet as needed.

The availability of water for the most demanding condition on the ERCW system is based on the following events occurring simultaneously:

- Loss of offsite power
- Loss of downstream dam
- Loss of two EDGs serving the same power train
- Design basis earthquake

Certain combined modes of operation under the above circumstances are not within the design capability of the ERCW system. The modes that cannot be adequately supplied are simultaneous shutdown/cooldown of both units or one unit in shutdown/cooldown and the other in a LOCA. In each of these situations, a non-accident unit can be maintained at Hot Standby, if necessary, until heat loads are low enough to cooldown, or if already shutdown, maintained in safe shutdown or allowed to return to Hot Standby, depending on the heat load. The design maximum heat load rejected to the ERCW system occurs with one unit in an accident condition and the other in Hot Standby.

ERCW Piping

The ERCW system piping is arranged in four headers (1A, 1B, 2A, and 2B), each serving certain components in each unit as described below (refer to Figure 1):

- Each header supplies ERCW to one of the two Containment Spray System (CSS) HXs associated with each unit.

- The primary cooling source for each of the EDG HXs is from the Unit 1 ERCW headers. Each diesel also has an alternate supply from the Unit 2 ERCW headers of the opposite train.

- The normal cooling water supplies to CCS HXs 1A1 and 1A2, 2A1 and 2A2, and 0B1 and 0B2 are from ERCW headers 2A, 2A, and 2B, respectively.

- Each A and B ERCW supply header in each unit provides a backup source of feedwater for the turbine-driven Auxiliary Feedwater pumps in the respective unit.

- Each of the A and B ERCW discharge headers provides a backup source of feedwater for the motor-driven Auxiliary Feedwater pumps in each unit.
- ERCW headers 1A and 1B provide cooling water to the control room and Control Building electrical board room air-conditioning systems.
- Each ERCW A and B header in each unit supplies cooling water to the Auxiliary Building ventilation coolers for ESF equipment, the containment ventilation system coolers, the RCP motor coolers, the CRD vent coolers, and the containment instrument room cooler water chillers in the respective unit.
- ERCW headers 1A and 1B provide an alternate source of cooling water for the Station Air Compressors.
- ERCW headers 1A and 2B provide cooling water for the shutdown board room air conditioners and ACA compressors.
- ERCW headers 2A and 2B provide cooling water for the Emergency Gas Treatment room coolers and boric acid transfer and Unit 2 AFW pump space coolers.
- ERCW headers 1A and 1B provide cooling water for the CCS pumps and Unit 1 AFW pump space coolers.
- Under flood conditions, ERCW provides cooling water to the SFP HXs, RCP thermal barriers, ice machine refrigeration condensers, Sampling System sample HXs, and the RHR HXs as needed.

<u>ERCW Strainers</u>

The ERCW system has four supply strainers designated as A1A-A, A2A-A, B1B-B, and B2B-B. Each ERCW supply header (1A, 2A, etc.) is provided with two system supply strainers (manual continuous backwash type) capable of removing particles and organic matter larger than 1/32-inch diameter and are required to operate during and/or after an accident. These strainers are located in the ERCW pumping station downstream of the ERCW pumps. Each ERCW header can be supplied by the two train specific ERCW supply strainers, one with a Unit 1 designation and the other with a Unit 2 designation. For example (refer to Figure 1), ERCW header 1A can receive ERCW flow through ERCW supply strainers A1A-A and/or A2A-A. This is because of the ERCW supply crossties. Each ERCW train has two supply crossties which are normally in service; one just downstream of the ERCW pumps the other downstream of the ERCW supply strainers. The ERCW supply crosstie downstream of the ERCW pumps does not have any isolation valves and is continuously in service. The crosstie downstream of the ERCW supply strainers (the yard header) has isolation valves that are normally open. Therefore, during operation with both ERCW supply crossties open, ERCW flow from any of the four train specific ERCW pumps can be provided through both of the train specific (e.g., Train A, Unit 1 or Unit 2) supply strainers. Even with the crosstie downstream of the supply strainers closed, ERCW flow from any of the four train specific

ERCW pumps can be provided to either supply header through the associated train specific supply strainer.

ERCW Loop Operability

SQN Technical Specifications (TSs) require at least two independent ERCW loops to be operable in MODES 1, 2, 3, and 4. Two ERCW loops are required to be operable to provide the required redundancy to ensure that the system function to remove post-accident heat loads is met, assuming that the worst case single active failure occurs coincident with the loss of offsite power. An ERCW loop is considered operable when the required number of pumps are operable, and the associated piping, supply strainers, valves, instrumentation, and controls required to perform the safety related function are operable.

The ERCW system is shared between the units. The two trains are independent of each other. Within each train exist various crossties between supply headers. While these crossties may be configured as open or closed, the crossties are all within their respective train.

The ERCW system also contains physical crossties between the trains at two locations. The valves on these crossties are configured closed for all normal plant operation modes, and all design basis accidents. These crossties would only be opened when both units are in Mode 5, 6, or defueled, in Flood Mode operation, or in certain plant accidents or events that are outside the plant design basis. If the crossties between the trains were to be opened in Modes 1 through 4, then one or both of the ERCW trains would be inoperable. The valves on these crossties are motor operated valves configured with their power supply breakers open.

Operability of an ERCW loop is determined by its independent capability of taking suction from the UHS and removing post accident heat loads upon an ESF actuation signal coincident with the loss of offsite power. During normal operation with UHS temperature (ERCW average supply temperature) up to and including 87°F, an ERCW loop is considered operable if two of the four same train ERCW pumps are operable; with each pump aligned to a separate 6.9 kV shutdown board. ERCW loop operability also includes the associated valves, piping, instruments, and controls to ensure a flow path capable of taking suction from the UHS and removing post accident heat loads upon an ESF actuation signal.

TVA has performed an evaluation that demonstrates that than ERCW loop can also be considered operable if an ERCW supply strainer is removed from service or only one ERCW pump is operable per loop. To consider the ERCW loop operable when an ERCW supply strainer is removed from service or only one ERCW pump per loop is operable, specific ERCW system alignments must be made and UHS temperature limit reduced. This proposed LAR presents the UHS temperature limitations and plant configurations that must be in place.

Single Failure

As discussed in Section 3.1.2 of the UFSAR, Criterion 44, "Cooling Water," of the NRC General Design Criteria (GDC), published as Appendix A to Title 10, of the Code of Federal Regulations (10 CFR) Part 50 (10 CFR 50), states that a system to transfer heat from SSCs important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these SSCs under normal operating and accident conditions. Criterion 44 also states that suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be 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.

To meet this criterion, including the ability to withstand a single failure, the ERCW system consists of two independent loops, each of which is capable of providing all necessary heat sink requirements. TVA has determined that the proposed TS limitations on the UHS temperature and ERCW alignments to allow maintenance on the ERCW supply strainers and 6.9 kV shutdown boards will not affect continued compliance with this criterion.

The following Table shows the relationship between 6.9 kV shutdown boards, associated EDGs, and supported ERCW system pumps.

6.9 kV Shutdown Board	EDG	Supported ERCW Pump
1A-A	1A-A	J-A
		Q-A
1B-B	1B-B	L-B
		N-B
2A-A	2A-A	K-A
		R-A
2B-B	2B-B	M-B
		P-B

The ERCW system transfers heat to the UHS and is powered by either the offsite power sources or the onsite emergency power sources. The EDGs are used to supply power for the pumps and motor operated valves during a loss of offsite power. Two ERCW pumps are supplied power from each 6.9 kV shutdown board and are interlocked such that only one ERCW pump automatically starts on restoration of power to the shutdown board by the EDG. On a loss of offsite power, one EDG supplies power to each 6.9 kV shutdown board.

With an ERCW supply strainer out of service, the ERCW yard headers crosstied, and the ERCW supply temperature within the proposed TS limit, Criterion 44 continues to be met. The train with a strainer that is out of service is fully capable of providing all necessary heat sink requirements. Therefore, if any single failure renders one loop inoperable, the remaining loop is capable of providing all necessary UHS requirements.

With an ERCW supply header aligned to support one pump per loop operation; one 6.9 kV shutdown board out of service; the ERCW yard, Auxiliary Building, and ESF headers are crosstied; and the ERCW supply temperature within the proposed TS limits; Criterion 44 continues to be met. The train that is aligned for one pump per loop operation is fully capable of providing all necessary heat sink requirements. Therefore, if any single failure renders one loop inoperable, the remaining loop is capable of providing all necessary UHS requirements.

4.2 Technical Analysis

4.2.1 Overview

As described in UFSAR Section 3.1.1, SQN is a Hot Standby plant. The ERCW system design basis requires operation under the worst case initial condition of operation as described in UFSAR Section 9.2.2. This condition is postulated to be the low probability combination of a design basis earthquake coincident with a LOCA in one unit, abrupt loss of the downstream dam, loss of the emergency power train, shutdown of the other unit to Hot Standby, and loss of all offsite power.

TVA is requesting approval of additional temperature limitations on the UHS (average ERCW supply temperature) in order to allow performance of maintenance on the ERCW supply strainers or the 6.9 kV shutdown boards. Performing maintenance on these components requires reconfiguring the ERCW system for supply strainer maintenance or removing two ERCW pumps from service (powered from the same shutdown board) for shutdown board maintenance. This involves reducing flow to certain ERCW components. Removing two ERCW pumps from service to support shutdown board maintenance leaves only one EDG backed ERCW pump remaining for that loop.

Coincident with removing an ERCW supply strainer from service or the two ERCW pumps powered by a 6.9 kV shutdown board are flow reductions to heat loads supplied by the affected loop(s). A flow reduction in a loop reduces the heat removal capability of the affected HXs. Therefore, to ensure the component heat loads assumed in the accident analyses are removed as required, reduced UHS TS temperature limitations are proposed.

For the SQN ERCW system, TVA has determined the ERCW heat removal requirements for the safety related components to confirm that adequate ERCW flow rates exist to the components for design basis conditions. In addition, for off-normal ERCW system alignments, this analysis determined the ERCW maximum supply temperatures for components that do not receive their normal design flow rate of 87°F water such that they would perform their required function(s).

The minimum design flow rates for each ERCW heat load were developed in various calculations. The design required flow rate for each safety related ERCW heat load is listed in Table 4.2-1 (Section 8.0 of this enclosure), based on an 87°F average UHS temperature (i.e., average ERCW supply header water temperature). Information obtained from these various calculations was also used to determine the required maximum average UHS temperature for flow rates less than the design required flow rate for these components. For flow rates less than the design required flow rate, a curve fit equation was developed for each of the safety related components. The curve fit equation provided the maximum ERCW temperature that would remove the required heat load with a flow rate of less than the design required ERCW flow rate. The lowest ERCW supply temperature for the various ERCW supply strainer outages and ERCW pump outages was used as the maximum UHS TS temperature limit. The analysis assumes that for ERCW in the range of 84°F to 130°F, the density of water does not vary significantly; therefore, mass flow is assumed to be directly proportional (and linear) to gallons per minute (gpm).

4.2.2 Limiting Temperature Determination

To determine the limiting (maximum) UHS temperature, TVA applied the methodology previously used to support SQN License Amendment 317/307 (Reference 2), justifying a maximum UHS temperature limitation of 87°F. The 87°F limitation was based on establishing minimum required ERCW flow rates to ERCW supplied ESF components. These minimum required ERCW flow rates are listed in Table 4.2-1. For the determination of the limiting UHS temperatures, when aligned for ERCW supply strainer maintenance or single ERCW pump per loop operation, the reconfigured flow rates were compared to the design required flow rates. For a component where the reconfigured flow rate was less than the design required flow rate, a curve fit equation was developed to determine the ERCW supply temperature at which the reconfigured flow rate would remove the required heat load from the affected component.

To determine the temperature at which the reconfigured flow rate would remove the required heat load, one of three methods was used to develop a "curve fit equation." The curve fit equation provides the relationship between the component's flow rate and the ERCW supply temperature (UHS temperature) at which the required heat load was removed.

The first method used energy balance equations (e.g., q(dot) = m(dot)($C_p \Delta T$) to develop a correlation factor that was then applied to the various component flows in order to calculate the available flow margins where:

q(dot) = heat transfer rate, is the transfer of thermal energy across the HX,

M(dot) = the mass flow rate, is the mass of a substance which flows past a given location per unit of time,

Cp = the specific heat capacity, the amount of heat energy required to raise the temperature of a body per unit of mass, and

ΔT = is the temperature difference between the HX inlet fluid and outlet fluid.

The correlation factor method was used for the electrical board room coolers, main control room (MCR) chiller, ACA compressors, and the Safety Injection System (SIS) pump oil cooler. Using a previously determined minimum flow rate for 84.5°F for these components, the required minimum flow rates for 87°F and 81°F for the specific structures, systems, or components (SSCs) were determined. The minimum flow rate values at 87°F, 84.5°F, and 81°F were tabulated in Microsoft® Excel (Excel) and an Excel trendgraph was then produced, with a trendline. A second order polynomial curve that fit the trendline was selected. From the polynomial curve, a curve fit equation was developed and used to determine the required maximum supply temperature if the hydraulic analysis shows the HX receives less than the design required flowrate. The results were further reduced in order to ensure that all temperatures computed from the equations are conservative.

The second method used was the manipulation of the PROTO-HX computer code to model the component. In PROTO-HX, changes to the calculation settings were made to provide resulting data for required ERCW flow over various ERCW supply temperatures. The values determined were again tabulated in Excel, and an Excel trendgraph was produced, with a trendline. A second or third order polynomial curve that fit the trendline was selected. From the polynomial curve, a curve fit equation was developed and used to determine the required maximum supply temperature if the hydraulic analysis shows the HX receives less than the design required flowrate. The results were reduced further in order to ensure that all temperatures computed from the equations are conservative.

The third method was the use of values directly from other design inputs that had determined the required flowrate for those components at various temperatures, such as a chiller analysis for ERCW temperature change. The values were tabulated in Excel, and an Excel trendgraph was produced, with a trendline. A second order polynomial curve that fit the trendline was selected. From the polynomial curve, a curve fit equation was developed and used to determine the required maximum supply temperature if the hydraulic analysis shows the HX receives less than the required design flowrate. The results were reduced further in order to ensure that all temperatures computed from the equations are conservative.

4.2.3 Determination of Acceptability of Available ERCW Flowrates

The analysis compared the available flow under specific plant conditions, referred to as cases, (e.g., strainer outage and one ERCW pump per loop operation) to the required flow. If the available flow rate is less than the required flow rate for 87°F, the curve fit equations are applied to determine the applicable limitations on the ERCW supply temperature.

To determine the available flow for the specific plant condition of concern, the ERCW Flow Balanced Hydraulic Model (Multiflow Model) was configured for several different cases. Tables 4.2-2 and 4.2-3 describes eight strainer cases for ERCW strainers isolated during normal plant operation. The eight strainer cases are listed by crosstie operation and other plant conditions, such as which strainer(s) are isolated and the unit in which a LOCA is postulated to occur. The results from the Multiflow Model for each ERCW strainer outage case are listed in Tables 4.2-8 through 4.2-11. To determine the available ERCW flow when only one ERCW pump per loop is in operation, the Multiflow Model was configured in the various cases listed in Table 4.2-6, which describes alignments that may occur during single unit shutdowns, and would allow only one ERCW pump per loop to be operable. Specifically, this would occur because of the removal of the two ERCW pumps associated with an out of service 6.9 kV shutdown board, with one unit shutdown, and various components with their ERCW supply isolated. The results from the Multiflow Model for each ERCW pump outage case are listed in Tables 4.2-12 through 4.2-14.

The ERCW flow values determined in the Multiflow hydraulic analysis had a five percent uncertainty subtracted from each calculated flow value to account for the measurement and analysis uncertainties. The five percent uncertainty was accepted by the NRC in a previous requested amendment (References 3 and 4). The five percent subtraction bounds the measurement and analysis uncertainties.

Tables 4.2-8 through 4.2-14 present the results of the analysis, divided by cases, with each case identifying the results of the Multiflow Model output (Multiflow Results), the Multiflow Model output reduced by five percent (minus 5%), and the results of the curve fit equation (Temp. Limit). The cases are labeled Strainer 1 through Strainer 8 for the analysis determining the restriction necessary for an ERCW supply strainer being removed from service. The cases are labeled Outage 1 through Outage 4 for the analysis determining the restriction necessary when only one ERCW pump per loop is operable. If the five percent reduced flow rate is less than the component's design required flow rate, a temperature limit is listed. If no temperature limit is listed, the five percent reduced flow rate is greater than the component's design required flow rate and the current average ERCW supply temperature TS limit of 87°F provides adequate heat removal capability.

The analysis for determining the acceptability of available ERCW flow rates was done by comparing the reconfigured available flow rate to the design required flow rate. If the reconfigured available flow rate is less than the design required flow rate, the curve fit equations are applied to determine the applicable limitation on the ERCW supply temperature.

Tables 4.2-8 through 4.2-14 present the results of the Multiflow analysis and list any required temperature limitations. Tables 4.2-8 through 4.2-11 present the results of the Multiflow analysis associated with the ERCW system supply strainer outage cases. Tables 4.2-12 through 4.2-14 present the results of the Multiflow analysis associated with single ERCW pump per loop operability and required reconfiguration of the ERCW system. The Tables are separated by train designation, except for Table 4.2-14, with Tables 4.2-8, 4.2-10, and 4.2-12 associated with A Train components. Tables 4.2-9, 4.2-11, and 4.2-13 are associated with B Train components. Table 4.2-2 presents the ERCW system supply strainer cases for the corresponding plant conditions. Table 4.2-6 presents the one ERCW pump per loop outage cases and the corresponding plant conditions.

