From: Rankin, Jennivine
Sent: Friday, April 10, 2020 8:55 AM
To: Vogtle PEmails
Subject: FW: RE: Vogtle 3&4 LAR Pre-Submittal Meeting Request
Attachments: LAR-20-004_PSM_Draft_NRC.pdf

SNC draft LAR 20-004 to support public meeting on 4/23.

From: Henderson, Ryan Donald <RDHENDER@SOUTHERNCO.COM>
Sent: Thursday, April 09, 2020 3:28 PM
To: Rankin, Jennivine <Jennivine.Rankin@nrc.gov>
Cc: Arafeh, Yasmeen N. <YNARAFEH@southernco.com>; Humphrey, Mark Phillips <MPHUMPHR@southernco.com>; Santos, Cayetano <Cayetano.Santos@nrc.gov>
Subject: [External_Sender] RE: Vogtle 3&4 LAR Pre-Submittal Meeting Request

Jennie,

See attached for the draft LAR in preparation for the Pre-Submittal Meeting on 4/23. Assuming the comments from the staff are manageable, we intend to submit the LAR by 4/30.

Thanks,

Ryan Henderson
Licensing
Office: 205-992-6426
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Hearing Identifier: Vogtle_COL_Docs_Public
Email Number: 555

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Subject: FW: RE: Vogtle 3&4 LAR Pre-Submittal Meeting Request
Sent Date: 4/10/2020 8:54:33 AM
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From: Rankin, Jennivine

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Southern Nuclear Operating Company

ND-20-XXXX

Enclosure 1

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Request for License Amendment:

Core Makeup Tank Boron Concentration Requirements (LAR-20-004)

(This Enclosure consists of 17 pages, including this cover page)

Table of Contents

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC, or the “Licensee”) hereby requests an amendment to Combined License (COL) Nos. NPF-91 and NPF-92 for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, respectively.

1. SUMMARY DESCRIPTION

The requested amendment proposes changes to the upper limit of the Core Makeup Tank (CMT) boron concentration Technical Specification (TS) Surveillance Requirement (SR), the mass of trisodium phosphate (TSP) required by TS Limiting Condition for Operation (LCO) and associated SR, and the frequency of performance of the CMT boron concentration TS SR.

The requested amendment proposes changes to the licensing basis documents in the form of departures from the plant-specific Design Control Document (DCD) Tier 2 information (as incorporated into the UFSAR), and involves changes to the plant-specific TS (COL Appendix A). This enclosure requests approval of the license amendment necessary to implement the changes.

2. DETAILED DESCRIPTION

As described in the UFSAR, the Passive Core Cooling System (PXS) performs the primary function to provide emergency core cooling following postulated design basis events. PXS is a safety-related system and consists of two CMTs, two accumulators, the in-containment refueling water storage tank (IRWST), the passive residual heat removal heat exchanger, pH adjustment baskets, and associated piping, valves, instrumentation, and other related equipment.

The CMTs provide Reactor Coolant System (RCS) makeup and boration during events not involving loss of coolant when the normal makeup system is unavailable or insufficient. The two CMTs are located inside the containment at an elevation slightly above the reactor coolant loops. During normal operation, the CMTs are completely full of cold, borated water. The boration capability of these tanks provides adequate core shutdown margin following a steam line break.

The CMTs are connected to the RCS through a discharge injection line and an inlet pressure balance line connected to a cold leg. The discharge line is blocked by two normally closed, parallel air-operated isolation valves that open on a loss of air pressure or electrical power, or on control signal actuation.

The pressure balance line from the cold leg is normally open to maintain the CMTs at RCS pressure, which prevents water hammer upon initiation of CMT injection.

The cold leg pressure balance line is connected to the top of the cold leg and is routed continuously upward to the high point near the CMT inlet. The normal water temperature in this line will be hotter than the discharge line.

The outlet line from the bottom of each CMT provides an injection path to one of the two direct vessel injection lines, which are connected to the reactor vessel downcomer annulus. Upon receipt of a safeguards actuation signal, the two parallel valves in each discharge line open to align the associated CMT to the RCS.

There are two operating processes for the CMTs, steam-compensated injection and water recirculation. During steam-compensated injection, steam is supplied to the CMTs to displace the water that is injected into the RCS. This steam is provided to the CMTs through the cold leg pressure balance line. The cold leg line only has steam flow if the cold legs are voided.

During water recirculation, hot water from the cold leg enters the CMTs, and the cold water in the tank is discharged to the RCS. This results in RCS boration and a net increase in RCS mass.

The operating process for the CMTs depends on conditions in the RCS, primarily voiding in the cold leg. When the cold leg is full of water, the cold leg pressure balance line remains full of water and the injection occurs via water recirculation. If RCS inventory decreases sufficiently to cause cold leg voiding, then steam flows through the cold leg balance lines to the CMTs.

Also, the CMTs provide passive safety injection during loss of coolant accidents at a relatively high flow for a longer duration than the accumulators. During a loss of coolant accident, they provide injection rates commensurate with the severity of the loss of coolant accident.