Tables 4.2-8 through 4.2-14 are organized by component, listing the associated design required flow rates, Multiflow analysis results, and any required temperature limitations less than 87°F. The first column identifies the component that relies on the ERCW system as a heat sink. The second column is labeled "Required Flow," and lists the ERCW system design required flow rate, in gpm, at the TS limit of 87°F. The next three columns are duplicated in each ERCW system case. These duplicate columns are grouped by strainer/outage designation. The first of the three columns is labeled "Multiflow Results," the second of the three columns is labeled "minus 5%," and the third of the three columns is labeled "Temp Limit." Column 1 of 3 lists the reconfigured available flow rate, in gpm, determined by the Multiflow Model when aligned as identified in Table 4.2-2 or Table 4.2-6, and a postulated LOCA is occurring on the designated unit. Column 2 of 3 ("minus 5%") is the value listed in Column 1 of 3 minus five percent. Column 3 of 3 ("Temp Limit") lists the reduced ERCW system supply temperature limit required because the Column 2 of 3 flow rate (reconfigured available flow rate minus five percent) is less than the component's design required flow rate listed in the "Required Flow" column. This temperature limitation is determined using the reconfigured available flow rate minus five percent, and the curve fit equation for the specific component that was previously developed. The last row in Tables 4.2-8 through 4.2-14 lists the maximum temperature limit determined for each ERCW system supply strainer or pump outage case. These minimum temperatures are summarized in Tables 4.2-4, 4.2-5, and 4.2-7.

For example, in Table 4.2-8 the first listed component is EDG 1A1. The "Required Flow" column list 522 gpm, this is the amount of ERCW flow in gpm that EDG 1A1 needs to remove the necessary heat at a maximum UHS temperature of 87°F. The next three columns are grouped under the "Strainer 1" case number. Column 1 of 3 lists the results of the Multiflow analysis of 545 gpm. Column 2 of 3 lists the results of Column 1 of 3 reduced by five percent (545 gpm – (545 x 0.05) = 545 - 27.25 = 517.8 gpm). Column 3 of 3 lists any temperature limitation needed if the Column 2 of 3 results are less that the "Required Flow" column, as in the EDG 1A1 Strainer 1 case. For this case, Column 2 of 3 lists 517.8 gpm, which is less than the required 522 gpm, so the curve fit equation is used to determine a reduced temperature (i.e., 86.3°F) where the required heat load of EDG 1A1 is removed. The last row in each table lists the minimum temperature of all the components evaluated in that case.

4.2.3.1 Strainer Outage

To perform maintenance on the ERCW system supply strainers, the strainers must be isolated. Table 4.2-2 describes the alignments (by case) for having the ERCW strainers isolated during normal plant operation. The 24-inch yard header crossties are open for all cases. The 6-inch ESF header crossties and 16-inch Auxiliary Building header crossties are analyzed both the open and closed condition.

Tables 4.2-8 through 4.2-11 provide the results of the evaluation. Tables 4.2-8 and 4.2-9 provide the results for Strainer Outage Cases 1, 3, 5, and 7, when SQN Unit 1 is the unit postulated with a LOCA. Tables 4.2-10 and 4.2-11 provide the results for Strainer Outage Cases 2, 4, 6, and 8, when SQN Unit 2 is the unit postulated with a LOCA.

To demonstrate that the condition of the 16-inch Auxiliary Building header crossties or the 6-inch ESF header crossties is not a factor in ensuring acceptable results, several strainer cases were performed with the 6-inch ESF header crossties and the 16-inch Auxiliary Building header crossties both in service and isolated. All cases assumed the yard header crossties were open. The results show that with UHS temperature is limited to less than 83°F, the 16-inch Auxiliary Building header crossties and/or the 6-inch ESF crossties can be either in service or isolated.

Table 4.2-4 compiles the maximum temperature limitation for each ERCW system supply strainer outage case. For conservatism, the limiting temperature is rounded down to the nearest whole number and listed in Table 4.2-5. As indicated in Table 4.2-5, the lowest maximum ERCW supply temperature limitation of 83°F occurs when ERCW supply strainer A2A-A is removed from service.

4.2.3.2 ERCW Pump Outages

In determining the limiting conditions for examining the ERCW system capabilities when only one ERCW pump is in operation, two design bases accidents were reviewed; a LOCA and a Main Steam Line Break (MSLB) inside containment. These accident scenarios were examined to support removing one 6.9 kV shutdown board from service, along with its associated EDG, to perform maintenance on the 6.9 kV shutdown board and its associated 480 V boards.

Note that in the Table 4.2-6 "Component Alignment" column, for Outage 1, it states, "Only one EDG per train is running, the 2A and 2B EDGs are shutdown," with similar statements made for all pump outages. The purpose of this assumption was to minimize the model configurations required to cover the possible condition combinations that result in one EDG backed ERCW pump in each loop during a design basis LOCA. Because Train A and Train B are independent, the analysis can be performed assuming only one pump is running in each loop simultaneously. Although this demonstrates that acceptable results are obtained with only one ERCW pump per loop operable in each loop, other TS requirements (e.g., EDG TSs) would not allow performance of maintenance on two shutdown boards.

With both Unit 1 and Unit 2 in Modes 1, 2, 3, or 4, TS 3.7.4 requires at least two ERCW loops to be operable. The SQN TS Bases state that the OPERABILITY of the ERCW system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident conditions within acceptable limits. The assumption used is that two ERCW pumps will operate in one train during the hypothetical combined accident and loss of normal power, assuming one of the other train's EDGs fail. TVA has revised the assumption that two ERCW pumps per train are required to be operable using an initial condition of one unit in Mode 1, 2, 3, or 4, while the other unit is in Mode 5, 6, or defueled with ERCW flow isolated to selected components as described in Table 4.2-6 and reflected in the unit's TS Bases.

Once the initial conditions of one unit in Mode 5, 6, or defueled was modeled in the Multiflow Model, additional conditions were established that isolated various ERCW loads on the unit that was shutdown. Because one unit is in a shutdown condition, several of the shutdown unit's ESF loads are not required and can be isolated. Isolation of these unnecessary loads with the header crossties open increases the available ERCW supply to the required ERCW loads of the operating unit. Table 4.2-6 provides details of the initial conditions established for the Multiflow Model runs. The results of the calculations for only one ERCW pump in service are contained in Tables 4.2-12 through 4.2-14. For each outage case, the ERCW Multiflow Model is configured as described in Table 4.2-6.

Four outage alignment cases were run. Two of the alignment cases, Outages 1 and 3, were run based on postulating that the operating unit has a LOCA. The other two alignment cases, Outages 2 and 4, were run based on postulating the operating unit has a MSLB inside containment. Outages 1 and 3 were used to determine if all ESF components would receive sufficient ERCW flow rate to remove the component heat loads. Outages 2 and 4 were used to determine if the lower containment vent coolers (LCCs) received sufficient flow rate to remove the heat load assumed for equipment qualification of certain equipment located in the lower containment compartment. Table 4.2-14 shows the results of the MSLB run for the LCCs, which is discussed in Section 4.2.4, "Equipment Environmental Qualification Issue." The limiting temperatures are listed separately on Table 4.2-7.

Based on the limiting temperature summarized in Table 4.2-7, TVA is proposing an UHS temperature limit of ≤ 81°F when Unit 1 is in operation and Unit 2 is shutdown (Table 4.2-7 Train A Outage 1) and ≤ 79°F when Unit 2 is in operation and Unit 1 is shutdown (Table 4.2-7, Train A Outage 3). The alignments described in Table 4.2-6 are listed in the proposed TS Bases included in Attachments 3 and 5.

4.2.4 Equipment Environmental Qualification Issue

Based on the results of the Environmental Qualification (EQ) analysis associated with an MSLB, the SQN LCCs were added to SQN TSs under License Amendments 67/59 (U1/U2) (Reference 5). The analysis determined that during a MSLB accident the potential exists that the long-term EQ temperature limit for certain equipment located in the lower containment may be exceeded. Current EQ temperatures inside containment are based on the RCS reaching cold shutdown conditions. Plant cooldown to cold shutdown is accomplished post-accident by recirculation mode core cooling or by placing the RHR system into operation once RCS temperature and pressure are less than approximately 350°F and 380 psig, respectively. However, an MSLB inside containment creates flooding conditions at the single RCS suction line that could potentially prevent the use of RHR because one of the series suction isolation valves is submerged. Failure of either suction valve to open would prevent RHR system operation for plant cooldown. Without RHR cooling capability, the RCS would be maintained in Hot Standby, the current licensing basis for SQN. This causes additional long-term heat loads that drive lower containment and pressurizer enclosure temperatures above the EQ limits. Based on the assumptions used in the analysis, post-accident use of the LCCs will ensure containment temperatures remain below the current EQ profile limits.

The analysis used in License Amendments 67/59 did not assume only one ERCW pump per loop was operable. To ensure the LCCs receive 200 gpm, as required by TS Surveillance Requirement 4.6.2.2.b.2 with one operable ERCW pump per loop, Outages 2 and 4 were developed. Based on the Multiflow Model results (Table 4.2-14), no additional ERCW supply temperature limitations are required.

Although no additional temperature limitations were identified in the analysis, the analysis showed that actions may be needed based on plant conditions. SQN procedures provide direction for environmental qualification operating concerns for containment cooling following a non-LOCA event (e.g. loss of secondary coolant). The procedural direction provided is to: 1) cooldown to 350°F within 12 hours, using the steam generators if the normal RHR suction valves fail to open; 2) place the LCCs in service within one to four hours after event initiation; 3) evaluate containment heat loads, 4) Reduce ERCW flow in the accident unit's Containment Spray Heat Exchangers and A-train Component Cooling Heat Exchanger, if necessary to ensure the required flow is available to the Lower Compartment Coolers. These actions ensure the environmental qualification temperature limitation on instrumentation in lower containment are not exceeded.

4.2.5 Summary of Results

4.2.5.1 Removal of an ERCW Supply Strainer from Service

If an ERCW supply strainer is to be removed from service, the appropriate yard header crosstie must be in service and the ERCW supply temperature limits applied. The remaining crossties may be in service or out of service. No other portions of the ERCW supply headers can be out of service, or the analysis is not valid. The ERCW supply temperature limitation for removing an ERCW supply strainer from service is < 83°F, and is the proposed UHS TS temperature limit.

4.2.5.2 One ERCW Pump per Loop Operation

Unit 1 in Operation, Unit 2 Shutdown

- The ERCW system loop operability requirements for Train A can be met with only one running ERCW pump per loop, during a Unit 2 cold shutdown outage, subject to a maximum ERCW supply temperature of 81°F. The analysis assumptions include that the 2A EDG, 2A CS HX, U2 TDAFWP, 2A and 2C LCC groups, 2A and 2C UCCs, 2A IIRC all have no ERCW flow. The analysis assumed that the yard header, the 16-inch Auxiliary Building header, and the 6-inch ESF header crossties are in service on Train A ERCW.

- The ERCW system loop operability requirements for Train B can be met with only one running ERCW pump per loop, during a Unit 2 cold shutdown outage, subject to a maximum ERCW supply temperature of 82°F. The analysis assumptions include that the 2B D/G, 2B CS HX, U2 TDAFWP, 2B and 2D LCC groups, 2B and 2D UCCs, and 2B IIRC all have no ERCW flow. The analysis assumed that the yard header, the 16-inch Auxiliary Building header, and the 6-inch ESF header crossties are in service on Train B ERCW. Also, the ERCW flow to the 1B Control Rod Drive cooler must be isolated.

The proposed Unit 1 average ERCW supply temperature limit listed in the UHS TS is ≤ 81°F based on Train A results.

Unit 2 in Operation, Unit 1 Shutdown

- The ERCW system loop operability requirements for Train A can be met with only one running ERCW pump per loop, during a Unit 1 cold shutdown outage, subject to a maximum ERCW supply temperature of 79°F. The analysis assumptions include that the 1A EDG, 1A CS HX, U1 TDAFWP, 1A and 1C LCC groups, and 1A IIRC all have no ERCW flow. The analysis assumed that the yard header, the 16-inch Auxiliary Building header, and the 6-inch ESF header crossties are in service on Train A ERCW.

- The ERCW system loop operability requirements for Train B can be met with only one running ERCW pump per loop, during a Unit 1 cold shutdown outage, subject to a maximum ERCW supply temperature of 82°F. The analysis assumptions include that the 1B EDG, 1B CS HX, U1 TDAFWP, 1B and 1D LCC groups, and 1B IIRC all have no ERCW flow. The analysis assumed that the yard header, the 16-inch Auxiliary Building header, and the 6-inch ESF header crossties are in service on Train B ERCW.

The proposed Unit 2 average ERCW supply temperature limit listed in the UHS TS is ≤ 79°F based on Train A results.

4.2.6 Generic Letter 89-13 Program

In Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," (GL 89-13) the NRC requested that licensees perform the action listed in the generic letter or equally effective actions to ensure that their service water systems are in compliance and will be maintained in compliance with 10 CFR Part 50, Appendix A, General Design Criteria 44, 45, and 46 and Appendix B, Section XI. By the definition of "service water" found in the generic letter, "the system or systems that transfer heat from safety related structures, systems, or components to the UHS," this system at SQN is the ERCW system. In accordance with GL 89-13, a continuing program is maintained to perform periodic inspections of the ERCW intake structure for biological fouling mechanisms, sediment and corrosion. In addition, a continuing test/inspection program is maintained to verify the heat transfer capability of all safety related HXs included in the GL 89-13 program.

Additional details associated with SQN's ERCW HXs and GL 89-13 program were provided to the NRC as a part of TVA's LAR to raise the UHS temperature limit and water level limit. This request was approved by the NRC under License Amendment 317/307 [Unit 1/Unit 2] (Reference 3).

5.0 REGULATORY EVALUATION

5.1 Applicable Regulatory Requirements/Criteria

The NRC's regulatory requirements related to the content of the TSs are contained in 10 CFR 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) LCO; (3) surveillance requirements; (4) design features; and (5) administrative controls. The water temperature and elevation requirements for the UHS are included in the TSs in accordance with 10 CFR 50.36(c)(2), "Limiting Conditions for Operation."

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 the NRC approve the TS changes before they are implemented. TVA's submittal meets the requirements of 10 CFR 50.59(c)(1)(i) and 10 CFR 50.90.

General Design Criterion

SQN was designed to meet the intent of the Proposed General Design Criteria for Nuclear Power Plant Construction Permits published in July 1967. The Sequoyah construction permit was issued in May 1970. The UFSAR; however, addresses the NRC GDCs published as Appendix A to 10 CFR 50 in July 1971. Conformance with the GDC is described in Section 3.1.2 of the UFSAR.

Each criterion listed below is followed by a discussion of the design features and procedures which meet the intent of the criteria. Any exception to the 1971 GDCs resulting from the earlier commitments is identified in the discussion of the corresponding criterion.

Criterion 2, "Design Bases for Protection Against Natural Phenomena"

Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety function. The design bases for these structures, systems, and components shall reflect:

1. Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated,

2. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and

3. The importance of the safety functions to be performed.

SQN Criterion 2 Compliance

The SSCs important to safety are designed to either withstand the effects of natural phenomena without loss of capability to perform their safety functions, or to fail in the safest condition. Those SSCs vital to the shutdown capability of the reactor are designed to withstand the maximum probable natural phenomenon expected at the site, determined from recorded data for the site vicinity, with appropriate margin to account for uncertainties in historical data. Appropriate combinations of normal, accident, and natural phenomena structural loadings are considered in the plant design.

This proposed LAR has no effect on SQN's compliance with Criterion 2 as described above.

Criterion 5, "Sharing of Structures, Systems, and Components"

Structures, systems, and components important to safety shall not be shared between nuclear power units unless it is shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

SQN Criterion 5 Compliance

The two units share several structures and systems, many of which have no safety function. The structures important to safety are the Auxiliary/Control Building, Diesel Generator Building, CCW pumping station, the ERCW pumping station, and a few miscellaneous structures. Shared safety-related systems include the ERCW, component cooling, fire protection, fuel handling/storage and cooling, fuel oil storage, preferred and emergency electric power, chemical and volume control, condensate, radioactive waste, gas treatment, and Control and Auxiliary Building ventilation systems. The Vital Direct-Current (DC) Power System is shared to the extent that a few loads (e.g., the vital inverters) in one nuclear unit are energized by the DC power channels assigned primarily to power loads of the other unit. In no case does the sharing inhibit the safe shutdown of one unit while the other unit is experiencing an accident. All shared systems are sized for all credible initial combinations of normal and accident states for the two units, with appropriate isolation to prevent an accident condition in one unit from carrying into the other.

This proposed LAR has no effect on SQN's compliance with Criterion 5 as described above.

Criterion 18, "Inspection and Testing of Electric Power Systems"

Electric Power Systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components. The systems shall be designed with a capability to test periodically (1) the operability and functional performance of the components of the systems, such as onsite power sources, relays, switches, and buses, and (2) the operability of the systems as a whole and, under conditions as close to design as practical, the full operation sequence that brings the systems into operation, including operation of applicable portions of the protection system, and the transfer of power among the nuclear power unit, the offsite power system and the onsite power system.

SQN Criterion 18 Compliance - Inspection

In addition to continuous surveillance by visual and audible alarms for any abnormal condition, the onsite power system is designed to permit inspection and checking of wiring, insulation, connections, and switchboards to the extent that personnel safety is not jeopardized, equipment not damaged, and the plant not exposed to accidental tripping.

Approval of this LAR is one part of the activities needed to permit maintenance on the 6.9 kV shutdown boards while maintaining personnel safety, preventing equipment damage, and minimizing exposure of the plant to accidental tripping. The proposed changes in this LAR will assure SQN's continued compliance with Criterion 18.

Criterion 44, "Cooling Water"

A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.

Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be 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.

SQN Criterion 44 Compliance

A Seismic Category I CCS is provided to transfer heat from the RCS, and selected reactor support equipment to a Seismic Category I ERCW system. The CSS HXs are cooled directly by ERCW.

The CCS consists of two independent ESF subsystems, each of which is capable of serving all necessary loads under normal or accident conditions, powered by either offsite sources or onsite emergency power sources.

In addition to serving as the heat sink for the CCS, the ERCW system is also used as the heat sink for the containment spray and ESF equipment through use of compartment and space coolers and selected seal jackets on ESF pumps. The ERCW system consists of two independent loops, each of which is capable of providing all necessary heat sink requirements. The ERCW system transfers heat to the UHS and is powered by either the offsite sources or the onsite emergency power sources.

This proposed LAR has no effect on SQN's compliance with Criterion 44 as described above.

Criterion 45, "Inspection of Cooling Water System"

The Cooling Water System shall be designed to permit appropriate periodic inspection of important components, such as HXs and piping, to assure the integrity and capability of the system.

SQN Criterion 45 Compliance

The CCS and ERCW system components can be visually inspected on a periodic basis. Those components that cannot be inspected with the unit in operation can be inspected during shutdown.