For a larger loss of coolant accident, and after the automatic depressurization system has been actuated, the cold legs are expected to be voided. In this situation, the CMTs operate at their maximum injection rate with steam entering the CMTs through the cold leg pressure balance lines.

For smaller loss of coolant accidents the CMTs initially operate in the water recirculation mode since the cold legs are water filled. During this water recirculation, the CMTs remain full, but the cold, borated water is purged with hot, less borated cold leg water. The water recirculation provides RCS makeup and also effectively borates the RCS. As the accident progresses, when the cold legs void, the CMTs switch to the steam displacement mode which provides higher flow rates.

Connections are provided for remotely adjusting the boron concentration of the borated water in each CMT during normal plant operation, as required. Makeup water for the CMT is provided by the Chemical and Volume Control System (CVS). Samples from the CMTs are taken periodically to check boron concentration.

Control of the pH in the containment sump water post-accident is achieved through the use of pH adjustment baskets containing granulated TSP. The baskets are located below the minimum post-accident floodup level, and chemical addition is initiated passively when the water reaches the baskets. The baskets are placed at least a foot above the floor to reduce the chance that water spills in containment will dissolve the TSP.

The TSP is designed to maintain the pH of the containment sump water in a range from 7.0 to 9.5. The chemistry reduces radiolytic formation of elemental iodine in the containment sump, consequently reducing the aqueous production of organic iodine, and ultimately reducing the airborne iodine in containment and offsite doses.

The chemical addition also helps to reduce the potential for stress corrosion cracking of stainless steel components in a post floodup condition, where chlorides can leach out of the containment concrete and potentially affect these components during a long-term floodup event.

LCO 3.6.8, pH Adjustment, requires the pH adjustment baskets contain ≥ 25,920 lbs of TSP. SRs exist to verify this and to verify that a sample of the TSP in the pH adjustment baskets provides adequate pH adjustment of the post-accident water.

Two sample lines, one in the upper head and the other in the lower head, are provided for sampling the solution in the core makeup tank. A fill connection is provided for core makeup tank make up water from the chemical and volume control system.

Prior to the collection of liquid samples either in the laboratory or in the grab sampling unit, the lines are purged with source liquid to provide representative samples. The purging flow returns to the effluent holdup tank of the liquid radwaste system.

LCO 3.5.2, CMTs – Operating, requires both CMTs to be operable. One of the SRs exists to verify the boron concentration in each CMT is ≥ 3400 ppm and ≤ 3700 ppm. LCO 3.5.3, CMTs – Shutdown, Reactor Coolant System (RCS) Intact, requires one CMT to be operable, with the same SR applicable to the required CMT. The SR Frequency is 7 days.

Because the CMT is in open communication with the RCS via the balance line, whenever the surveillance is performed, the volume removed is replaced by water via the balance line. The RCS water is typically at a lower boron concentration; therefore, each sample dilutes the CMT.

Depending on the starting boron concentration, there is the possibility that this sampling activity could cause the CMT boron concentration to fall to a point which would require borated makeup. Borated makeup at power is not desirable because it forces the displaced water back into the RCS via the balance line. This causes additional thermal transients on the balance line and also causes the potential for a reactivity excursion in the reactor if the boron concentration of the RCS is affected.

The proposed solution to mitigate these issues is to raise the upper boron concentration limit permitted for the CMT, extend the frequency of the CMT boron concentration surveillance, and to increase the mass of TSP required for the pH adjustment baskets.

<u>Licensing Basis Change Descriptions:</u>

<u>COL Appendix A, Technical Specifications Changes</u>

- SR 3.5.2.4 maximum boron concentration is revised from 3700 ppm to 4500 ppm
- SR 3.5.2.4 frequency is revised from 7 days to 31 days
- LCO 3.6.8 and SR 3.6.8.1 required TSP is revised from ≥ 25,920 lbs to ≥ 26,460 lbs

<u>UFSAR Changes</u>

- UFSAR Subsection 6.3.2.2.4 required TSP is revised from at least 25,920 pounds to at least 26,460 pounds

- UFSAR Subsection 9.3.6.2.6 upper boron concentration of the CVS ability for borated makeup is revised to reflect that the 4375 ppm value is a nominal value

Conforming changes to the Technical Specification Bases are identified for the Technical Specifications changes. The changes will be made under the Technical Specification Bases Control Program upon approval of the amendment and markups are provided for information only with this application.

3. TECHNICAL EVALUATION

Calculations were performed to provide validation that raising the upper limit of the CMT boron concentration to 4500 ppm resulting in the maximum amount of post-accident boron concentration of 3050 ppm is acceptable with respect to long term containment pH and boron concentration. The pH adjustment calculations were revised to use a more conservative maximum CMT water volume, which results in the maximum post-accident containment water volume being revised from 867,308 gallons to 867,830 gallons. The calculations resulted in a change to the minimum measured TSP volume from 480 ft^3 to 490 ft^3 to provide proper buffering of post-accident water.

The containment flood-up water sources and the available TSP have been analyzed to calculate a post-loss of coolant accident (LOCA) pH value. The goal of the calculation is to confirm that the pH is above 7.0 within 8 hours of an event. The results of the calculation yield a minimum pH (utilizing the minimum required TSP) of 7.23 when CMT boron concentration is 4500 ppm, which corresponds to a containment flood-up boron concentration of 3050 ppm.

Post-accident boron concentration calculations confirm two things: that there is adequate shutdown margin and that the maximum boron concentration for the Reactor Vessel, the Containment, and the IRWST does not cause boron to come out of solution. Boron does not come out of solution due to high concentrations (i.e. will not go above the solubility limit). The increase in maximum CMT boron concentration from 3700 ppm to 4500 ppm decreases the amount of margin with respect to solubility limits. The reduction in margin is a minimal percentage. The margin to the solubility limit (35,000 ppm) for containment in the evaluation of maximum reactor vessel boron concentration went from 29,387 ppm to 29,339 ppm and for the evaluation of maximum IRWST concentration it went from 26,043 ppm to 26,007 ppm. Therefore, the increase in the maximum CMT boron concentration with this magnitude has little effect on the minimum overall margin to the solubility limit due to the significant margin which exists.

The equipment qualification program previously evaluated 4375 ppm for the CVS and equipment that could be subjected to the 4375 ppm of the CVS (including the CMTs). An increase to 4500 ppm does not significantly impact the conclusions of the existing analyses. The increase in concentration represents a 0.01 weight percent increase, and a 0.01 pH decrease (making the pH more acidic). These differences are negligible for the materials subjected to the increase in boron concentration.

The non-LOCA safety analyses typically model minimum CMT boron concentration for applications considering minimum safeguards and maximum CMT boron concentration for applications considering maximum safeguards. Since the time frame of interest for applications considering maximum safeguards is after a reactor trip, these analyses are not sensitive to increases in the maximum CMT boron concentration. For cases where nominal safeguards are modeled, the increase in the CMT boron concentration would be a benefit or have no impact. Therefore, the proposed change is acceptable with respect to the non-LOCA safety analyses.

COL Appendix A, Technical Specification 3.5.2 is proposed to be revised to identify the maximum CMT boron concentration of 4500 ppm. The maximum boron concentration allowed within each CMT at any time shall be 4500 ppm to prevent overboration.

The boron concentration inside the CMTs is required to be maintained to support safety analysis initial conditions. To confirm that the CMTs have adequate boron concentration, they are periodically sampled based on the Technical Specification 3.5.2 Surveillance Requirements. Leakage from the CMT can lead to RCS water (at a lower boron concentration) entering the CMT and reducing the total available boron in the CMT. If leakage is occurring, sampling will identify the reduced boron concentration.

Due to the arrangement of the CMTs (see UFSAR Figure 6.3-1 Sheet 1), the act of sampling the CMTs also creates in-leakage from the RCS to the tank and reduces the boron concentration. To minimize the effect of sampling on CMT boron concentration, a longer time between sampling is proposed. This proposed change is to reduce the frequency from 7 days to 31 days which is consistent with the sampling frequency of the Accumulators and the In-Containment Refueling Water Storage Tank (IRWST). This change in sampling frequency is acceptable as it can be demonstrated that at low, undetectable leakage rates, the boron concentration in the CMT can continue to meet the minimum 3400 ppm requirement for 31 days.

Boron dilution predictions have been performed to evaluate the time the CMT average boron concentration will reach 3400 ppm for different leak rates with an initial nominal CMT boron concentration of approximately 4375 ppm and the conservative assumption that the RCS water coming into the CMT when the leak exists is pure water (i.e., RCS water diluted to 0 ppm boron). This is conservative because a realistic RCS boron concentration is approximately 500 ppm and would therefore result in less dilution of the CMT boron concentration due to in-leakage. At a leakage rate of 0.125 gpm, the CMT average boron concentration remains at or above 3400 ppm for approximately 23 days. At lower leakage rates, such as 0.062 gpm, the CMT average boron concentration remains at or above 3400 ppm for approximately 46 days. At a leakage rate of approximately 0.1 gpm, the CMT average boron concentration will remain at or above 3400 ppm for 29 days.

One justification for reducing sample frequency is that there are other indicators that can identify RCS leakage into the CMT. An additional method to detect in-leakage from the RCS to the CMTs is to monitor the CMT temperature at the top of the tank since any leakage into the CMT results in water being pulled into the top of the tank through the normally open balance line. There are two non-safety-related (Safety Class E) thermowell mounted temperature elements at the top of each CMT near the inlet nozzle which will alarm if the temperature exceeds the setpoint of 107.5°F (this setpoint plus uncertainty is the 120°F CMT top high temperature alarm which has indication in the Main Control Room used for SR 3.5.2.1). There are CMT leakage levels that are detectable, as demonstrated by the time period it takes for the high temperature alarm to be reached from the steady state CMT temperature due to in-leakage, and therefore can indicate a potential reduction in the CMT boron concentration before the surveillance frequency of 31 days if these higher leakage rates are occurring.