The CCS and ERCW pumps are arranged such that any pump may be isolated for inspection and maintenance.

This proposed LAR has no effect on SQN's compliance with Criterion 45 as described above.

Criterion 46, "Testing of Cooling System"

The Cooling Water System shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leak-tight integrity of its components, (2) the operability and the performance of the active components of the system, and (3) the operability of the system as a whole and under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for LOCA, including operation of applicable portions of the protection system and the transfer between normal and emergency power sources.

SQN Criterion 46 Compliance

The CCS and the ERCW system are normally pressurized during plant operations. The systems/components are subject to tests per the ASME Section XI Inservice Inspection / Inservice Testing programs. The emergency functions of the systems are periodically tested out to the final actuated device.

This proposed LAR has no effect SQN's compliance with Criterion 46 as described above.

5.2 Precedent

In Reference 3, the NRC approved the current UHS minimum water level at or above elevation 674 feet mean sea level United States Geological Survey (USGS) datum and an average ERCW supply header water temperature of less than or equal to 87°F for SQN, Units 1 and 2.

In Reference 1, the NRC approved a request for SQN Unit 1 to limit UHS temperature based on a temporary configuration of the ERCW system needed to support the Unit 2 steam generator replacement project. TVA used the same methodology in determining adequate heat removal capability of the ERCW system.

5.3 Significant Hazards Consideration

The proposed change modifies the Ultimate Heat Sink (UHS) Technical Specification (TS) for Sequoyah Nuclear Plant (SQN) Units 1 and 2 to be consistent with the conditions and assumptions of the current design heat transfer and flow modeling analyses for the UHS and Essential Raw Cooling Water (ERCW) system. The proposed change adds requirements to allow an ERCW system supply strainer to be removed from service or only one ERCW pump per loop to be operable. These requirements include additional temperature limitations on the average ERCW supply temperature and required actions and associated completion times if the temperature limits are exceeded. This change is needed to support required periodic maintenance on the safety related 6.9 kilovolt (kV) shutdown boards and ERCW system supply strainers.

This proposed change also includes the deletion of one-time TS License Condition and Limiting Condition for Operation (LCO) requirements for SQN Unit 1 that were added to support the Unit 2 steam generator replacement project. The one-time requirements are no longer needed because the project was completed in January 2013.

Tennessee Valley Authority (TVA) has concluded that the proposed change to the UHS TS for SQN Units 1 and 2 does not involve a significant hazards consideration. TVA's conclusion is based on its evaluation in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.91(a)(1) of the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. *Does the proposed amendment involve a significant increase in the probability or consequence of an accident previously evaluated?*

   Response: No.

   The proposed change to impose additional limits on UHS temperature while in certain ERCW system alignments does not result in any physical changes to plant safety-related structures, systems, or components (SSCs). The UHS and associated ERCW system function is to remove plant system heat loads during normal and accident conditions. As such, the UHS and ERCW system are not accident initiators, but instead perform accident mitigation functions by serving as the heat sink for safety-related equipment to ensure the conditions and assumptions credited in the accident analyses are preserved. During operation under the proposed change with only one ERCW pump operable in a loop a single failure could cause a total loss of ERCW flow in one loop whereas with two pumps per loop operable only a reduction in flow would occur. In either case, one pump or two pumps per loop operable, the other ERCW loop will continue to perform the design function of the ERCW system. Therefore, the proposed change does not involve a significant increase in the probability of an accident previously evaluated.

   The purpose of this change is to modify the UHS TS to be consistent with the conditions and assumptions of the current design basis heat transfer and flow modeling analyses for the UHS and ERCW system. The proposed change provides assurance that the minimum conditions necessary for the UHS and ERCW system to perform their heat removal safety function is maintained. Accordingly, as demonstrated by TVA design heat transfer and flow modeling calculations, the proposed new requirements will provide the necessary assurance that fuel cladding, Reactor Coolant System (RCS) pressure boundary, and containment integrity limits are not challenged during worst-case post-accident conditions. Accordingly, the conclusions of the accident analyses will remain as previously evaluated such that there will be no significant increase in the post-accident dose consequences.

   Therefore, the proposed change does not involve a significant increase in the probability or consequence of an accident previously evaluated.

2. *Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?*

   Response: No.

   The proposed change does not involve any physical changes to plant safety related SSCs or alter the modes of plant operation in a manner that is outside the bounds of the current UHS and ERCW system design heat transfer and flow modeling analyses. The proposed additional limits on UHS temperature for the specified ERCW system alignments provide assurance that the conditions and assumptions credited in the accident analyses are preserved. Thus, although the specified ERCW system alignments result in reduced heat transfer flow capability, the plant's overall ability to reject heat to the UHS during normal operation, normal shutdown, and hypothetical worst-case accident conditions will not be significantly affected by this proposed change. Since the safety and design requirements continue to be met and the integrity of the RCS pressure boundary is not challenged, no new credible failure mechanisms, malfunctions, or accident initiators are created, and there will be no effect on the accident mitigating systems in a manner that would significantly degrade the plant's response to an accident.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. *Does the proposed amendment involve a significant reduction in a margin of safety?*

   Response: No.

   The proposed change modifies the UHS TS to maintain the UHS temperature and associated ERCW system flows within the bounds of the conditions and assumptions credited in the accident analyses. As demonstrated by TVA design basis heat transfer and flow modeling calculations, the additional limits on UHS temperature for the specified ERCW system alignments will provide assurance that the design limits for fuel cladding, RCS pressure boundary, and containment integrity are not exceeded under both normal and post-accident conditions. As required, these calculations include evaluation of the worst-case combination of meteorology and operational parameters, and establish adequate margins to account for measurement and instrument uncertainties. While operating margins have been reduced by the proposed change in order to support necessary maintenance activities, the current limiting design basis accidents remain applicable and the analyses conclusions remain bounding such that the accident safety margins are maintained. Accordingly, the proposed change will not significantly degrade the margin of safety of any SSCs that rely on the UHS and ERCW system for heat removal to perform their safety related functions.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in

10 CFR 50.92 (c), and accordingly, a finding of "no significant hazards consideration" is justified.

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.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from Siva P. Lingam (NRC) to Joseph W. Shea (TVA), "Sequoyah Nuclear Plant, Unit 1 - Issuance of Amendment Regarding the Proposed Operating License and Technical Specification Changes for Unit 2 Replacement Steam Generator Project to Conduct Heavy Load Lifts (TAC NO. ME7225) (TS-SQN-2011-05)," dated September 6, 2012. [ADAMS Accession No. ML12234A381]
2. Letter from Brendan T. Moroney (NRC) to William R. Campbell (TVA), "Sequoyah Nuclear Plant, Units 1 and 2 - Issuance of Amendments Regarding Increased Temperature and Level Limits of Ultimate Heat Sink (TAC NOS. MD2621 AND MD2622)," dated September 28, 2007. [ADAMS Accession No. ML072420043]
3. Letter from Glenn W. Morris (TVA to Document Control Desk (NRC), "Sequoyah Nuclear Plant (SQN) - Units 1 and 2 – Technical Specifications (TS) Change 06-03, 'Ultimate Heat Sink (UHS) Temperature Increase and Elevation Changes Supplemental Information,' (TAC NOS. MD2621 & MD2622)," dated December 7, 2006. [ADAMS Accession No. ML063470029]
4. Letter from Brendan T. Moroney (NRC) to William R. Campbell (TVA), "Sequoyah Nuclear Plant, Units 1 and 2 - Issuance of Amendments Regarding Increased Temperature and Level Limits of Ultimate Heat Sink (TAC NOS. MD2621 AND MD2622)," dated September 28, 2007. [ADAMS Accession No. ML072420043]
5. Letter from Gary G. Zech (NRC) to S.A. White (TVA), "Lower Containment Vent Coolers (TAC 00209, 00210) (TS 87-37)," dated February 11, 1988. [ADAMS Accession No. ML013250508]
6. Letter from J.W. Shea (TVA) to Document Control Desk (NRC), Application to Revise Sequoyah Nuclear Plant Units 1 and 2 Updated Final Safety Analysis Report Regarding Changes to Hydrologic Analysis, (SQN-TS-12-02), dated August 10, 2012. [ADAMS Accession Nos ML12226A561, ML12226A562, and ML12226A563]

8.0 ANALYSIS TABLES

Table 4.2-1 Component Minimum Design Required ERCW Flow Rate	
Component	Required Flow Rate[1] (gpm)
EDG HX	522
CCS HX Train A, LOCA unit	3605
CCS HX Train A, non-LOCA unit	1348
CCS HX 0B1/0B2	3365
CSS HX	3400
ELECTRIC (ELECT) BOARD (BD) ROOM (RM) CHILLER (CHR) A	163.9
MCR CHR A	95.4
SHUTDOWN BD RM CHR A	380
CENTRIFUGAL CHARGING PUMP (CCP) OIL COOLER (CLR)	23
CCP Gear OIL CLR	12
CCP RM CLR 1A	34
SIS PUMP (PMP) RM CLR	18
SIS OIL CLR	4.1
EMERGENCY GAS TREATMENT SYSTEM (EGTS)	9
AUXILIARY (AUX) CONTROL (CONT) AIR	5.1
SFP & THERMAL BARRIER BOOSTER PUMP (TBBP) CLR	28
CCS & AFW CLR	55
BORIC ACID TANK (BAT) & AFW CLR	62
714 PENETRATION (PEN) RM CLR	19
690 PEN RM CLR	12
669 PEN RM CLR	17
PIPE CHASE CLR	29
CONTAINMENT (CNT) SPRAY PMP RM CLR	10
RHR PMP RM CLR	15
LCC[2]	170

(1) Required flow rate supporting 87°F average ERCW supply temperature.

(2) The LCCs only have a safety function to help mitigate a non-LOCA high energy line break (HELB) inside containment, such as an MSLB. The design flow was determined to be 170 gpm in order to achieve the required thermal performance. However, TS Surveillance Requirement 4.6.2.2.b.2 requires that 200 gpm be available to each LCC.

Table 4.2-2
Strainer Outage Case Descriptions

Case Number[1]	Crosstie Operation	Plant Condition
Strainer 1	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Building (Bldg) Header Crossties are closed.	Isolate the A1A-A and B1B-B ERCW strainers in a U1 LOCA
Strainer 2	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are closed.	Isolate the A1A-A and B1B-B ERCW strainers in a U2 LOCA
Strainer 3	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are closed.	Isolate the A2A-A and B2B-B ERCW strainers in a U1 LOCA.
Strainer 4	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are closed.	Isolate the A2A-A and B2B-B ERCW strainers in a U2 LOCA
Strainer 5	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are open.	Isolate the A1A-A and B1B-B ERCW strainers in a U1 LOCA
Strainer 6	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are open.	Isolate the A1A-A and B1B-B ERCW strainers in a U2 LOCA
Strainer 7	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are open.	Isolate the A2A-A and B2B-B ERCW strainers in a U1 LOCA.
Strainer 8	Yard Header Crossties open, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are open.	Isolate the A2A-A and B2B-B ERCW strainers in a U2 LOCA

(1) Case Number refers to a specific plant condition (e.g., Strainer 1) as described in the "Crosstie Operation" and "Plant Condition" columns.

Table 4.2-3
Table/Strainer Cases

Case	Table		Plant Conditions		
	Train A Components Table	Train B Components Table	Unit with Strainers Isolated	LOCA Unit	ESF & Aux Bldg Crossties
Strainer 1	4.2-8	4.2-9	1	1	Closed
Strainer 2	4.2-10	4.2-11	1	2	Closed
Strainer 3	4.2-8	4.2-9	2	1	Closed
Strainer 4	4.2-10	4.2-11	2	2	Closed
Strainer 5	4.2-8	4.2-9	1	1	Open
Strainer 6	4.2-10	4.2-11	1	2	Open
Strainer 7	4.2-8	4.2-9	2	1	Open
Strainer 8	4.2-10	4.2-11	2	2	Open

Table 4.2-4
Temperature Limit by Strainer Case

Strainer Out of Service	Applicable Cases	Temperature Limitation		Strainer Out of Service	Applicable Cases	Temperature Limitation
A1A-A	Strainer 1	84.8(1)		B1B-B	Strainer 1	84.5(1)
A1A-A	Strainer 2	85.2		B1B-B	Strainer 2	85.5
A1A-A	Strainer 5	85.3		B1B-B	Strainer 5	84.7
A1A-A	Strainer 6	84.5		B1B-B	Strainer 6	84.8
A2A-A	Strainer 3	84.0		B2B-B	Strainer 3	85.1
A2A-A	Strainer 4	83.8(1)		B2B-B	Strainer 4	85.4
A2A-A	Strainer 7	84.5		B2B-B	Strainer 7	84.8(1)
A2A-A	Strainer 8	83.8		B2B-B	Strainer 8	84.9

(1) Lowest temperature for associated out of service strainer

Table 4.2-5
One ERCW Strainer Temperature Limits

To remove from service ERCW strainer:	The ERCW supply temperature must be less than:
A1A-A	84°F
B1B-B	84°F
A2A-A	83°F
B2B-B	84°F

Table 4.2-6
One Pump per Loop ERCW Operation Case Description

Case Number[a]	Crosstie Operation	Plant Condition	Component Alignment
Outage 1	Yard Header Crossties, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are all open.	U1 LOCA, Unit 2 outage, only one pump per train running.	Only one EDG per train is running, the 2A and 2B EDGs are shutdown. U2 CS HX, U2 UCCs, U2 TDAFWP, U2 IIRC, U2 LCC groups are isolated.
Outage 2	Yard Header Crossties, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are all open.	U1 MSLB, Unit 2 outage, only one pump per train running.	Only one EDG per train is running, the 2A and 2B EDGs are shutdown. U2 CS HX, U2 UCCs, U2 TDAFWP, U2 IIRC, U2 LCC groups are isolated. This analysis is the same as Outage 1, except what is being examined is the ability of the LCCs to receive 200 gpm. The U1 CSS HXs are isolated, 1-Flow Control Valve (FCV)-67-146 is in the 35% position.[b] The 1B CRD cooler is required to be isolated in order to have sufficient flow to the 1B LCC.[c]
Outage 3	Yard Header Crossties, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are all open.	U2 LOCA, Unit 1 outage, only one pump per train running.	Only one EDG per train is running, the 1A and 1B EDGs are shutdown. U1 CS HX, U1 TDAFWP, U1 IIRC, U1 LCCs are isolated.
Outage 4	Yard Header Crossties, 6" ESF Header Crossties and 16" Aux Bldg Header Crossties are all open.	U2 MSLB, Unit 1 outage, only one pump per train running.	Only one EDG per train is running, the 1A and 1B EDGs are shutdown. U1 CS HX, U1 TDAFWP, U1 IIRC, U1 LCC groups are isolated. This analysis is the same as Outage 3, except what is being examined is the ability of the LCCs to receive 200 gpm. The U2 CSS HXs are isolated, 2-FCV-67-146 is in the 35% position[b].

(a) Case Number refers to a specific plant condition (e.g., Outage 1) as described in the "Crosstie Operation", "Plant Condition", and "Component Alignment" columns.
(b) Isolating the operating unit's CSS HX and placing valve FCV-67-146 in the 35% position are actions that may be necessary in the post-recirculation phase as discussed in Section 4.2.4, "Equipment Qualification Issue."
(c) To ensure 1B CRD cooler is isolated, it is included in the prerequisite line up for one-pump operation.

Table 4.2-7 ERCW One Pump per Loop Temperature Limits	
Train Limiting Temperature	The ERCW supply temperature maximum limitation
Train A Outage 1 (Unit 1 LOCA)	81.7°F
Train A Outage 3 (Unit 2 LOCA)	79.5°F
Train B Outage 1 (Unit 1 LOCA)	82.6°F
Train B Outage 3 (Unit 2 LOCA)	82.3°F
Train A Outage 2 (Unit 1 MSLB)	None[(a)]
Train A Outage 4 (Unit 2 MSLB)	None[(a)]
Train B Outage 2 (Unit 1 MSLB)	None[(a)]
Train B Outage 4 (Unit 2 MSLB)	None[(a)]

(a) No additional ERCW supply temperature limitation less than 87°F

Table 4.2-8
Train A Strainer Outage Cases 1, 3, 5, and 7

A-Train ERCW components	Required Flow (gpm)	Strainer 1			Strainer 3			Strainer 5			Strainer 7		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
EDG 1A1	522.0	545.0	517.8	86.3	542.4	515.3	86.2	553.5	525.8	---	539.3	512.3	86.1
EDG 1A2	522.0	538.2	511.3	86.0	535.6	508.8	85.9	546.8	519.5	86.4	532.5	505.9	85.7
EDG 2A1	522.0	542.5	515.4	86.2	539.9	512.9	86.1	550.9	523.4	---	536.8	510.0	85.9
EDG 2A2	522.0	515.3	489.5	84.8	512.8	487.2	84.7	523.5	497.3	85.3	509.7	484.2	84.5
ELECT BD RM CHR A	163.9	177.5	168.6	---	177.0	168.2	---	184.7	175.5	---	173.6	164.9	---
MCR CHILLER A	95.4	126.0	119.7	---	125.7	119.4	---	131.2	124.6	---	123.2	117.0	---
SHUTDOWN BD RM CHR A	380.0	420.6	399.6	---	419.4	398.4	---	434.8	413.1	---	410.0	389.5	---
CCP PMP OIL CLR 1A	23.0	28.6	27.2	---	28.5	27.1	---	29.8	28.3	---	28.0	26.6	---
CCP Gear OIL CLR 1A	12.0	16.3	15.5	---	16.2	15.4	---	17.0	16.2	---	15.9	15.1	---
CCP RM CLR 1A	34.0	40.7	38.7	---	40.6	38.6	---	42.4	40.3	---	39.8	37.8	---
CCP OIL CLR 2A		52.5	49.9	---	46.7	44.4	---	51.0	48.5	---	47.4	45.0	---
CCP PMP OIL CLR 2A	23.0	33.7	32.0	---	30.1	28.6	---	32.8	31.2	---	30.5	29.0	---
CCP Gear OIL CLR 2A	12.0	18.8	17.9	---	16.7	15.9	---	18.2	17.3	---	16.9	16.1	---
CCP RM CLR 2A	34.0	49.1	46.6	---	43.8	41.6	---	47.7	45.3	---	44.4	42.2	---
SIS PMP RM CLR 1A	18.0	30.7	29.2	---	30.6	29.1	---	32.2	30.6	---	30.1	28.6	---
SIS OIL CLR 1A	4.1	9.2	8.7	---	9.2	8.7	---	9.7	9.2	---	9.0	8.6	---
SIS PMP RM CLR 2A	18.0	32.0	30.4	---	28.5	27.1	---	30.8	29.3	---	28.8	27.4	---
SIS OIL CLR 2A	4.1	12.3	11.7	---	10.9	10.4	---	11.9	11.3	---	11.0	10.5	---
EGTS 2A	9.0	13.9	13.2	---	12.3	11.7	---	13.5	12.8	---	12.5	11.9	---
AUX CONT AIR A	5.1	5.4	5.1	---	5.4	5.1	---	5.6	5.3	---	5.3	5.0	86.0
SFP & TBBP CLR 1A	28.0	34.0	32.3	---	33.9	32.2	---	35.3	33.5	---	33.2	31.5	---
CCS & AFW CLR 1A	55.0	97.6	92.7	---	97.3	92.4	---	101.7	96.6	---	95.4	90.6	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-8 (continued)
Train A Strainer Outage Cases 1, 3, 5, and 7

A-Train ERCW components	Required Flow (gpm)	Strainer 1			Strainer 3			Strainer 5			Strainer 7		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
BAT & AFW CLR 2A	62.0	71.9	68.3	---	63.9	60.7	86.6	69.9	66.4	---	64.9	61.7	86.7
714 PEN RM CLR 1A	19.0	27.5	26.1	---	27.4	26.0	---	28.9	27.5	---	27.0	25.7	---
714 PEN RM CLR 2A	19.0	30.0	28.5	---	26.8	25.5	---	28.9	27.5	---	27.0	25.7	---
690 PEN RM CLR 1A	12.0	27.3	25.9	---	27.2	25.8	---	28.6	27.2	---	26.8	25.5	---
690 PEN RM CLR 2A	12.0	28.5	27.1	---	25.4	24.1	---	27.5	26.1	---	25.7	24.4	---
669 PEN RM CLR 1A	17.0	45.5	43.2	---	45.4	43.1	---	47.7	45.3	---	44.7	42.5	---
669 PEN RM CLR 2A	17.0	58.0	55.1	---	51.6	49.0	---	55.8	53.0	---	52.1	49.5	---
PIPE CHASE CLR 1A	29.0	54.8	52.1	---	54.6	51.9	---	57.4	54.5	---	53.8	51.1	---
PIPE CHASE CLR 2A	29.0	47.6	45.2	---	42.4	40.3	---	45.8	43.5	---	42.8	40.7	---
CNT SPRAY PMP RM CLR 1A	10.0	22.9	21.8	---	22.8	21.7	---	24.0	22.8	---	22.5	21.4	---
CNT SPRAY PMP RM CLR 2A	10.0	34.7	33.0	---	30.9	29.4	---	33.4	31.7	---	31.2	29.6	---
RHR PMP RM CLR 1A	15.0	15.6	14.8	86.8	15.6	14.8	86.8	16.4	15.6	---	15.4	14.6	86.6
RHR PMP RM CLR 2A	15.0	22.0	20.9	---	19.6	18.6	---	21.1	20.0	---	19.7	18.7	---
CCS HX 1A1/1A2	3605.0	4050.1	3847.6	---	3621.3	3440.2	84.0	3949.2	3751.7	---	3716.4	3530.6	84.5
CCS HX 2A1/2A2	1348.0	1579.2	1500.2	---	1415.7	1344.9	86.1	1543.8	1466.6	---	1450.4	1377.9	---
CSS HX 1A	3400.0	3769.3	3580.8	---	3761.8	3573.7	---	3893.2	3698.5	---	3678.1	3494.2	---
CSS HX 2A	3400.0	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---
MINIMUM TEMPERATURE:				84.8			84.0			85.3			84.5

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-9
Train B Strainer Outage Cases 1, 3, 5, and 7

B-Train ERCW components	Required Flow (gpm)	Strainer 1			Strainer 3			Strainer 5			Strainer 7		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
EDG 1B1	522.0	546.4	519.1	86.4	558.3	530.4	---	551.9	524.3	---	553.9	526.2	---
EDG 1B2	522.0	510.6	485.1	84.6	521.9	495.8	85.2	515.8	490.0	84.9	517.7	491.8	85.0
EDG 2B1	522.0	508.4	483.0	84.5	519.4	493.4	85.1	513.6	487.9	84.7	515.4	489.6	84.8
EDG 2B2	522.0	522.2	496.1	85.2	533.9	507.2	85.8	527.7	501.3	85.5	529.6	503.1	85.6
ELECT BD RM CHR B	163.9	187.9	178.5	---	193.0	183.4	---	192.9	183.3	---	187.1	177.7	---
MCR CHILLER B	95.4	138.1	131.2	---	141.8	134.7	---	141.8	134.7	---	137.5	130.6	---
SHUTDOWN BD RM CHR B	380.0	420.5	399.5	---	387.4	368.0	86.0	415.1	394.3	---	399.3	379.3	86.5
CCP PMP OIL CLR 1B	23.0	22.6	21.5	85.7	23.2	22.0	85.9	23.2	22.0	85.9	22.5	21.4	85.6
CCP Gear OIL CLR 1B	12.0	12.4	11.8	85.9	12.7	12.1	---	12.7	12.1	---	12.3	11.7	85.8
CCP RM CLR 1B	34.0	33.8	32.1	86.2	34.7	33.0	86.5	34.7	33.0	86.5	33.6	31.9	86.2
CCP PMP OIL CLR 2B	23.0	32.7	31.1	---	30.1	28.6	---	32.1	30.5	---	30.9	29.4	---
CCP Gear OIL CLR 2B	12.0	17.5	16.6	---	16.0	15.2	---	17.2	16.3	---	16.5	15.7	---
CCP RM CLR 2B	34.0	45.1	42.8	---	41.6	39.5	---	44.3	42.1	---	42.7	40.6	---
SIS PMP RM CLR 1B	18.0	26.6	25.3	---	27.3	25.9	---	27.5	26.1	---	26.5	25.2	---
SIS OIL CLR 1B	4.1	10.4	9.9	---	10.7	10.2	---	10.8	10.3	---	10.4	9.9	---
SIS PMP RM CLR 2B	18.0	34.3	32.6	---	31.6	30.0	---	33.6	31.9	---	32.4	30.8	---
SIS OIL CLR 2B	4.1	11.9	11.3	---	10.9	10.4	---	11.6	11.0	---	11.2	10.6	---
EGTS 2B	9.0	14.1	13.4	---	12.9	12.3	---	13.9	13.2	---	13.3	12.6	---
AUX CONT AIR B	5.1	6.4	6.1	---	5.9	5.6	---	6.3	6.0	---	6.1	5.8	---
SFP & TBBP CLR 1B	28.0	31.9	30.3	---	32.8	31.2	---	32.7	31.1	---	31.7	30.1	---
CCS & AFW CLR 1B	55.0	89.8	85.3	---	92.3	87.7	---	92.3	87.7	---	89.4	84.9	---
BAT & AFW CLR 2B	62.0	69.5	66.0	---	63.8	60.6	86.5	68.2	64.8	---	65.6	62.3	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-9 (continued)
Train B Strainer Outage Cases 1, 3, 5, and 7

B-Train ERCW components	Required Flow (gpm)	Strainer 1			Strainer 3			Strainer 5			Strainer 7		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
714 PEN RM CLR 1B	19.0	28.5	27.1	---	29.3	27.8	---	29.5	28.0	---	28.5	27.1	---
714 PEN RM CLR 2B	19.0	31.6	30.0	---	29.0	27.6	---	30.9	29.4	---	29.8	28.3	---
690 PEN RM CLR 1B	12.0	27.6	26.2	---	28.3	26.9	---	28.5	27.1	---	27.5	26.1	---
690 PEN RM CLR 2B	12.0	29.7	28.2	---	27.3	25.9	---	29.0	27.6	---	28.0	26.6	---
669 PEN RM CLR 1B	17.0	33.7	32.0	---	34.7	33.0	---	34.9	33.2	---	33.7	32.0	---
669 PEN RM CLR 2B	17.0	57.0	54.2	---	52.4	49.8	---	55.7	52.9	---	53.8	51.1	---
PIPE CHASE CLR 1B	29.0	42.0	39.9	---	43.1	40.9	---	43.4	41.2	---	41.9	39.8	---
PIPE CHASE CLR 2B	29.0	46.8	44.5	---	43.1	40.9	---	45.8	43.5	---	44.2	42.0	---
CNT SPRAY PMP RM CLR 1B	10.0	24.6	23.4	---	25.3	24.0	---	25.4	24.1	---	24.6	23.4	---
CNT SPRAY PMP RM CLR 2B	10.0	36.0	34.2	---	33.2	31.5	---	35.2	33.4	---	34.0	32.3	---
RHR PMP RM CLR 1B	15.0	14.9	14.2	86.3	15.3	14.5	86.6	15.4	14.6	86.6	14.8	14.1	86.3
RHR PMP RM CLR 2B	15.0	18.8	17.9	---	17.3	16.4	---	18.4	17.5	---	17.8	16.9	---
CCS HX 0B1/0B2	3365.0	5274.9	5011.2	---	4868.9	4625.5	---	5196.8	4937.0	---	5032.2	4780.6	---
CSS HX 1B	3400.0	3759.9	3571.9	---	3857.7	3664.8	---	3844.9	3652.7	---	3735.7	3548.9	---
CSS HX 2B	3400.0	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---
MINIMUM TEMPERATURE:				84.5			85.1			84.7			84.8

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-10
Train A Strainer Outage Cases 2, 4, 6, and 8

A-Train ERCW components	Required Flow (gpm)	Strainer 2			Strainer 4			Strainer 6			Strainer 8		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(c) (°F)
EDG 1A1	522.0	552.4	524.8	---	548.3	520.9	86.5	539.7	512.7	86.1	526.2	499.9	85.4
EDG 1A2	522.0	545.7	518.4	86.3	541.5	514.4	86.2	532.9	506.3	85.7	519.2	493.2	85.0
EDG 2A1	522.0	549.8	522.3	---	545.7	518.4	86.3	537.1	510.2	85.9	523.7	497.5	85.3
EDG 2A2	522.0	522.4	496.3	85.2	518.4	492.5	85.0	510.1	484.6	84.5	496.9	472.1	83.8
ELECT BD RM CHR A	163.9	184.0	174.8	---	183.7	174.5	---	177.1	168.2	---	166.5	158.2	86.0
MCR CHILLER A	95.4	130.7	124.2	---	130.5	124.0	---	125.8	119.5	---	118.2	112.3	---
SHUTDOWN BD RM CHR A	380.0	436.6	414.8	---	435.7	413.9	---	419.1	398.1	---	396.0	376.2	86.4
CCP PMP OIL CLR 1A	23.0	29.7	28.2	---	29.6	28.1	---	28.6	27.2	---	26.9	25.6	---
CCP Gear OIL CLR 1A	12.0	16.9	16.1	---	16.9	16.1	---	16.2	15.4	---	15.2	14.4	---
CCP RM CLR 1A	34.0	42.3	40.2	---	42.2	40.1	---	40.7	38.7	---	38.2	36.3	---
CCP PMP OIL CLR 2A	23.0	30.5	29.0	---	26.7	25.4	---	30.9	29.4	---	28.7	27.3	---
CCP Gear OIL CLR 2A	12.0	17.0	16.2	---	14.8	14.1	---	17.2	16.3	---	15.9	15.1	---
CCP RM CLR 2A	34.0	44.5	42.3	---	39.0	37.1	---	45.0	42.8	---	41.8	39.7	---
SIS PMP RM CLR 1A	18.0	31.9	30.3	---	31.8	30.2	---	30.8	29.3	---	28.7	27.3	---
SIS OIL CLR 1A	4.1	9.6	9.1	---	9.6	9.1	---	9.2	8.7	---	8.6	8.2	---
SIS PMP RM CLR 2A	18.0	29.0	27.6	---	25.4	24.1	---	29.2	27.7	---	27.3	25.9	---
SIS OIL CLR 2A	4.1	11.1	10.5	---	9.7	9.2	---	11.2	10.6	---	10.4	9.9	---
EGTS 2A	9.0	12.5	11.9	---	10.9	10.4	---	12.7	12.1	---	11.7	11.1	---
AUX CONT AIR A	5.1	5.6	5.3	---	5.6	5.3	---	5.4	5.1	---	5.1	4.8	85.8
SFP & TBBP CLR 1A	28.0	35.3	33.5	---	35.3	33.5	---	33.9	32.2	---	31.9	30.3	---
CCS & AFW CLR 1A	55.0	101.4	96.3	---	101.2	96.1	---	97.4	92.5	---	91.4	86.8	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-10 (continued)
Train A Strainer Outage Cases 2, 4, 6, and 8

A-Train ERCW components	Required Flow (gpm)	Strainer 2			Strainer 4			Strainer 6			Strainer 8		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Tem p Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(c) (°F)
BAT & AFW CLR 2A	62.0	64.9	61.7	86.7	56.6	53.8	85.6	65.8	62.5	---	60.8	57.8	86.1
714 PEN RM CLR 1A	19.0	28.6	27.2	---	28.5	27.1	---	27.6	26.2	---	25.7	24.4	---
714 PEN RM CLR 2A	19.0	27.2	25.8	---	23.8	22.6	---	27.4	26.0	---	25.5	24.2	---
690 PEN RM CLR 1A	12.0	28.3	26.9	---	28.3	26.9	---	27.4	26.0	---	25.5	24.2	---
690 PEN RM CLR 2A	12.0	25.8	24.5	---	22.6	21.5	---	26.0	24.7	---	24.3	23.1	---
669 PEN RM CLR 1A	17.0	47.2	44.8	---	47.1	44.7	---	45.6	43.3	---	42.6	40.5	---
669 PEN RM CLR 2A	17.0	52.4	49.8	---	45.8	43.5	---	52.8	50.2	---	49.2	46.7	---
PIPE CHASE CLR 1A	29.0	56.9	54.1	---	56.8	54.0	---	54.9	52.2	---	51.2	48.6	---
PIPE CHASE CLR 2A	29.0	43.1	40.9	---	37.6	35.7	---	43.4	41.2	---	40.4	38.4	---
CNT SPRAY PMP RM CLR 1A	10.0	23.7	22.5	---	23.7	22.5	---	22.9	21.8	---	21.4	20.3	---
CNT SPRAY PMP RM CLR 2A	10.0	31.4	29.8	---	27.5	26.1	---	31.7	30.1	---	29.5	28.0	---
RHR PMP RM CLR 1A	15.0	16.2	15.4	---	16.2	15.4	---	15.7	14.9	86.8	14.6	13.9	86.2
RHR PMP RM CLR 2A	15.0	19.9	18.9	---	17.4	16.5	---	20.0	19.0	---	18.7	17.8	---
CCS HX 1A1/1A2	1348.0	1818.4	1727.5	---	1602.4	1522.3	---	1864.7	1771.5	---	1738.9	1652.0	---
CCS HX 2A1/2A2	3605.0	4057.5	3854.6	---	3577.0	3398.2	83.8	4159.0	3951.1	---	3880.5	3686.5	---
CSS HX 1A	3400.0	0.0	0.0	---	0.0	0.0		0.0	0.0	---	0.0	0.0	---
CSS HX 2A	3400.0	3922.8	3726.7	---	3457.2	3284.3	85.4	3986.4	3787.1	---	3690.0	3505.5	---
MINIMUM TEMPERATURE:				85.2			83.8			84.5			83.8

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-11
Train B Strainer Outage Cases 2, 4, 6, and 8

B-Train ERCW components	Required Flow (gpm)	Strainer 2			Strainer 4			Strainer 6			Strainer 8		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit[*] (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit[*] (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit[*] (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit[c] (°F)
EDG 1B1	522.0	567.1	538.7	---	576.5	547.7	---	553.2	525.5	---	555.4	527.6	---
EDG 1B2	522.0	530.4	503.9	85.6	539.4	512.4	86.1	517.1	491.2	84.9	519.1	493.1	85.0
EDG 2B1	522.0	527.6	501.2	85.5	536.4	509.6	85.9	514.6	488.9	84.8	516.6	490.8	84.9
EDG 2B2	522.0	542.5	515.4	86.2	551.9	524.3	---	528.8	502.4	85.5	530.9	504.4	85.6
ELECT BD RM CHR B	163.9	205.9	195.6	---	209.9	199.4	---	197.8	187.9	---	192.2	182.6	---
MCR CHILLER B	95.4	151.2	143.6	---	154.1	146.4	---	145.3	138.0	---	141.2	134.1	---
SHUTDOWN BD RM CHR B	380.0	409.0	388.6	---	373.4	354.7	85.4	417.7	396.8	---	401.1	381.0	---
CCP PMP OIL CLR 1B	23.0	24.7	23.5	---	25.2	23.9	---	23.7	22.5	86.2	23.1	21.9	85.9
CCP Gear OIL CLR 1B	12.0	13.6	12.9	---	13.9	13.2	---	13.1	12.4	---	12.7	12.1	---
CCP RM CLR 1B	34.0	37.0	35.2	---	37.7	35.8	---	35.6	33.8	86.7	34.5	32.8	86.4
CCP PMP OIL CLR 2B	23.0	31.8	30.2	---	29.0	27.6	---	32.4	30.8	---	31.2	29.6	---
CCP Gear OIL CLR 2B	12.0	17.0	16.2	---	15.4	14.6	---	17.3	16.4	---	16.6	15.8	---
CCP RM CLR 2B	34.0	43.9	41.7	---	40.1	38.1	---	44.7	42.5	---	43.1	40.9	---
SIS PMP RM CLR 1B	18.0	29.1	27.6	---	29.7	28.2	---	28.0	26.6	---	27.1	25.7	---
SIS OIL CLR 1B	4.1	11.4	10.8	---	11.7	11.1	---	11.0	10.5	---	10.6	10.1	---
SIS PMP RM CLR 2B	18.0	33.4	31.7	---	30.5	29.0	---	33.9	32.2	---	32.8	31.2	---
SIS OIL CLR 2B	4.1	11.5	10.9	---	10.5	10.0	---	11.7	11.1	---	11.3	10.7	---
EGTS 2B	9.0	13.7	13.0	---	12.5	11.9	---	14.0	13.3	---	13.4	12.7	---
AUX CONT AIR B	5.1	6.3	6.0	---	5.7	5.4	---	6.4	6.1	---	6.1	5.8	---
SFP & TBBP CLR 1B	28.0	35.0	33.3	---	35.7	33.9	---	33.6	31.9	---	32.6	31.0	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-11 (continued)
Train B Strainer Outage Cases 2, 4, 6, and 8