An analysis has been performed to evaluate small in-flow which would be indicative of leakage from within the CMT. A range of leakage rates were evaluated to determine a detectable level of leakage by the rate of the change in CMT temperature. A Computational Fluid Dynamics (CFD) model, originally developed to evaluate flow out of the CMT inlet when makeup was added was modified to evaluate a small leak causing an in-flow of water into the CMT from the balance line. A leakage rate of 0.125 gpm was analyzed to demonstrate how rapidly the temperature of the tank increases to the alarm setpoint at the CMT temperature elements at the top of the tank. These sensors are located on either side of the inlet nozzle and approximately 20 inches over the center line of the tank and 5 inches down. At a leakage rate of 0.125 gpm, this analysis indicates the temperature increase from 100°F to 107.5°F occurs within approximately 3 hours. For a leakage rate of 0.25 gpm, a temperature increase from 100°F to 120°F occurs within approximately 4 hours.

In order to address uncertainties in the CFD modeling, several conservatisms were applied to the CFD results as transient time multipliers. These applied conservatisms increase the time it takes the in-leakage to increase the CMT temperature. The expected CMT temperature change will likely be greater than the temperature change from 100°F to 107.5°F that was modelled; however, this has been addressed by the conservatisms applied to the CFD results. The CMT temperatures used in the modeling is representative of Mode 1, steady state conditions; however, in Modes 2 and 3 the CMT temperature will experience similar temperature increase due to in-leakage. During Modes 4 and 5, the lower pressure of the RCS will limit the potential for leakage.

Based on the CFD modeling with additional conservatisms, it is predicted that at leakage rates as low as approximately 0.1 gpm, the alarm response to the top CMT temperature would occur within 20 days, and therefore the CMT top temperature would detect leakages of this flow rate and higher within a surveillance frequency of 31 days. At a leakage rate of approximately 0.1 gpm, and performing a boron dilution analysis starting at a CMT boron concentration of 4375 ppm and RCS concentration of 0 ppm, the CMT remains above 3400 ppm for approximately 28 days and therefore the CMT temperature alarm would indicate the leakage in advance of the CMT concentration dropping below 3400 ppm. At higher leakage rates, the high temperature alarm will be reached much sooner. For example, at a leakage rate of 0.2 gpm the leakage would be indicated by 6 days and per the boron dilution analysis, the CMT boron concentration reaches 3400 ppm at approximately 14 days. At a leakage rate of 0.125 gpm, the leakage would be indicated by approximately 14 days and, the CMT boron concentration reaches 3400 ppm at approximately 23 days. These cases demonstrate there is margin between the time that the CMT high temperature indicates leakage and the CMT boron concentration is reduced to 3400 ppm.

By comparison of the calculated allowable leakage time from the boron dilution analysis cases and the time calculated by the CFD model with conservatisms to detect the CMT leakage as indicated by reaching the CMT top temperature alarm, CMT sampling could be conducted at a frequency of 42 days and the CMT boron concentration would remain at or above 3400 ppm.

Since the sampled boron concentration is expected to drop over the fuel cycle, either due to sampling itself or due to very small leaks in the CMT, the starting concentration may not always be as high as the 4375 ppm initial concentration used in the boron dilution analysis cases. Based on the predictions for identifiable leakage, the starting CMT concentration could be as low as 4184 ppm boron concentration, conservatively assuming 0 ppm RCS boron concentration in-leakage, and still ensure that unacceptable leakage is identified prior to the CMT violating the 3400 ppm boron concentration limit with a 31 day sampling frequency.

Therefore, the CMT top high temperature alarm can indicate to the operators that there may be in-leakage and to initiate by procedure steps to identify if the CMT boron concentration remains within the required limits. If the temperature or boron concentration is outside acceptable limits, TS 3.5.2 Required Action B.1 or C.1 would be performed to restore the temperature and boron concentration in the affected CMT(s).

Therefore, a sampling frequency of 31 days will adequately demonstrate that the CMT boron concentration has been maintained within the required limits. Leakage at a rate which could lead to a boron concentration less than 3400 ppm within 31 days will be indicated by the CMT high temperature alarm.

COL Appendix A, Technical Specification 3.5.2, is proposed to revise the frequency of surveillance of the CMT boron concentration to 31 days. The 31 day verification frequency of the boron concentration is adequate to identify changes which could occur from mechanisms such as in-leakage considering the provisions for monitoring temperature of the inlet line and top of the CMT. Additionally, the top of the CMT has control room indication and an alarm on increased temperature, which would be indicative of in-leakage.

UFSAR Subsection 9.3.6.2.6 states that borated makeup can be varied from 0 to 4375 ppm (2.5 weight present) by taking suction from both the boric acid storage tank and the demineralized water tank. This section is revised to clarify that 4375 ppm is a nominal value. The maximum value is not added here since the maximum is provided as margin to the nominal value and not intended to be the normal operating concentration.

The total containment boron concentration is derived by calculating the total boron mass concentration provided by various systems and components and then dividing this value by the mass of the water. The TSP concentration required to obtain a pH of 7.0 is derived using the boron concentration plus margin for other acids. The required TSP value is then calculated using the TSP concentration and the total containment water volume. As a result, increasing the maximum boron concentration results in a TSP value of 26,460 lbs. Therefore, COL Appendix A, Technical Specification 3.6.8 is proposed to be revised to increase the TSP value from 25,920 lbs to 26,460 lbs. This value is consistent with the minimum effective TSP required by analysis to bring the post-accident containment flood-up water to a pH of ≥ 7.0 in the required time frame. The function of the PXS and containment pH control is not adversely impacted. The Applicable MODES and Actions are not changed.

This required TSP mass value supports the design basis accident (DBA) releases of iodine into containment such that the pH of the containment sump is adjusted to enhance the retention of the iodine.

A TSP volume of 490 ft^3 corresponds to the TSP mass value of 26,460 lbs. The initial loading value for the TSP volume of 560 ft^3 contains an additional 14% margin, which was previously 15%. This initial loading TSP volume corresponds to a TSP value of 30,240 lbs, which also includes the 14% margin. This total TSP mass value (TSP mass + margin) accounts for degradation of the TSP during normal operation. The 1% reduction in margin over the original margin continues to satisfy the minimum pH requirement, even with an allowance for degradation of the TSP, and therefore is acceptable from a degradation standpoint. The TSP assumed density is not changed.

Associated with Surveillance Requirement 3.6.8.2 is a revision of the testing sample size from 2.14 grams at 480 ft^3 and 2.41 grams at 560 ft^3 to 2.19 grams at 490 ft^3 and 2.49 grams at 560 ft^3. While the revised volume of 490 ft^3 corresponds to 26,460 lbs when accounting for other acid sources, beyond boron, that buildup over time post-accident, this test is simplified and does not include the other acids produced post-accident. When only considering boron acid sources in the test, the minimum required TSP at a volume of 490 ft^3 is 15,829 lbs. Converting this value to grams and dividing by the maximum post-accident water volume of 867,830 gallons (converted into liters of water) yields a sample size of 2.19 grams TSP/liter water. This TSP sample size can be used for any TSP volume that is greater than or equal to the associated TS minimum TSP weight. However, a larger TSP sample size can be used if the TSP volume is verified to be larger than 490 ft^3 to allow the test to credit extra TSP margin compensating for any degradation that may have occurred. Therefore, the larger sample size allows for interpolation. Since a TSP volume of 560 ft^3 is approximately 14% greater than 490 ft^3, 15,829 lbs is increased by 14% to obtain 18,045 lbs. Using the same method for calculating the sample size as before yields a sample size of 2.49 grams TSP/liter water for a volume of 560 ft^3. Both of these sample sizes are above the TSP concentration curve for a pH of 7.0 at a boron concentration of 3050 ppm, confirming the TSP (and associated sample size) is conservative relative to the pH requirement.

The surveillance frequency of 24 months for both SR 3.6.8.1 and 3.6.8.2 is not changed.

UFSAR Subsection 6.3.2.2.4 is also revised to identify the revised TSP value of 26,460 lbs for the total weight of TSP contained in the pH adjustment baskets. This change does not adversely impact the ability to control the pH of the water in the containment sump and does not change the physical design of the baskets. The change to the TSP value does not affect how the TSP mixes with the containment water or conditions of extended plant operation following a postulated accident. The dissolution time of the TSP of 3 hours is not impacted by this activity as the chemical makeup of the TSP is not changed. Additionally, the pH requirements are not changed. The function of the PXS to control containment pH is not adversely impacted.

Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) No. 2.2.03.08d inspects the pH adjustment baskets and confirms the total calculated volume of the baskets is ≥ 560 ft^3. The ITAAC does not identify the amount of TSP needed for buffering the containment water following a postulated accident. This ITAAC is not adversely impacted as the physical baskets used to distribute the TSP are not changed. Additionally, the physical dimensions and the location of the baskets are not changed. Safety analyses as described in UFSAR Chapters 6 and 15 are not adversely impacted as the containment pH control is assumed to be maintained at the required pH of ≥ 7.0 following a design basis accident in accordance with UFSAR Subsection 6.3.2.1.4 and as described in UFSAR Subsection 15.6.5.3.1.3.

<u>Change Summary</u>

The proposed changes do not affect any function or feature's ability to be used for the prevention and mitigation of accidents. No system, structure, or component (SSC) function is changed. The proposed changes do not involve nor interface with any SSC accident initiator or initiating sequence of events related to the accidents evaluated in the plant-specific Design Control Document (DCD) or UFSAR. The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses. No system or design function or equipment qualification is negatively affected by the proposed changes. The changes do not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures. The proposed changes do not revise any aspects of the plant that could have any adverse effect on safety and security, including the site emergency plan.

4. REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 52, Appendix D, Section VIII.B.5.a allows an applicant or licensee who references this appendix to depart from Tier 2 information, without prior NRC approval, unless the proposed departure involves a change to or departure from Tier 1 information, Tier 2* information, or the Technical Specifications, or requires a license amendment under paragraphs B.5.b or B.5.c of the section. The proposed change to plant-specific Tier 2 information involves a change to the Technical Specifications (COL Appendix A). Therefore, NRC approval is required prior to making the change to Tier 2 information.

10 CFR 50.36, "Technical specifications," establishes the need to have Technical Specifications; including limiting conditions for operation (LCOs) and surveillance requirements (SRs). The Core Makeup Tanks (CMTs) and the trisodium phosphate (TSP) provided for pH adjustment satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii). The proposed changes have been analyzed to demonstrate that each continues to provide adequate LCOs or SRs, as applicable, for safe operation of the facility. Therefore, the proposed changes comply with the requirements of 10 CFR 50.36.

10 CFR Part 50, Appendix A General Design Criterion (GDC) 4, "Environmental and dynamic effects design bases," requires, in part, that structures, systems, and components important to safety be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. The proposed changes do not affect the conclusion that SSCs important to safety are designed to accommodate the effects of and are compatible with the environmental conditions associated normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant-accidents. The evaluation performed for the proposed changes demonstrate that the difference in pH that may

result are considered to be covered by the existing environmental qualification of applicable components. Therefore, the proposed changes comply with the requirements of GDC 4.

10 CFR Part 50, Appendix A GDC 14, “Reactor coolant pressure boundary,” requires that the reactor coolant pressure boundary shall be designed, fabricated, erected, and tests so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. The CMT balance line is designed for the movement of water resulting from routine sampling of the CMT or makeup to the CMT. The pH adjustment baskets provide adequate TSP to ensure that containment flooding water is buffered to prevent corrosion during long term floodup conditions. Therefore, the proposed changes comply with the requirements of GDC 14.

10 CFR Part 50, Appendix A GDC 15, “Reactor coolant system design,” requires that the reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during normal operation, including anticipated operational occurrences. The CMT balance line is designed for the movement of water resulting from routine sampling of the CMT or makeup to the CMT. Therefore, the proposed changes comply with the requirement of GDC 15.

10 CFR Part 50, Appendix A GDC 26, “Reactivity control system redundancy and capability,” requires, in part, that two independent reactivity control systems of different design principles. The second reactivity control system shall be capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure that the acceptable fuel design limits are not exceeded. The second reactivity control system is chemical shim (boric acid). The proposed change to the CMT upper boron concentration limit does not impact the ability of this system to provide this function since the analyses typically use the lower limit. The proposed change to the CMT boron concentration surveillance frequency provides timely detection of dilution of the CMT to verify operability of the tanks. Therefore, the proposed changes comply with the requirement of GDC 26.

10 CFR Part 50, Appendix A GDC 27, “Combined reactivity control systems capability,” requires that the reactivity control systems be designed to have a combined capability, in conjunction with poison addition by the emergency core cooling system, of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained. The proposed changes do not affect the means of making and holding the core subcritical under anticipated conditions and with appropriate margin for contingencies. Shutdown margin is not affected. Therefore, the proposed changes comply with the requirement of GDC 27.

10 CFR Part 50, Appendix A GDC 29, “Protection against anticipated operational occurrences,” requires that the protection and reactivity control systems be designed to assure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences. The proposed changes to the CMTs do not change the tank’s responses to events. Therefore, the proposed changes comply with the requirement of GDC 29.

10 CFR Part 50, Appendix A GDC 34, "Residual heat removal," requires that a system to remove residual heat be provided. The system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded. The proposed changes to the CMTs do not change the tank's responses to events. Therefore, the proposed changes comply with the requirement of GDC 34.

10 CFR Part 50, Appendix A GDC 35, "Emergency core cooling," requires that a system to provide abundant emergency core cooling whose safety function is to transfer heat from the reactor core following any loss of reactor coolant at a rate such that fuel and clad damage that could interfere with continued effective core cooling is prevented and clad metal-water reaction is limited to negligible amounts. The proposed changes to the CMTs do not change the tank's responses to events. Therefore, the proposed changes comply with the requirement of GDC 35.

10 CFR Part 50, Appendix A GDC 37, "Testing of emergency core cooling system," requires, in part, that the emergency core cooling system be designed to permit appropriate periodic functional testing to assure the operability of the system as a whole. The testing of the CMT boron concentration at the proposed frequency is sufficient to assure the operability of the system. Therefore, the proposed changes comply with the requirement of GDC 37.

10 CFR Part 50, Appendix A GDC 41, "Containment atmosphere cleanup," requires that systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained. The pH adjustment baskets and mass of TSP provided is sufficient to support the natural removal processes within containment. Therefore, the proposed changes comply with the requirement of GDC 41.