B-Train ERCW components	Required Flow (gpm)	Strainer 2			Strainer 4			Strainer 6			Strainer 8		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(c) (°F)
CCS & AFW CLR 1B	55.0	98.6	93.7	---	100.6	95.6	---	94.6	89.9	---	91.9	87.3	---
BAT & AFW CLR 2B	62.0	67.6	64.2	---	61.4	58.3	86.2	68.8	65.4	---	66.2	62.9	---
714 PEN RM CLR 1B	19.0	31.3	29.7	---	31.9	30.3	---	30.1	28.6	---	29.1	27.6	---
714 PEN RM CLR 2B	19.0	30.7	29.2	---	28.0	26.6	---	31.2	29.6	---	30.1	28.6	---
690 PEN RM CLR 1B	12.0	30.3	28.8	---	30.9	29.4	---	29.1	27.6	---	28.1	26.7	---
690 PEN RM CLR 2B	12.0	28.8	27.4	---	26.3	25.0	---	29.3	27.8	---	28.3	26.9	---
669 PEN RM CLR 1B	17.0	37.0	35.2	---	37.7	35.8	---	35.6	33.8	---	34.4	32.7	---
669 PEN RM CLR 2B	17.0	55.4	52.6	---	50.5	48.0	---	56.4	53.6	---	54.4	51.7	---
PIPE CHASE CLR 1B	29.0	46.0	43.7	---	46.9	44.6	---	44.3	42.1	---	42.8	40.7	---
PIPE CHASE CLR 2B	29.0	45.6	43.3	---	41.5	39.4	---	46.3	44.0	---	44.7	42.5	---
CNT SPRAY PMP RM CLR 1B	10.0	27.0	25.7	---	27.5	26.1	---	26.0	24.7	---	25.1	23.8	---
CNT SPRAY PMP RM CLR 2B	10.0	35.1	33.3	---	32.0	30.4	---	35.6	33.8	---	34.4	32.7	---
RHR PMP RM CLR 1B	15.0	16.3	15.5	---	16.7	15.9	---	15.7	14.9	86.8	15.2	14.4	86.5
RHR PMP RM CLR 2B	15.0	18.3	17.4	---	16.7	15.9	---	18.6	17.7	---	18.0	17.1	---
CCS HX 0B1/0B2	3365.0	5173.9	4915.2	---	4730.1	4493.6	---	5300.8	5035.8	---	5112.5	4856.9	---
CSS HX 1B	3400.0	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---	0.0	0.0	---
CSS HX 2B	3400.0	3780.5	3591.5	---	3456.4	3283.6	85.4	3855.0	3662.3	---	3703.6	3518.4	---
MINIMUM TEMPERATURE:				85.5			85.4			84.8			84.9

(∗) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-12
Train A One Pump Outages 1 and 3

A-Train ERCW components	Required Flow (gpm)	Outage 1			Outage 3		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
EDG 1A1	522.0	481.1	457.0	82.8	0.0	0.0	---
EDG 1A2	522.0	473.8	450.1	82.3	0.0	0.0	---
EDG 2A1	522.0	0.0	0.0	---	460.7	437.7	81.4
EDG 2A2	522.0	0.0	0.0	---	435.6	413.8	79.5
ELECT BD RM CHR A	163.9	153.3	145.6	85.1	145.9	138.6	84.4
MCR CHILLER A	95.4	108.8	103.4	---	103.5	98.3	---
SHUTDOWN BD RM CHR A	380.0	361.9	343.8	84.9	347.2	329.8	84.1
CCP PMP OIL CLR 1A	23.0	24.7	23.5	---	23.5	22.3	86.1
CCP Gear OIL CLR 1A	12.0	14.0	13.3	---	13.3	12.6	---
CCP RM CLR 1A	34.0	35.1	33.3	86.6	33.5	31.8	86.1
CCP PMP OIL CLR 2A	23.0	27.1	25.7	---	25.2	23.9	---
CCP Gear OIL CLR 2A	12.0	15.0	14.3	---	13.9	13.2	---
CCP RM CLR 2A	34.0	39.5	37.5	---	36.7	34.9	---
SIS PMP RM CLR 1A	18.0	26.7	25.4	---	25.2	23.9	---
SIS OIL CLR 1A	4.1	7.9	7.5	---	7.5	7.1	---
SIS PMP RM CLR 2A	18.0	25.6	24.3	---	23.9	22.7	---
SIS OIL CLR 2A	4.1	9.7	9.2	---	9.1	8.6	---
EGTS 2A	9.0	11.1	10.5	---	10.2	9.7	---
AUX CONT AIR A	5.1	4.7	4.5	84.9	4.5	4.3	84.2
SFP & TBBP CLR 1A	28.0	29.2	27.7	86.8	27.9	26.5	86.3
CCS & AFW CLR 1A	55.0	84.0	79.8	---	79.9	75.9	---
BAT & AFW CLR 2A	62.0	57.4	54.5	85.7	53.1	50.4	85.2
714 PEN RM CLR 1A	19.0	23.9	22.7	---	22.6	21.5	---
714 PEN RM CLR 2A	19.0	23.9	22.7	---	22.4	21.3	---
690 PEN RM CLR 1A	12.0	23.7	22.5	---	22.4	21.3	---
690 PEN RM CLR 2A	12.0	22.7	21.6	---	21.3	20.2	---
669 PEN RM CLR 1A	17.0	39.5	37.5	---	37.3	35.4	---
669 PEN RM CLR 2A	17.0	46.0	43.7	---	43.0	40.9	---
PIPE CHASE CLR 1A	29.0	47.4	45.0	---	44.8	42.6	---
PIPE CHASE CLR 2A	29.0	37.8	35.9	---	35.4	33.6	---
CNT SPRAY PMP RM CLR 1A	10.0	19.8	18.8	---	18.7	17.8	---
CNT SPRAY PMP RM CLR 2A	10.0	27.7	26.3	---	25.9	24.6	---
RHR PMP RM CLR 1A	15.0	13.6	12.9	85.6	12.8	12.2	85.2
RHR PMP RM CLR 2A	15.0	17.5	16.6	---	16.3	15.5	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-12 (continued)
Train A One Pump Outages 1 and 3

A-Train ERCW components	**Required Flow (gpm)**	**Outage 1**			**Outage 3**		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
CCS HX 1A1/1A2	3605.0	3243.1	3080.9	81.7	1504.4	1429.2	---
CCS HX 2A1/2A2	1348.0	1269.7	1206.2	82.0	3366.2	3197.9	82.5
CSS HX 1A	3400.0	3205.8	3045.5	82.6	0.0	0.0	---
CSS HX 2A	3400.0	0.0	0.0	---	3202.2	3042.1	82.5
MINIMUM TEMPERATURE:				81.7			79.5

(∗) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-13
Train B One Pump Outages 1 and 3

B-Train ERCW components	Required Flow (gpm)	Outage 1			Outage 3		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
EDG 1B1	522.0	539.1	512.1	86.0	0.0	0.0	---
EDG 1B2	522.0	503.5	478.3	84.2	0.0	0.0	---
EDG 2B1	522.0	0.0	0.0	---	501.7	476.6	84.1
EDG 2B2	522.0	0.0	0.0	---	515.1	489.3	84.8
ELECT BD RM CHR B	163.9	162.7	154.6	85.8	167.0	158.7	86.0
MCR CHILLER B	95.4	119.7	113.7	---	122.8	116.7	---
SHUTDOWN BD RM CHR B	380.0	349.8	332.3	84.2	349.0	331.6	84.2
CCP PMP OIL CLR 1B	23.0	19.5	18.5	84.7	20.0	19.0	84.9
CCP Gear OIL CLR 1B	12.0	10.7	10.2	84.5	11.0	10.5	84.7
CCP RM CLR 1B	34.0	29.2	27.7	85.3	30.0	28.5	85.4
CCP PMP OIL CLR 2B	23.0	27.0	25.7	---	27.0	25.7	---
CCP Gear OIL CLR 2B	12.0	14.3	13.6	---	14.4	13.7	---
CCP RM CLR 2B	34.0	37.3	35.4	---	37.4	35.5	---
SIS PMP RM CLR 1B	18.0	23.1	21.9	---	23.5	22.3	---
SIS OIL CLR 1B	4.1	9.0	8.6	---	9.2	8.7	---
SIS PMP RM CLR 2B	18.0	28.3	26.9	---	28.5	27.1	---
SIS OIL CLR 2B	4.1	9.7	9.2	---	9.7	9.2	---
EGTS 2B	9.0	11.6	11.0	---	11.6	11.0	---
AUX CONT AIR B	5.1	5.3	5.0	86.0	5.3	5.0	86.0
SFP & TBBP CLR 1B	28.0	27.4	26.0	86.2	28.2	26.8	86.4
CCS & AFW CLR 1B	55.0	77.5	73.6	---	79.6	75.6	---
BAT & AFW CLR 2B	62.0	57.0	54.2	85.6	57.2	54.3	85.7
714 PEN RM CLR 1B	19.0	24.7	23.5	---	25.2	23.9	---
714 PEN RM CLR 2B	19.0	25.9	24.6	---	26.1	24.8	---
690 PEN RM CLR 1B	12.0	23.9	22.7	---	24.4	23.2	---
690 PEN RM CLR 2B	12.0	24.4	23.2	---	24.5	23.3	---
669 PEN RM CLR 1B	17.0	29.3	27.8	---	29.8	28.3	---
669 PEN RM CLR 2B	17.0	46.8	44.5	---	47.1	44.7	---
PIPE CHASE CLR 1B	29.0	36.5	34.7	---	37.2	35.3	---
PIPE CHASE CLR 2B	29.0	38.4	36.5	---	38.7	36.8	---
CNT SPRAY PMP RM CLR 1B	10.0	21.4	20.3	---	21.8	20.7	---
CNT SPRAY PMP RM CLR 2B	10.0	29.7	28.2	---	29.9	28.4	---

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-13 (continued)
Train B One Pump Outages 1 and 3

B-Train ERCW components	**Required Flow (gpm)**	**Outage 1**			**Outage 3**		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
RHR PMP RM CLR 1B	15.0	12.9	12.3	85.3	13.1	12.4	85.4
RHR PMP RM CLR 2B	15.0	15.5	14.7	86.7	15.6	14.8	86.8
CCS HX 0B1/0B2	3365.0	4338.3	4121.4	---	4395.7	4175.9	---
CSS HX 1B	3400.0	3210.7	3050.2	82.6	0.0	0.0	---
CSS HX 2B	3400.0	0.0	0.0	---	3182.4	3023.3	82.3
MINIMUM TEMPERATURE:				82.6			82.3

(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

Table 4.2-14
LCC Available Flow Outages 2 and 4

Lower Containment Vent Coolers	**Required Flow (gpm)**	**Outage 2**			**Outage 4**		
		Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)	Multiflow Results (gpm)	minus 5% (gpm)	Temp Limit(*) (°F)
1AA LCC	170.0	318.2	302.3	---	---	---	---
1CA LCC	170.0	288.2	273.8	---	---	---	---
2AA LCC	170.0	---	---	---	288.0	273.6	---
2CA LCC	170.0	---	---	---	247.8	235.4	---
1BB LCC	170.0	225.0	213.8	---	---	---	---
1DB LCC	170.0	264.2	251.0	---	---	---	---
2BB LCC	170.0	---	---	---	242.1	230.0	---
2DB LCC	170.0	---	---	---	287.7	273.3	---
MINIMUM TEMPERATURE:				---			---

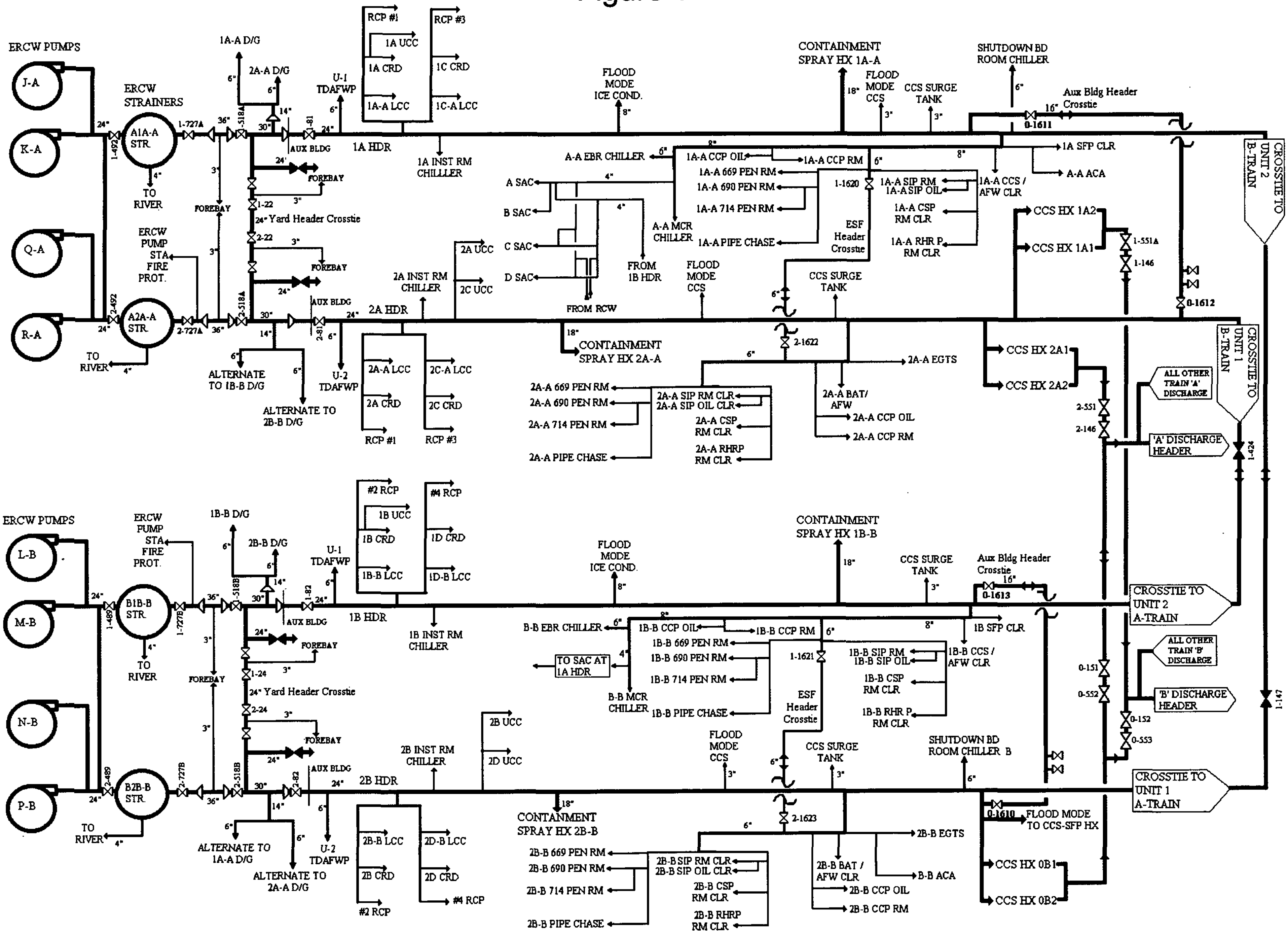
(*) Only temperatures less than the TS UHS maximum temperature limit of 87°F are indicated.

9.0 ACRONYMS

10 CFR	Title 10, of the Code of Federal Regulations
ACA	Auxiliary Control Air
ACB	Air Circuit Breaker
ADAMS	Agencywide Documents Access and Management System
AFW	Auxiliary Feedwater
AHU	Air Handling Unit
ASME	American Society of Mechanical Engineers
AUX	Auxiliary
BAT	Boric Acid Tank
DC	Direct Current
BD	Board
Bldg	Building
CCP	Centrifugal Charging Pump
CCS	Component Cooling System
cfs	Cubic Feet per Second
CHR	Chiller
CNT	Containment
CLR	Cooler
Cont	Control
CRD	Control Rod Drive
CSS	Containment Spray System
EDG	Emergency Diesel Generator
EGTS	Emergency Gas Treatment System
Elect	Electric
EQ	Environmental Qualification
ERCW	Essential Raw Cooling Water
ESF	Engineered Safety Features
°F	Degrees Fahrenheit
FCV	Flow Control Valve
GDC	General Design Criteria
GL 89-13	Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
gpm	Gallons per Minute
HX	Heat Exchanger
IIRC	Incore Instrumentation Room Cooler
ITS	Improved Technical Specifications
kV	Kilovolt
LAR	License Amendment Request
LCC	Lower Containment Vent Cooler
LCO	Limiting Condition for Operation
LOCA	Loss of Coolant Accident
MCR	Main Control Room
MOV	Motor Operated Valve
MSLB	Main Steam Line Break
NRC	Nuclear Regulatory Commission
PEN	Penetration
PMP	Pump
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RM	Room
SFP	Spent Fuel Pit
SIS	Safety Injection System
SQN	Sequoyah Nuclear Plant
SSC	Structure, System, or Component
SSE	Safe Shutdown Earthquake
SWP	Screen Wash Pump
TBBP	Thermal Barrier Booster Pump
TDAFWP	Driven Auxiliary Feedwater Pump
TS	Technical Specification
TVA	Tennessee Valley Authority
U1	Unit 1
U2	Unit 2
UCC	Upper Containment Cooler
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
USGS	United States Geological Survey
V	Volt

FIGURE 1 – SIMPLIFIED ERCW FLOW DIAGRAM

Figure 1


ERCW PUMPS
J-A
K-A
Q-A
R-A
ERCW STRAINERS
A1A-A STR.
A2A-A STR.
TO RIVER
ERCW PUMP STA. FIRE PROT.
FOREBAY
1A-A D/G
2A-A D/G
U-1 TDAFWP
AUX BLDG
1A HDR
24" Yard Header Crosstie
RCP #1
RCP #3
1A UCC
1A CRD
1C CRD
1A-A LCC
1C-A LCC
1A INST RM CHILLLER
FLOOD MODE ICE COND.
CONTAINMENT SPRAY HX 1A-A
FLOOD MODE CCS
CCS SURGE TANK
SHUTDOWN BD ROOM CHILLER
Aux Bldg Header Crosstie
A-A EBR CHILLER
1A-A CCP OIL
1A-A CCP RM
1A-A 669 PEN RM
1A-A 690 PEN RM
1A-A 714 PEN RM
1A-A PIPE CHASE
A-A MCR CHILLER
ESF Header Crosstie
1A-A SIP RM
1A-A SIP OIL
1A-A CCS / AFW CLR
1A-A CSP RM CLR
1A-A RHR P. RM CLR
1A SFP CLR
A-A ACA
CCS HX 1A2
CCS HX 1A1
CROSSTIE TO UNIT 2 B-TRAIN
A SAC
B SAC
C SAC
D SAC
FROM RCW
FROM 1B HDR
2A UCC
2C UCC
2A INST RM CHILLER
2A HDR
ALTERNATE TO 1B-B D/G
ALTERNATE TO 2B-B D/G
U-2 TDAFWP
2A-A LCC
2C-A LCC
2A CRD
2C CRD
CONTAINMENT SPRAY HX 2A-A
2A-A 669 PEN RM
2A-A 690 PEN RM
2A-A 714 PEN RM
2A-A PIPE CHASE
2A-A SIP RM CLR
2A-A SIP OIL CLR
2A-A CSP RM CLR
2A-A RHRP RM CLR
2A-A BAT/ AFW
2A-A CCP OIL
2A-A CCP RM
2A-A EGTS
CCS HX 2A1
CCS HX 2A2
ALL OTHER TRAIN 'A' DISCHARGE
'A' DISCHARGE HEADER
CROSSTIE TO UNIT 1 B-TRAIN
L-B
M-B
N-B
P-B
B1B-B STR.
B2B-B STR.
1B-B D/G
2B-B D/G
1B HDR
#2 RCP
#4 RCP
1B UCC
1B CRD
1D CRD
1B-B LCC
1D-B LCC
1B INST RM CHILLER
CONTAINMENT SPRAY HX 1B-B
B-B EBR CHILLER
1B-B CCP OIL
1B-B CCP RM
1B-B 669 PEN RM
1B-B 690 PEN RM
1B-B 714 PEN RM
1B-B PIPE CHASE
B-B MCR CHILLER
TO SAC AT 1A HDR
1B-B SIP RM
1B-B SIP OIL
1B-B CCS / AFW CLR
1B-B CSP RM CLR
1B-B RHR P. RM CLR
1B SFP CLR
CROSSTIE TO UNIT 2 A-TRAIN
ALL OTHER TRAIN 'B' DISCHARGE
'B' DISCHARGE HEADER
SHUTDOWN BD ROOM CHILLER B
CROSSTIE TO UNIT 1 A-TRAIN
2B HDR
2B INST RM CHILLER
2B UCC
2D UCC
ALTERNATE TO 1A-A D/G
ALTERNATE TO 2A-A D/G
2B-B LCC
2D-B LCC
2B CRD
2D CRD
CONTAINMENT SPRAY HX 2B-B
2B-B 669 PEN RM
2B-B 690 PEN RM
2B-B 714 PEN RM
2B-B PIPE CHASE
2B-B SIP RM CLR
2B-B SIP OIL CLR
2B-B CSP RM CLR
2B-B RHRP RM CLR
2B-B BAT / AFW CLR
2B-B CCP OIL
2B-B CCP RM
2B-B EGTS
B-B ACA
FLOOD MODE TO CCS-SFP HX
CCS HX 0B1
CCS HX 0B2

ATTACHMENT 1

Proposed Technical Specifications and Operating License Page Markups

Proposed Operating License Changes (Mark-Ups)
SQN Unit 1

5. Identification of readily-available pre-staged equipment
6. Training on integrated fire response strategy
7. Spent fuel pool mitigation measures

(c) Actions to minimize release to include consideration of:
1. Water spray scrubbing
2. Dose to onsite responders

(28) The licensee shall implement and maintain all Actions required by Attachment 2 to NRC Order EA-06-137, issued June 20, 2006, except the last action that requires incorporation of the strategies into the site security plan, contingency plan, emergency plan and/or guard training and qualification plan, as appropriate.

(29) Upon implementation of the amendment adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by Surveillance Requirement (SR) 4.7.7.h, in accordance with TS 6.17.c.(i), the assessment of CRE habitability as required by Specification 6.17.c.(ii), and the measurement of CRE pressure as required by Specification 6.17.d, shall be considered met. Following implementation:

(a) The first performance of SR 4.7.7.h, in accordance with Specification 6.17.c.(i), shall be within the specified Frequency of 6 years, plus the 18-month allowance of SR 4.0.2, as measured from May 3, 2004; the date of the most recent successful tracer gas test, as stated in the August 4, 2004, letter response to Generic Letter 2003-01; or within the next 18 months if the time period since the most recent successful tracer gas test is greater than 6 years.

(b) The first performance of the periodic assessment of CRE habitability, Specification 6.17.c.(ii), shall be within 3 years, plus the 9-month allowance of SR 4.0.2, as measured from May 3, 2004; the date of the most recent successful tracer gas test, as stated in the August 4, 2004, letter response to Generic Letter 2003-01; or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.

(c) The first performance of the periodic measurement of CRE pressure, Specification 6.17.d, shall be within 18 months, plus the 138 days allowed by SR 4.0.2, as measured from May 30, 2007, the date of the most recent successful pressure measurement test, or within 138 days if not performed previously.

(30) ~~Steam Generator Replacement Project~~Deleted

~~During the Sequoyah Nuclear Plant, Unit 2, refueling outage 18, lifts of heavy loads associated with the steam generator replacement project shall be performed in accordance with the additional conditions provided in Appendix C.~~

APPENDIX C

ADDITIONAL CONDITIONS

TO FACILITY OPERATING LICENSE

Deleted
~~PREREQUISITE ACTIONS TO HEAVY LOAD~~
~~MOVEMENT WITH THE OUTSIDE LIFE SYSTEM (OLS)~~

~~FOR~~

~~SEQUOYAH NUCLEAR PLANT, UNIT 1~~

~~DOCKET NOS. 50-327~~

~~TENNESSEE VALLEY AUTHORITY~~

Deleted

~~Prerequisite Actions to Heavy Load Movement with the Outside Lift System (OLS)~~

1. ~~Install a wall in the Sequoyah Nuclear Plant (SQN) Unit 2 pipe tunnel to seal the tunnel from the Auxiliary Building. Ensure that measures are in place to suitably handle significant leakage through the temporary SQN Unit 2 pipe tunnel wall. Develop criteria to quantify the amount of water behind the temporary pipe tunnel wall.~~

2. ~~Develop and issue plant procedure(s) to delineate specific actions required in case of a large heavy load drop from the OLS to address monitoring any leakage through the temporary SQN Unit 2 pipe tunnel wall and the actions to be taken to respond to detected leakage into the Auxiliary Building. Concerning Plant Operations training, Operations crews (licensed and non-licensed Operating personnel as applicable) will receive training for these procedures during a cycle of requalification training, and "just-in-time" refresher training will be conducted to specific crew(s) prior to each heavy lift.~~

3. ~~When erecting the OLS, utilize the safe load paths defined in procedures. During assembly of the OLS, when it is not possible to eliminate a potential impact with the Essential Raw Cooling Water (ERCW) System piping and where protection is necessary for other buried commodities, utilize timber mats, steel mats, or steel plate to distribute the impact from a load drop.~~

4. ~~Ensure that ERCW System supply header average water temperature is less than or equal to 74°F.~~

5. ~~Place the ERCW System in the alignment to support large heavy load lifts prior to the heavy load lifts occurring with the OLS. This alignment is as follows:~~

    a. ~~Isolation of the portions of the "2A" and "2B" ERCW supply headers in the drop zone from the remaining ERCW piping,~~

    b. ~~Cross-tie of the "1A" and 2A" ERCW supply headers and Cross-tie of the "1B" and "2B" ERCW supply headers,~~

    c. ~~Cross-tie of the "1A" and "2A" ERCW Engineered Safety Features (ESF) headers and Cross-tie of the "1B" and "2B" ESF headers,~~

    d. ~~Throttling valve 0-67-546C to reduce flow through CCS heat exchangers "0B1" and "0B2,"~~

    e. ~~Isolation of the ERCW supplies to the Unit 2 Reactor Building, the Unit 2 Containment Spray Heat Exchangers, and the Unit 2 Turbine Driven Auxiliary Feedwater Pump, and~~

Deleted

~~f. Alignment (i.e., cross-tie) of the "A" and "B" ERCW discharge headers such that ERCW discharge flow normally passing through the portion of the "B" ERCW discharge header that is located in the drop zone would flow through the "A" ERCW discharge header in the event of a large heavy load drop that crushed the "B" ERCW discharge header piping resulting in isolation of this discharge flow path.~~

~~6. Isolate the high-pressure fire pump and the flood mode pump piping in the SQN Unit 2 pipe tunnel to the Auxiliary Building.~~

~~7. Isolate the ERCW System, Component Cooling System, and Essential Air Distribution System to the SQN Unit 2 Containment using valves outside of the SQN Unit 2 Containment. Ensure that the Spent Fuel Pit and Spent Fuel Pool Cooling System are isolated from the SQN Unit 2 Containment.~~

~~Active Monitoring Actions During OLS Operation~~

~~1. Monitor weather conditions, for the expected duration of the lift, to ensure conditions are acceptable for OLS operation.~~

~~2. If weather conditions exceed operational limits of OLS and heavy loads are In the vicinity of safety-related structures, systems and components that are required to be operable, then take actions to terminate heavy load operation and place loads in a safe condition.~~

~~3. Utilize safe load paths defined in procedures during OLS operation.~~

~~4. Monitor OLS operation to ensure a minimum clearance of 20 feet exists between the Shield Building dome and the bottom of the steam generator when a steam generator is being moved over the Shield Building.~~

Proposed TS Changes (Mark-Ups)
SQN Unit 1

PLANT SYSTEMS

3/4.7.5 ULTIMATE HEAT SINK

LIMITING CONDITION FOR OPERATION

3.7.5 The ultimate heat sink shall be OPERABLE~~ with:~~

~~a. A minimum water level at or above elevation 674 feet mean sea level USGS datum, and~~

~~b. An average ERCW supply header water temperature of less than or equal to 87°F, when the ERCW System is notin the alignment to support large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project, and~~ .

~~c. An average ERCW supply header water temperature of less than or equal to 74°F, when the ERCW System is in the alignment to support large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project.~~

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the average ERCW supply header water temperature > 81°F and ≤ 87°F, and any ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump is OPERABLE on that loop, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

b. With the average ERCW supply header water temperature ≥ 83°F and ≤ 87°F, and one ERCW supply strainer inoperable on one or more loops, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

c. With the UHS not within limits for reasons other than ACTION a or ACTION b~~requirements of the above specification not satisfied~~, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying:

a. the ~~average ERCW supply header temperature and~~ UHS water level is~~to be~~ ≥ 674 feet mean sea level USGS datum~~within their limits,~~ and

b. the average ERCW supply header water temperature is:

1) ≤ 81°F with any ERCW loop aligned to support one pump per loop OPERABILITY and only one ERCW pump OPERABLE on that loop, or

2) < 83°F with one ERCW supply strainer and two ERCW pumps OPERABLE on that loop, or

3) ≤ 87°F with two ERCW supply strainers and two ERCW pumps OPERABLE per loop.

Proposed TS Changes (Mark-Ups)
SQN Unit 2

3/4.7.5 ULTIMATE HEAT SINK

LIMITING CONDITION FOR OPERATION

3.7.5 The ultimate heat sink shall be OPERABLE.~~, with:~~

~~a. A minimum water level at or above elevation 674 feet mean sea level USGS datum, and~~

~~b. An average ERCW supply header water temperature of less than or equal to 87°F.~~

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the average ERCW supply header water temperature > 79°F and ≤ 87°F, and any ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump is OPERABLE on that loop, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

b. With the average ERCW supply header water temperature ≥ 83°F and ≤ 87°F, and one ERCW supply strainer inoperable on one or more loops, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

c. With the UHS not within limits for reasons other than ACTION a or ACTION b~~requirements of the above specification not satisfied~~, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying:

a. the ~~average ERCW supply header temperature and~~ UHS water level is~~to be~~ ≥ 674 feet mean sea level USGS datum~~within their limits~~, and

b. the average ERCW supply header water temperature is:

1) ≤ 79°F with any ERCW loop aligned to support one pump per loop OPERABILITY and only one ERCW pump OPERABLE on that loop, or

2) < 83°F with only one ERCW supply strainer and two ERCW pumps OPERABLE on that loop, or

3) ≤ 87°F with two ERCW supply strainers and two ERCW pumps OPERABLE per loop.

ATTACHMENT 2

Proposed TS Bases Page Markups
(for information only)

Proposed TS Bases Page Markups
SQN Unit 1
(for information only)

PLANT SYSTEMS

BASES

3/4.7.3 COMPONENT COOLING WATER SYSTEM

The OPERABILITY of the component cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident analyses.

3/4.7.4 ESSENTIAL RAW COOLING WATER SYSTEM

The OPERABILITY of the essential raw cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident conditions within acceptable limits.

To meet the OPERABILITY requirements for ERCW loops, two ERCW loops are required to be OPERABLE to provide the required redundancy to ensure that the system functions as designed to remove post accident heat loads, assuming that the worst case single active failure occurs coincident with the loss of offsite power. Different sources refer to an ERCW loop or an ERCW train; for ERCW the term loop and train are interchangeable.

An ERCW loop is considered OPERABLE during MODES 1, 2, 3, and 4 when the associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety related function are OPERABLE and:

a. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board) and two ERCW supply strainers are OPERABLE per loop, or

b. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board), one ERCW supply strainer is inoperable, and the ERCW system aligned in accordance with Table B 3/4.7-2, or

c. Only one ERCW pump is OPERABLE per loop (fed from its associated shutdown board), two ERCW supply strainers are OPERABLE per loop, and the ERCW system aligned in accordance with Table B 3/4.7-1.

B 3/4.7 Plant Systems

B 3/4.7.5 Ultimate Heat Sink (UHS)

BASES

BACKGROUND	The UHS provides a heat sink for processing and operating heat from safety-related components during a transient or accident, as well as during normal operation and shutdown. This is done by utilizing the Essential Raw Cooling Water (ERCW) System and the Component Cooling System (CCS). The UHS has been defined as that complex of water sources, including necessary retaining structures (e.g., a river with its dam), and the canals or conduits connecting the sources with, but not including, the cooling water system intake structures as discussed in the UFSAR, Section 9.2.5 (Ref. 1). The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident. Chickamauga Lake (Tennessee River system) qualifies as a single source. The basic performance requirements are that a 30-day supply of water be available, and that the design basis temperatures of safety-related equipment not be exceeded
APPLICABLE SAFETY ANALYSES	The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation. SQN uses the UHS as the normal heat sink for condenser cooling via the Circulating Water System; so unit operation at full power is its maximum heat load. Its maximum post accident heat load occurs approximately 25 minutes after a design basis loss-of-coolant accident (LOCA). Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat. The operating limits are based on conservative heat transfer analyses for the worst-case LOCA. References 1, 2, and 3 provides the details of the assumptions used in the analysis, which include worst-expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst-case single active failure . The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 4), which requires a 30-day supply of cooling water in the UHS The UHS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ERCW to operate for at least 30 days following the design basis LOCA without the loss of net positive suction

LCO (continued)

head (NPSH), and without exceeding the maximum design temperature of the equipment served by the ERCW. To meet this condition, the UHS temperature should not exceed 87°F~~, when the ERCW System is not in the alignment to support large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project,~~ and the level should not fall below the 674 feet mean sea level during normal unit operation. When the ERCW System is in the alignment to support ~~large heavy load lifts associated with the Unit 2 refueling outage 18 steam generator replacement project, the~~ one pump per loop operation the UHS temperature should not exceed 81°F. When the ERCW System is in the alignment to support an ERCW supply strainer inoperable for maintenance, the UHS temperature should be less than ~~74~~83°F. The alignment to support the~~se~~ one pump per loop OPERABILITY configuration~~large heavy load lifts~~, which maintains the ERCW System OPERABLE~~ in the event of large heavy load drop~~, is described in Table B 3/4.7-1~~Appendix C, "Additional Conditions," of the Operating License~~. The alignment to support the operation with one ERCW supply strainer inoperable, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-2.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

APPLICABILITY

In MODES 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

The maximum allowed UHS temperature value is based on temperature limitations of the equipment that is relied upon for accident mitigation and safe shutdown of the unit and the configuration of the ERCW System. Measurement of this temperature is in accordance with NUREG/CR-3659 methodology which includes measurement uncertainties (Ref: 5).

With average water temperature of the UHS ≤ 87°F (when the ERCW System is aligned in its normal configuration), or~~(when the ERCW System is not in the alignment to support large heavy load lifts) or~~ <~~≤~~ 83°~~74°~~F (when the ERCW System is in the alignment to support strainer maintenance~~large heavy load lifts~~), or ≤ 81°F (when the ERCW System is in the alignment to support one pump per loop operation), the associated design basis assumptions remain bounded for all accidents, transients, and shutdown. Long-term cooling capability is provided to the Emergency Core Cooling System (ECCS) and Emergency Diesel Generator loads.

a.

With the average ERCW supply header water temperature > 81°F the ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump on that loop is OPERABLE, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

ACTION a (continued)

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and the applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

b.

With the average ERCW supply header water temperature ≥ 83°F, the ERCW loop aligned for an inoperable ERCW supply strainer, and one ERCW supply strainer is inoperable on one or more loops, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and the applicable Action(s) of TS 3/4 7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

c.

If the water temperature of the UHS exceeds 87°F or the UHS water level is less than 674 feet mean sea level USGS datum,~~the limits of the LCO,~~ the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within the following 30 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 4.7.5.1

This SR verifies that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident.

a.