4.2 Precedent

No precedent is identified.

4.3 Significant Hazards Consideration Determination

The requested amendment proposes changes to the upper limit of the Core Makeup Tank (CMT) boron concentration Technical Specification (TS) Surveillance Requirement (SR), the mass of trisodium phosphate (TSP) required by TS Limiting Condition for Operation (LCO) and associated SR, and the frequency of performance of the CMT boron concentration TS SR.

An evaluation to determine whether a significant hazards consideration is involved with the proposed amendment was completed by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

4.3.1 Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed changes revise the TS SR of the CMT boron concentration upper limit, the frequency of the TS SR of the CMT boron concentration upper limit, and the TS and SR of the mass of TSP in the pH adjustment baskets. The pH adjustment baskets are not initiators of an accident previously evaluated. Inadvertent operation of the CMT during power operations is evaluated in Chapter 15. However, the analysis of this event utilizes the lower boron concentration limit; therefore, the increase to the upper boron concentration limit doesn't impact this analysis. The change to the frequency of the surveillance doesn't change the probability of falling below the lower boron concentration limit because slow leaks can be detected within the new surveillance frequency and fast leaks can be detected with the CMT top temperature alarm. Therefore, the consequences of an accident previously evaluated is not impacted because the parameters credited by the safety analysis remain within limits in support of meeting requirements.

Post-accident boron concentration calculations confirm that there is adequate shutdown margin and that the maximum boron concentration of the various water sources does not cause boron to come out of solution. The equipment qualification program considers the increase and finds the differences are negligible for the materials subjected to the increase in boron concentration. The non-loss-of-coolant-accident (LOCA) safety analyses typically model minimum CMT boron concentration considering minimum safeguards and maximum boron concentration for applications considering maximum safeguards. Since the time frame of interest for applications considering maximum safeguards is after a reactor trip, these analyses are not sensitive to increases in the maximum CMT boron concentration. For cases where nominal safeguards are modeled, the increase in the CMT boron concentration would be a benefit or have no impact.

The changes to the amount of TSP required is sufficient to buffer post-accident pH in the short-term and long-term to prevent stress corrosion cracking and help with iodine retention in solution within containment in accordance with analysis assumptions used in dose analysis.

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

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

Response: No.

The proposed changes do not change the design function of the CMTs or the pH adjustment baskets. These proposed changes do not introduce any new equipment or components that would result in a new failure mode, malfunction or sequence of events that could adversely affect safety-related or non-safety-related equipment. This activity will not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

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

4.3.3 Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

The change to the margin provided for initial loading of the pH adjustment baskets from 15% to 14% continues to satisfy the minimum pH requirement, even with allowance for degradation of the TSP. Post-accident boron concentration calculations confirm that there is adequate shutdown margin and that the maximum boron concentration of the various water sources does not cause boron to come out of solution as a result of the revision to the CMT boron concentration. The non-loss-of-coolant-accident (LOCA) safety analyses typically model minimum CMT boron concentration considering minimum safeguards and maximum boron concentration for applications considering maximum safeguards. Since the time frame of interest for applications considering maximum safeguards is after a reactor trip, these analyses are not sensitive to increases in the maximum CMT boron concentration. For cases where nominal safeguards are modeled, the increase in the CMT boron concentration would be a benefit or have no impact. The change to the frequency of boron concentration surveillance doesn’t change the validation of the CMTs to support safety analysis initial conditions. No safety analysis or design basis acceptance limit/criterion is challenged or exceeded by the requested change, thus no margin of safety is reduced.

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

4.4 Conclusions

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

5. ENVIRONMENTAL CONSIDERATIONS

The requested amendment proposes changes to the upper limit of the Core Makeup Tank (CMT) boron concentration Technical Specification (TS) Surveillance Requirement (SR), the mass of trisodium phosphate (TSP) required by TS Limiting Condition for Operation (LCO) and associated SR, and the frequency of performance of the CMT boron concentration TS SR.

(i) *There is no significant hazards consideration.*

As documented in Section 4.3, Significant Hazards Consideration Determination, of this license amendment request, an evaluation was completed to determine whether a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment." The Significant Hazards Consideration Determination determined that (1) the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) the proposed amendment does not create the possibility of a new or different kind of accident form any accident previously evaluated; and (3) the proposed amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded 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.

(ii) *There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

The requested amendment proposes changes to the upper limit of the Core Makeup Tank (CMT) boron concentration Technical Specification (TS) Surveillance Requirement (SR), the mass of trisodium phosphate (TSP) required by TS Limiting Condition for Operation (LCO) and associated SR, and the frequency of performance of the CMT boron concentration TS SR. The proposed changes are unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents) or affect any plant radiological or non-radiological effluent release quantities. Furthermore, the proposed changes do not affect any effluent release path or diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation. Therefore, it is concluded that the proposed amendment does not involve a significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

(iii) *There is no significant increase in individual or cumulative occupational radiation exposure.*

The requested amendment proposes changes to the upper limit of the Core Makeup Tank (CMT) boron concentration Technical Specification (TS) Surveillance Requirement (SR), the mass of trisodium phosphate (TSP) required by TS Limiting Condition for Operation (LCO) and associated SR, and the frequency of performance of the CMT boron concentration TS SR. The proposed changes in the requested amendment do not affect or alter any walls, floors, or other structures. Plant radiation zones and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above review of the proposed amendment, it has been determined that anticipated construction and operational effects of the proposed amendment do 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 criteria 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.