This SR also verifies that adequate long-term (30 day) cooling can be maintained. The specified level ensures that sufficient reservoir volume exists at the initiation of a LBLOCA concurrent with loss of downstream dam to meet the short-term recovery. NPSH of the ERCW pumps is~~are~~ not challenged with loss of downstream dam. This SR verifies that the UHS water level is ≥ 674 feet mean sea level United States Geological Survey (USGS) datum. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

b.

This SR verifies that the average water temperature of the UHS is ≤ 87°F when the ERCW System is aligned in its normal configuration. ~~(when the ERCW Sysem is not in the alignment to support large heavy load lifts) and ≤ 74°F (when the ERCW System is in the alignment to support large heavy load lifts) and that the UHS water level is ≥ 674 feet mean sea level.~~ In addition, this SR provides temperature limitations for alternate ERCW loop alignments.

When an ERCW loop is aligned in accordance with Table B 3/4.7-1 and only one ERCW pump is OPERABLE per loop, this SR verifies that the average water temperature of the UHS is ≤ 81°F. When an ERCW loop is aligned in accordance with Table B 3/4.7-2 and one ERCW supply strainer is inoperable, this SR verifies that the average water temperature of the UHS is < 83°F. These actions verify that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident when aligned in either the Table B 3/4.7-1 or Table B 3/4.7-2 alternate configuration. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

BASES

REFERENCES

1. UFSAR, Section 9.2.5, Ultimate Heat Sink

2. UFSAR, Section 6.2.1, Containment Functional Design

3. UFSAR, Section 9.2.2, Essential Raw Cooling Water (ERCW)

4. Regulatory Guide 1.27 R0, "Ultimate Heat Sink For Nuclear Power Plants," 1972

5. NUREG/CR-3659, "A Mathematical Model For Assessing The Uncertainties Of Instrumentation Measurements For Power And Flow Of PWR Reactors," February 1985.

Table B 3/4.7-1
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop A One Pump Operation

1. ERCW System supply header average water temperature is ≤ 81°F.

2. Unit 2 is in MODE 5 or 6, or defueled.

3. Place the ERCW System in the alignment to support Loop A one pump operation as follows:

   a. Isolate ERCW Flow to the following components;

      1) 2A-A Diesel Generator Heat Exchangers

      2) Unit 2 Containment Spray Heat Exchanger 2A

      3) Unit 2 TDAFW Pump from the "2A" ERCW Main Supply Header

      4) Lower Containment Vent Cooler 2A, Control Rod Drive Vent Cooler 2A, and Reactor Coolant Pump 2-1 Motor Cooler

      5) Lower Containment Vent Cooler 2C, Control Rod Drive Vent Cooler 2C, and Reactor Coolant Pump 2-3 Motor Cooler

      6) Upper Containment Vent Cooler 2A, and

      7) Upper Containment Vent Cooler 2C, and

      8) Incore Instrumentation Room Water Coolers 2A, and

   b. Place in service;

      1) A Train ERCW yard header crosstie

      2) A Train ERCW 16-inch Auxiliary Building header crosstie, and

      3) A Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie.

Table B 3/4.7-1 (continued)
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop B One Pump Operation

1. ERCW System supply header average water temperature is ≤ 81°F.

2. Unit 2 is in MODE 5, MODE 6, or defueled.

3. Place the ERCW System in the alignment to support Loop B one pump operation as follows:

   a. Isolate ERCW flow to the following components;

      1) 2B-B Diesel Generator Heat Exchangers

      2) Containment Spray Heat Exchanger 2B

      3) Unit 2 TDAFW Pump from the "2B" ERCW Main Supply Header

      4) Lower Containment Ventilation Cooler 2B, Control Rod Drive Vent Cooler 2B, and Reactor Coolant Pump 2-2 Motor Cooler

      5) Lower Containment Ventilation Coolers 2D, Control Rod Drive Vent Cooler 2D, and Reactor Coolant Pump 2-4 Motor Cooler

      6) Upper Containment Ventilation Coolers 2B

      7) Upper Containment Ventilation Coolers 2D

      8) Incore Instrumentation Room Water Coolers 2B

   b. Place in service;

      1) B Train ERCW yard header crosstie

      2) B Train ERCW 16-inch Auxiliary Building header crosstie

      3) B Train ERCW 6-inch Engineered Safety Features (ESF) header crossties.

   c. Isolate ERCW flow to the 1B Control Rod Drive Vent Cooler

TABLE B 3/4.7-2
MINIMUM REQUIREMENTS FOR ERCW
One ERCW Supply Strainer Inoperable

FEATURE	Condition
Average ERCW System supply header water temperature	$\leq$ 83°F
ERCW Yard header crosstie (associated loop)	In service
ERCW 16-Inch Auxiliary Building header crossties	In service or isolated
ERCW 6-Inch ESF header crossties	In service or isolated

Proposed TS Bases Page (Markups)
SQN Unit 2
(for information only)

3/4.7.3 COMPONENT COOLING WATER SYSTEM

The OPERABILITY of the component cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident analyses.

3/4.7.4 ESSENTIAL RAW COOLING WATER SYSTEM

The OPERABILITY of the essential raw cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident conditions within acceptable limits.

To meet the OPERABILITY requirements for ERCW loops, two ERCW loops are required to be OPERABLE to provide the required redundancy to ensure that the system functions as designed to remove post accident heat loads, assuming that the worst case single active failure occurs coincident with the loss of offsite power. Different sources refer to an ERCW loop or an ERCW train; for ERCW the term loop and train are interchangeable.

An ERCW loop is considered OPERABLE during MODES 1, 2, 3, and 4 when the associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety related function are OPERABLE and:

a. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board) and two ERCW supply strainers are OPERABLE per loop, or

b. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board), one ERCW supply strainer inoperable, and the ERCW system aligned in accordance with Table B 3/4.7-2, or

c. Only one ERCW pump is OPERABLE per loop (fed from its associated shutdown board), two ERCW supply strainers are OPERABLE per loop, and the ERCW system aligned in accordance with Table B 3/4.7-1.

B 3/4.7 Plant Systems

B 3/4.7.5 Ultimate Heat Sink (UHS)

BASES

BACKGROUND	The UHS provides a heat sink for processing and operating heat from safety-related components during a transient or accident, as well as during normal operation and shutdown. This is done by utilizing the Essential Raw Cooling Water (ERCW) System and the Component Cooling System (CCS). The UHS has been defined as that complex of water sources, including necessary retaining structures (e.g., a river with its dam), and the canals or conduits connecting the sources with, but not including, the cooling water system intake structures as discussed in the UFSAR, Section 9.2.5 (Ref. 1). The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident. Chickamauga Lake (Tennessee River system) qualifies as a single source. The basic performance requirements are that a 30-day supply of water be available, and that the design basis temperatures of safety-related equipment not be exceeded
APPLICABLE SAFETY ANALYSES	The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation. SQN uses the UHS as the normal heat sink for condenser cooling via the Circulating Water System; so unit operation at full power is its maximum heat load. Its maximum post accident heat load occurs approximately 25 minutes after a design basis loss-of-coolant accident (LOCA). Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat. The operating limits are based on conservative heat transfer analyses for the worst-case LOCA. References 1, 2, and 3 provides the details of the assumptions used in the analysis, which include worst-expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst-case single active failure . The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 4), which requires a 30-day supply of cooling water in the UHS The UHS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ERCW to operate for at least 30 days following the design basis LOCA without the loss of net positive suction

LCO (continued)

head (NPSH), and without exceeding the maximum design temperature of the equipment served by the ERCW. To meet this condition, the UHS temperature should not exceed 87°F and the level should not fall below the 674 feet mean sea level during normal unit operation. When the ERCW System is in the alignment to support one pump per loop operation the UHS temperature should not exceed 79°F. When the ERCW System is in the alignment to support an ERCW supply strainer inoperable for maintenance, the UHS temperature should be less than 83°F. The alignment to support the one pump per loop OPERABILITY configuration, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-1. The alignment to support the operation with one ERCW supply strainer inoperable, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-2.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

APPLICABILITY

In MODES 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

87°F is the maximum allowed UHS temperature value is based on temperature limitations of the equipment that is relied upon for accident mitigation and safe shutdown of the unit. Measurement of this temperature is in accordance with NUREG/CR-3659 methodology which includes measurement uncertainties (Ref: 5).

With average water temperature of the UHS ≤ 87°F(when the ERCW System is aligned in its normal configuration), or < 83°F (when the ERCW System is in the alignment to support supply strainer maintenance), or ≤ 79°F (when the ERCW System is in the alignment to support one pump per loop operation), the associated design basis assumptions remain bounded for all accidents, transients, and shutdown. Long-term cooling capability is provided to the Emergency Core Cooling System (ECCS) and Emergency Diesel Generator loads.

a.

With the average ERCW supply header water temperature > 79°F, the ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump on that loop is OPERABLE, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

BASES

ACTION a (continued)

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

b.

With the average ERCW supply header water temperature ≥ 83°F, the ERCW loop aligned for an inoperable ERCW supply strainer, and one ERCW supply strainer is inoperable on one or more loops, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

c.

If the water temperature of the UHS exceeds 87°F or the UHS water level is less than 674 feet mean sea level USGS datum, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within the following 30 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 4.7.5.1

This SR verifies that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident.

a.

This SR also verifies that adequate long-term (30 day) cooling can be maintained. The specified level ensures that sufficient reservoir volume exists at the initiation of a LBLOCA concurrent with loss of downstream dam to meet the short-term recovery. NPSH of the ERCW pumps is~~are~~ not challenged with loss of downstream dam. This SR verifies that the UHS water level is ≥ 674 feet mean sea level United States Geological Survey (USGS) datum. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

b.

This SR verifies that the average water temperature of the UHS is ≤ 87°F when the ERCW System is aligned in its normal configuration~~and that the UHS water level is > 674 feet mean sea level~~. In addition, this SR provides temperature limitations for alternate ERCW loop alignments.

When an ERCW loop is aligned in accordance with Table B 3/4.7-1 and only one ERCW pump is OPERABLE per loop this SR verifies that the average water temperature of the UHS is ≤ 79°F. When an ERCW loop is aligned in accordance with Table B 3/4.7-2 and one ERCW supply strainer is inoperable, this SR verifies that the average water temperature of the UHS is < 83°F. These actions verify that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident when aligned in either Table B 3/4.7-1 or Table B 3/4.7-2 alternate configuration. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

BASES

REFERENCES

1. UFSAR, Section 9.2.5, Ultimate Heat Sink
2. UFSAR, Section 6.2.1, Containment Functional Design
3. UFSAR, Section 9.2.2, Essential Raw Cooling Water (ERCW)
4. Regulatory Guide 1.27 R0, "Ultimate Heat Sink For Nuclear Power Plants," 1972
5. NUREG/CR-3659, "A Mathematical Model For Assessing The Uncertainties Of Instrumentation Measurements For Power And Flow Of PWR Reactors," February 1985.

Table B 3/4.7-1
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop A One Pump Operation

1. ERCW System supply header average water temperature is ≤ 79°F.

2. Unit 1 is in MODE 5, MODE 6, or defueled.

3. Place the ERCW System in the alignment to support Loop A one pump operation as follows:

   a. Isolate ERCW flow to the following components;

      1) 1A-A Diesel Generator Heat Exchangers

      2) Containment Spray Heat Exchanger 1A

      3) Unit 1 TDAFW Pump from the "1A" ERCW Main Supply Header

      4) Lower Containment Ventilation Coolers 1A, Control Rod Drive Vent Cooler 1A, and Unit 1 Reactor Coolant Pump 1-1 Motor Cooler

      5) Lower Containment Ventilation Coolers 1C, Control Rod Drive Vent Cooler 1C and Unit 1 Reactor Coolant Pump 1-3 Motor Cooler

      6) Incore Instrumentation Room Water Coolers 1A

   b. Place in service;

      1) A Train ERCW yard header crosstie

      2) A Train ERCW 16-inch Auxiliary Building header crosstie

      3) A Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie

Table B 3/4.7-1 (continued)
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop B One Pump Operation

1. ERCW System supply header average water temperature is ≤ 79°F.

2. Unit 1 is in MODE 5, MODE 6, or defueled.

3. Place the ERCW System in the alignment to support Loop B one pump operation as follows:

    a. Isolate ERCW flow to the following components;

        1) 1B-B Diesel Generator Heat Exchangers

        2) Containment Spray Heat Exchanger 1B

        3) Unit 1 TDAFW Pump from the "1B" ERCW Main Supply Header

        4) Lower Containment Ventilation Coolers 1B, Control Rod Drive Vent Cooler 1B, and Unit 1 Reactor Coolant Pump 1-2 Motor Cooler

        5) Lower Containment Ventilation Coolers 1D, Control Rod Drive Vent Cooler 1D, and Unit 1 Reactor Coolant Pump 1-4 Motor Cooler

        6) Incore Instrumentation Room Water Coolers 1B

    b. Place in service;

        1) B Train ERCW yard header crosstie

        2) B Train ERCW 16-inch Auxiliary Building header crosstie

        3) B Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie

TABLE B 3/4.7-2
MINIMUM REQUIREMENTS FOR ERCW
One ERCW Supply Strainer Inoperable

FEATURE	**Condition**
Average ERCW System supply header water temperature	< 83°F
ERCW Yard header crosstie (associated loop)	In service
ERCW 16-Inch Auxiliary Building header crossties	In service or isolated
ERCW 6-Inch ESF header crossties	In service or isolated

ATTACHMENT 3

Proposed Retyped Technical Specifications and Operating License Pages

Proposed Retyped Operating License Pages
SQN Unit 1

5. Identification of readily-available pre-staged equipment
6. Training on integrated fire response strategy
7. Spent fuel pool mitigation measures

(c) Actions to minimize release to include consideration of:
1. Water spray scrubbing
2. Dose to onsite responders

(28) The licensee shall implement and maintain all Actions required by Attachment 2 to NRC Order EA-06-137, issued June 20, 2006, except the last action that requires incorporation of the strategies into the site security plan, contingency plan, emergency plan and/or guard training and qualification plan, as appropriate.

(29) Upon implementation of the amendment adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air inleakage as required by Surveillance Requirement (SR) 4.7.7.h, in accordance with TS 6.17.c.(i), the assessment of CRE habitability as required by Specification 6.17.c.(ii), and the measurement of CRE pressure as required by Specification 6.17.d, shall be considered met. Following implementation:

(a) The first performance of SR 4.7.7.h, in accordance with Specification 6.17.c.(i), shall be within the specified Frequency of 6 years, plus the 18-month allowance of SR 4.0.2, as measured from May 3, 2004; the date of the most recent successful tracer gas test, as stated in the August 4, 2004, letter response to Generic Letter 2003-01; or within the next 18 months if the time period since the most recent successful tracer gas test is greater than 6 years.

(b) The first performance of the periodic assessment of CRE habitability, Specification 6.17.c.(ii), shall be within 3 years, plus the 9-month allowance of SR 4.0.2, as measured from May 3, 2004; the date of the most recent successful tracer gas test, as stated in the August 4, 2004, letter response to Generic Letter 2003-01; or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.

(c) The first performance of the periodic measurement of CRE pressure, Specification 6.17.d, shall be within 18 months, plus the 138 days allowed by SR 4.0.2, as measured from May 30, 2007, the date of the most recent successful pressure measurement test, or within 138 days if not performed previously.

(30) Deleted

APPENDIX C

ADDITIONAL CONDITIONS

TO FACILITY OPERATING LICENSE

Deleted

Deleted

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Proposed Retyped Technical Specifications Pages
SQN Unit 1

3/4.7.5 ULTIMATE HEAT SINK

LIMITING CONDITION FOR OPERATION

3.7.5 The ultimate heat sink shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the average ERCW supply header water temperature > 81°F and ≤ 87°F, and any ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump is OPERABLE on that loop, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

b. With the average ERCW supply header water temperature ≥ 83°F and ≤ 87°F, and one ERCW supply strainer inoperable on one or more loops, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

c. With the UHS not within limits for reasons other than ACTION a or ACTION b, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying:

a. the UHS water level is ≥ 674 feet mean sea level USGS datum, and

b. the average ERCW supply header water temperature is:

1) ≤ 81°F with any ERCW loop aligned to support one pump per loop OPERABILITY and only one ERCW pump OPERABLE on that loop, or

2) < 83°F with one ERCW supply strainer and two ERCW pumps OPERABLE on that loop, or

3) ≤ 87°F with two ERCW supply strainers and two ERCW pumps OPERABLE per loop.

Proposed Retyped Technical Specifications Pages
SQN Unit 2

3/4.7.5 ULTIMATE HEAT SINK

LIMITING CONDITION FOR OPERATION

3.7.5 The ultimate heat sink shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the average ERCW supply header water temperature > 79°F and ≤ 87°F, and any ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump is OPERABLE on that loop, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

b. With the average ERCW supply header water temperature ≥ 83°F and ≤ 87°F, and one ERCW supply strainer inoperable on one or more loops, immediately declare the associated ERCW loop inoperable and comply with the ACTION requirements of Specification 3.7.4.

c. With the UHS not within limits for reasons other than ACTION a or ACTION b, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.5.1 The ultimate heat sink shall be determined OPERABLE at least once per 24 hours by verifying:

a. the UHS water level is ≥ 674 feet mean sea level USGS datum, and

b. the average ERCW supply header water temperature is:

1) ≤ 79°F with any ERCW loop aligned to support one pump per loop OPERABILITY and only one ERCW pump OPERABLE on that loop, or

2) < 83°F with only one ERCW supply strainer and two ERCW pumps OPERABLE on that loop, or

3) ≤ 87°F with two ERCW supply strainers and two ERCW pumps OPERABLE per loop.

ATTACHMENT 4

Proposed Retyped TS Bases Pages
(for information only)

Proposed Retyped TS Bases Pages
SQN Unit 1
(for information only)

3/4.7.3 COMPONENT COOLING WATER SYSTEM

The OPERABILITY of the component cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident analyses.

3/4.7.4 ESSENTIAL RAW COOLING WATER SYSTEM

The OPERABILITY of the essential raw cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident conditions within acceptable limits.

To meet the OPERABILITY requirements for ERCW loops, two ERCW loops are required to be OPERABLE to provide the required redundancy to ensure that the system functions as designed to remove post accident heat loads, assuming that the worst case single active failure occurs coincident with the loss of offsite power. Different sources refer to an ERCW loop or an ERCW train; for ERCW the term loop and train are interchangeable.

An ERCW loop is considered OPERABLE during MODES 1, 2, 3, and 4 when the associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety related function are OPERABLE and:

a. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board) and two ERCW supply strainers are OPERABLE per loop, or

b. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board), one ERCW supply strainer is inoperable, and the ERCW system aligned in accordance with Table B 3/4.7-2, or

c. Only one ERCW pump is OPERABLE per loop (fed from its associated shutdown board), two ERCW supply strainers are OPERABLE per loop, and the ERCW system aligned in accordance with Table B 3/4.7-1.

B 3/4.7 Plant Systems

B 3/4.7.5 Ultimate Heat Sink (UHS)

BASES

BACKGROUND

The UHS provides a heat sink for processing and operating heat from safety-related components during a transient or accident, as well as during normal operation and shutdown. This is done by utilizing the Essential Raw Cooling Water (ERCW) System and the Component Cooling System (CCS). The UHS has been defined as that complex of water sources, including necessary retaining structures (e.g., a river with its dam), and the canals or conduits connecting the sources with, but not including, the cooling water system intake structures as discussed in the UFSAR, Section 9.2.5 (Ref. 1).

The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident. Chickamauga Lake (Tennessee River system) qualifies as a single source. The basic performance requirements are that a 30-day supply of water be available, and that the design basis temperatures of safety-related equipment not be exceeded

APPLICABLE SAFETY ANALYSES

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation. SQN uses the UHS as the normal heat sink for condenser cooling via the Circulating Water System; so unit operation at full power is its maximum heat load. Its maximum post accident heat load occurs approximately 25 minutes after a design basis loss-of-coolant accident (LOCA). Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat.

The operating limits are based on conservative heat transfer analyses for the worst-case LOCA. References 1, 2, and 3 provides the details of the assumptions used in the analysis, which include worst-expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst-case single active failure . The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 4), which requires a 30-day supply of cooling water in the UHS

The UHS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ERCW to operate for at least 30 days following the design basis LOCA without the loss of net positive suction

BASES

LCO (continued)

head (NPSH), and without exceeding the maximum design temperature of the equipment served by the ERCW. To meet this condition, the UHS temperature should not exceed 87°F and the level should not fall below the 674 feet mean sea level during normal unit operation. When the ERCW System is in the alignment to support one pump per loop operation the UHS temperature should not exceed 81°F. When the ERCW System is in the alignment to support an ERCW supply strainer inoperable for maintenance, the UHS temperature should be less than 83°F. The alignment to support the one pump per loop OPERABILITY configuration, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-1. The alignment to support the operation with one ERCW supply strainer inoperable, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-2.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

APPLICABILITY

In MODES 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

The maximum allowed UHS temperature value is based on temperature limitations of the equipment that is relied upon for accident mitigation and safe shutdown of the unit and the configuration of the ERCW System. Measurement of this temperature is in accordance with NUREG/CR-3659 methodology which includes measurement uncertainties (Ref: 5).

With average water temperature of the UHS ≤ 87°F (when the ERCW System is aligned in its normal configuration), or < 83°F (when the ERCW System is in the alignment to support strainer maintenance), or ≤ 81°F (when the ERCW System is in the alignment to support one pump per loop operation), the associated design basis assumptions remain bounded for all accidents, transients, and shutdown. Long-term cooling capability is provided to the Emergency Core Cooling System (ECCS) and Emergency Diesel Generator loads.

a.

With the average ERCW supply header water temperature > 81°F the ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump on that loop is OPERABLE, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

ACTION a (continued)

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and the applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

b.

With the average ERCW supply header water temperature ≥ 83°F, the ERCW loop aligned for an inoperable ERCW supply strainer, and one ERCW supply strainer is inoperable on one or more loops, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and the applicable Action(s) of TS 3/4 7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

c.

If the water temperature of the UHS exceeds 87°F or the UHS water level is less than 674 feet mean sea level USGS datum, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within the following 30 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 4.7.5.1

This SR verifies that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident.

a.

This SR also verifies that adequate long-term (30 day) cooling can be maintained. The specified level ensures that sufficient reservoir volume exists at the initiation of a LBLOCA concurrent with loss of downstream dam to meet the short-term recovery. NPSH of the ERCW pumps is not challenged with loss of downstream dam. This SR verifies that the UHS water level is ≥ 674 feet mean sea level United States Geological Survey (USGS) datum. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

b.

This SR verifies that the average water temperature of the UHS is ≤ 87°F when the ERCW System is aligned in its normal configuration. In addition, this SR provides temperature limitations for alternate ERCW loop alignments.

When an ERCW loop is aligned in accordance with Table B 3/4.7-1 and only one ERCW pump is OPERABLE per loop, this SR verifies that the average water temperature of the UHS is ≤ 81°F. When an ERCW loop is aligned in accordance with Table B 3/4.7-2 and one ERCW supply strainer is inoperable, this SR verifies that the average water temperature of the UHS is < 83°F. These actions verify that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident when aligned in either the Table B 3/4.7-1 or Table B 3/4.7-2 alternate configuration. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

REFERENCES

1. UFSAR, Section 9.2.5, Ultimate Heat Sink
2. UFSAR, Section 6.2.1, Containment Functional Design
3. UFSAR, Section 9.2.2, Essential Raw Cooling Water (ERCW)
4. Regulatory Guide 1.27 R0, "Ultimate Heat Sink For Nuclear Power Plants," 1972
5. NUREG/CR-3659, "A Mathematical Model For Assessing The Uncertainties Of Instrumentation Measurements For Power And Flow Of PWR Reactors," February 1985.

Table B 3/4.7-1
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop A One Pump Operation

1. ERCW System supply header average water temperature is ≤ 81°F.

2. Unit 2 is in MODE 5 or 6, or defueled.

3. Place the ERCW System in the alignment to support Loop A one pump operation as follows:

   a. Isolate ERCW Flow to the following components;

      1) 2A-A Diesel Generator Heat Exchangers

      2) Unit 2 Containment Spray Heat Exchanger 2A

      3) Unit 2 TDAFW Pump from the "2A" ERCW Main Supply Header

      4) Lower Containment Vent Cooler 2A, Control Rod Drive Vent Cooler 2A, and Reactor Coolant Pump 2-1 Motor Cooler

      5) Lower Containment Vent Cooler 2C, Control Rod Drive Vent Cooler 2C, and Reactor Coolant Pump 2-3 Motor Cooler

      6) Upper Containment Vent Cooler 2A, and

      7) Upper Containment Vent Cooler 2C, and

      8) Incore Instrumentation Room Water Coolers 2A, and

   b. Place in service;

      1) A Train ERCW yard header crosstie

      2) A Train ERCW 16-inch Auxiliary Building header crosstie, and

      3) A Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie.

Table B 3/4.7-1 (continued)
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop B One Pump Operation

1. ERCW System supply header average water temperature is ≤ 81°F.

2. Unit 2 is in MODE 5, MODE 6, or defueled.

3. Place the ERCW System in the alignment to support Loop B one pump operation as follows:

   a. Isolate ERCW flow to the following components;

      1) 2B-B Diesel Generator Heat Exchangers

      2) Containment Spray Heat Exchanger 2B

      3) Unit 2 TDAFW Pump from the "2B" ERCW Main Supply Header

      4) Lower Containment Ventilation Cooler 2B, Control Rod Drive Vent Cooler 2B, and Reactor Coolant Pump 2-2 Motor Cooler

      5) Lower Containment Ventilation Coolers 2D, Control Rod Drive Vent Cooler 2D, and Reactor Coolant Pump 2-4 Motor Cooler

      6) Upper Containment Ventilation Coolers 2B

      7) Upper Containment Ventilation Coolers 2D

      8) Incore Instrumentation Room Water Coolers 2B

   b. Place in service;

      1) B Train ERCW yard header crosstie

      2) B Train ERCW 16-inch Auxiliary Building header crosstie

      3) B Train ERCW 6-inch Engineered Safety Features (ESF) header crossties.

   c. Isolate ERCW flow to the 1B Control Rod Drive Vent Cooler

TABLE B 3/4.7-2
MINIMUM REQUIREMENTS FOR ERCW
One ERCW Supply Strainer Inoperable

FEATURE	Condition
Average ERCW System supply header water temperature	< 83°F
ERCW Yard header crosstie (associated loop)	In service
ERCW 16-Inch Auxiliary Building header crossties	In service or isolated
ERCW 6-Inch ESF header crossties	In service or isolated

Proposed Retyped TS Bases Pages
SQN Unit 2
(for information only)

3/4.7.3 COMPONENT COOLING WATER SYSTEM

The OPERABILITY of the component cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident analyses.

3/4.7.4 ESSENTIAL RAW COOLING WATER SYSTEM

The OPERABILITY of the essential raw cooling water system ensures that sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions. The redundant cooling capacity of this system, assuming a single failure, is consistent with the assumptions used in the accident conditions within acceptable limits.

To meet the OPERABILITY requirements for ERCW loops, two ERCW loops are required to be OPERABLE to provide the required redundancy to ensure that the system functions as designed to remove post accident heat loads, assuming that the worst case single active failure occurs coincident with the loss of offsite power. Different sources refer to an ERCW loop or an ERCW train; for ERCW the term loop and train are interchangeable.

An ERCW loop is considered OPERABLE during MODES 1, 2, 3, and 4 when the associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety related function are OPERABLE and:

a. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board) and two ERCW supply strainers are OPERABLE per loop, or

b. At least two ERCW pumps are OPERABLE per loop (with one pump fed from each shutdown board), one ERCW supply strainer inoperable, and the ERCW system aligned in accordance with Table B 3/4.7-2, or

c. Only one ERCW pump is OPERABLE per loop (fed from its associated shutdown board), two ERCW supply strainers are OPERABLE per loop, and the ERCW system aligned in accordance with Table B 3/4.7-1.

B 3/4.7 Plant Systems

B 3/4.7.5 Ultimate Heat Sink (UHS)

BASES

BACKGROUND

The UHS provides a heat sink for processing and operating heat from safety-related components during a transient or accident, as well as during normal operation and shutdown. This is done by utilizing the Essential Raw Cooling Water (ERCW) System and the Component Cooling System (CCS). The UHS has been defined as that complex of water sources, including necessary retaining structures (e.g., a river with its dam), and the canals or conduits connecting the sources with, but not including, the cooling water system intake structures as discussed in the UFSAR, Section 9.2.5 (Ref. 1).

The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident. Chickamauga Lake (Tennessee River system) qualifies as a single source. The basic performance requirements are that a 30-day supply of water be available, and that the design basis temperatures of safety-related equipment not be exceeded

APPLICABLE SAFETY ANALYSES

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation. SQN uses the UHS as the normal heat sink for condenser cooling via the Circulating Water System; so unit operation at full power is its maximum heat load. Its maximum post accident heat load occurs approximately 25 minutes after a design basis loss-of-coolant accident (LOCA). Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat.

The operating limits are based on conservative heat transfer analyses for the worst-case LOCA. References 1, 2, and 3 provides the details of the assumptions used in the analysis, which include worst-expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst-case single active failure . The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 4), which requires a 30-day supply of cooling water in the UHS

The UHS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ERCW to operate for at least 30 days following the design basis LOCA without the loss of net positive suction

LCO (continued)

head (NPSH), and without exceeding the maximum design temperature of the equipment served by the ERCW. To meet this condition, the UHS temperature should not exceed 87°F and the level should not fall below the 674 feet mean sea level during normal unit operation. When the ERCW System is in the alignment to support one pump per loop operation the UHS temperature should not exceed 79°F. When the ERCW System is in the alignment to support an ERCW supply strainer inoperable for maintenance, the UHS temperature should be less than 83°F. The alignment to support the one pump per loop OPERABILITY configuration, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-1. The alignment to support the operation with one ERCW supply strainer inoperable, which maintains the ERCW System OPERABLE, is described in Table B 3/4.7-2.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

APPLICABILITY

In MODES 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

87°F is the maximum allowed UHS temperature value is based on temperature limitations of the equipment that is relied upon for accident mitigation and safe shutdown of the unit. Measurement of this temperature is in accordance with NUREG/CR-3659 methodology which includes measurement uncertainties (Ref: 5).

With average water temperature of the UHS ≤ 87°F(when the ERCW System is aligned in its normal configuration), or < 83°F (when the ERCW System is in the alignment to support supply strainer maintenance), or ≤ 79°F (when the ERCW System is in the alignment to support one pump per loop operation), the associated design basis assumptions remain bounded for all accidents, transients, and shutdown. Long-term cooling capability is provided to the Emergency Core Cooling System (ECCS) and Emergency Diesel Generator loads.

a.

With the average ERCW supply header water temperature > 79°F, the ERCW loop aligned to support one pump per loop OPERABILITY, and only one ERCW pump on that loop is OPERABLE, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

BASES

ACTION a (continued)

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

b.

With the average ERCW supply header water temperature ≥ 83°F, the ERCW loop aligned for an inoperable ERCW supply strainer, and one ERCW supply strainer is inoperable on one or more loops, the ERCW heat removal capability for that loop is less than that assumed in the accident analysis and the associated ERCW loop must be immediately declared inoperable.

In this Condition, any remaining OPERABLE ERCW loop is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure could result in a loss of the UHS function. Therefore, to ensure action is taken to restore the inoperable ERCW loop to an OPERABLE status, the affected ERCW loop is immediately declared inoperable and applicable ACTION(S) of TS 3/4.7.4, "Essential Raw Cooling Water System," entered. Action c is not required to be entered provided the average ERCW supply temperature is ≤ 87°F.

c.

If the water temperature of the UHS exceeds 87°F or the UHS water level is less than 674 feet mean sea level USGS datum, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within the following 30 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 4.7.5.1

This SR verifies that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident.

a.

This SR also verifies that adequate long-term (30 day) cooling can be maintained. The specified level ensures that sufficient reservoir volume exists at the initiation of a LBLOCA concurrent with loss of downstream dam to meet the short-term recovery. NPSH of the ERCW pumps is not challenged with loss of downstream dam. This SR verifies that the UHS water level is ≥ 674 feet mean sea level United States Geological Survey (USGS) datum. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

b.

This SR verifies that the average water temperature of the UHS is ≤ 87°F when the ERCW System is aligned in its normal configuration. In addition, this SR provides temperature limitations for alternate ERCW loop alignments.

When an ERCW loop is aligned in accordance with Table B 3/4.7-1 and only one ERCW pump is OPERABLE per loop this SR verifies that the average water temperature of the UHS is ≤ 79°F. When an ERCW loop is aligned in accordance with Table B 3/4.7-2 and one ERCW supply strainer is inoperable, this SR verifies that the average water temperature of the UHS is < 83°F. These actions verify that the ERCW is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident when aligned in either Table B 3/4.7-1 or Table B 3/4.7-2 alternate configuration. The 24-hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

REFERENCES

1. UFSAR, Section 9.2.5, Ultimate Heat Sink

2. UFSAR, Section 6.2.1, Containment Functional Design

3. UFSAR, Section 9.2.2, Essential Raw Cooling Water (ERCW)

4. Regulatory Guide 1.27 R0, "Ultimate Heat Sink For Nuclear Power Plants," 1972

5. NUREG/CR-3659, "A Mathematical Model For Assessing The Uncertainties Of Instrumentation Measurements For Power And Flow Of PWR Reactors," February 1985.

Table B 3/4.7-1
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop A One Pump Operation

1. ERCW System supply header average water temperature is ≤ 79°F.
2. Unit 1 is in MODE 5, MODE 6, or defueled.
3. Place the ERCW System in the alignment to support Loop A one pump operation as follows:
    a. Isolate ERCW flow to the following components;
        1) 1A-A Diesel Generator Heat Exchangers
        2) Containment Spray Heat Exchanger 1A
        3) Unit 1 TDAFW Pump from the "1A" ERCW Main Supply Header
        4) Lower Containment Ventilation Coolers 1A, Control Rod Drive Vent Cooler 1A, and Unit 1 Reactor Coolant Pump 1-1 Motor Cooler
        5) Lower Containment Ventilation Coolers 1C, Control Rod Drive Vent Cooler 1C and Unit 1 Reactor Coolant Pump 1-3 Motor Cooler
        6) Incore Instrumentation Room Water Coolers 1A
    b. Place in service;
        1) A Train ERCW yard header crosstie
        2) A Train ERCW 16-inch Auxiliary Building header crosstie
        3) A Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie

Table B 3/4.7-1 (continued)
MINIMUM REQUIREMENTS FOR ERCW
Prerequisite Actions to One Pump per Loop Operation

Loop B One Pump Operation

1. ERCW System supply header average water temperature is ≤ 79°F.

2. Unit 1 is in MODE 5, MODE 6, or defueled.

3. Place the ERCW System in the alignment to support Loop B one pump operation as follows:

    a. Isolate ERCW flow to the following components;

        1) 1B-B Diesel Generator Heat Exchangers

        2) Containment Spray Heat Exchanger 1B

        3) Unit 1 TDAFW Pump from the "1B" ERCW Main Supply Header

        4) Lower Containment Ventilation Coolers 1B, Control Rod Drive Vent Cooler 1B, and Unit 1 Reactor Coolant Pump 1-2 Motor Cooler

        5) Lower Containment Ventilation Coolers 1D, Control Rod Drive Vent Cooler 1D, and Unit 1 Reactor Coolant Pump 1-4 Motor Cooler

        6) Incore Instrumentation Room Water Coolers 1B

    b. Place in service;

        1) B Train ERCW yard header crosstie

        2) B Train ERCW 16-inch Auxiliary Building header crosstie

        3) B Train ERCW 6-inch Engineered Safety Features (ESF) header crosstie

TABLE B 3/4.7-2
MINIMUM REQUIREMENTS FOR ERCW
One ERCW Supply Strainer Inoperable

FEATURE	**Condition**
Average ERCW System supply header water temperature	< 83°F
ERCW Yard header crosstie (associated loop)	In service
ERCW 16-Inch Auxiliary Building header crossties	In service or isolated
ERCW 6-Inch ESF header crossties	In service or isolated