6. REFRENCES

None.

Southern Nuclear Operating Company

ND-20-XXXX

Enclosure 2

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Proposed Changes to Licensing Basis Documents
(LAR-20-004)

Insertions Denoted by Blue Underline and Deletions by Red Strikethrough
Omitted text is identified by three asterisks (* * *)

(This Enclosure consists of 2 pages, including this cover page)

Revise UFSAR Subsection 6.3.2.2.4, pH Adjustment Baskets, as shown below:

[* * *]

The total weight of TSP contained in the baskets is at least ~~25,920~~ 26,460 pounds. [* * *]

Revise UFSAR Subsection 9.3.6.2.6, Borated Makeup, as shown below:

The makeup pumps are used to provide makeup at the proper boron concentration to the passive core cooling system accumulators, core makeup tanks, in-containment refueling water storage tank, and to the spent fuel pool. Makeup to these locations is at boric acid concentration as required, which can be varied from 0 to 4375 (nominal) parts per million (2.5 weight percent). A mixture of 2.5 weight percent boric acid and demineralized water is provided by taking suction from both the boric acid storage tank and the demineralized water tank.

Revise LCO 3.5.2, CMTs – Operating, Surveillance Requirement (SR) as shown below:

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	* * *	* * *
SR 3.5.2.4	Verify the boron concentration in each CMT is ≥ 3400 ppm~~,~~ and ≤ ~~3700~~ 4500 ppm.	~~7 days~~ 31 days
	* * *	* * *

Revise LCO 3.6.8, pH Adjustment, LCO and SR as shown below:

LCO 3.6.8 The pH adjustment baskets shall contain ≥ ~~25,920~~ 26,460 lbs of trisodium phosphate (TSP).

[* * *]

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
3.6.8.1	Verify the pH adjustment baskets contain ≥ ~~25,920~~ 26,460 lbs of TSP.	24 months
	* * *	* * *

Southern Nuclear Operating Company

ND-20-XXXX

Enclosure 3

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Conforming Changes to the Technical Specification Bases
(For Information Only)
(LAR-20-004)

Insertions Denoted by Blue Underline and Deletions by Red Strikethrough
Omitted text is identified by three asterisks (* * *)

(This Enclosure consists of 4 pages, including this cover page)

Revise Technical Specifications Bases B 3.5.2, CMTs – Operating, as shown below:

BASES

* * *

SURVEILLANCE REQUIREMENTS

* * *

SR 3.5.2.4

The minimum boron concentration of 3400 ppm assures the CMT safety analysis minimum reactivity control requirements are met. The maximum boron concentration allowed within each CMT at any time shall be 4500 ppm to prevent overboration.

Verification every ~~7 days~~ 31 days that the boron concentration in each CMT is within the required limits ensures that the reactivity control from each CMT, assumed in the safety analysis, will be available as required. The ~~7 day~~ 31 day Frequency is adequate to ~~promptly~~ identify changes which could occur from mechanisms such as in-leakage considering the provisions for monitoring temperature of the inlet line and top of the CMT. Additionally, the top of the CMT has control room indication and an alarm on increased temperature, which would be indicative of in-leakage.

* * *

Revise Technical Specifications Bases B 3.6.8, pH Adjustment, as shown below:

BASES

LCO

The requirements to maintain the pH adjustment baskets ≥ ~~25,920~~ 26,460 lbs of TSP assures that for DBA releases of iodine into containment, the pH of the containment sump will be adjusted to enhance the retention of the iodine.

* * *

SURVEILLANCE REQUIREMENTS

SR 3.6.8.1

The minimum amount of TSP is ~~25,920~~ 26,460 lbs. This weight is based on providing sufficient TSP to buffer the post accident containment water to a minimum pH of 7.0. Additionally, the TSP weight is based on treating the maximum volume of post accident water (~~867,308~~ 867,830 gallons) containing the maximum amount of boron (~~3014~~ 3050 ppm) as well as other sources of acid. The minimum required mass of TSP is ~~25,920~~ 26,460 lbs at an assumed assay of 100%.

While a weight is specified, the normal manner to confirm the weight limit is met is by measuring the volume of the TSP contained in the pH adjustment baskets. The minimum measured volume of TSP is ~~480~~ 490 ft^3, which is based on the minimum required mass of TSP (~~25,920~~ 26,460 lbs) and assumes the minimum density of TSP. The minimum TSP density is based on the manufactured desnity (54 lbm/ft^3), since the density may increase and the volume decrease, during plant operation, due to agglomeration from humidity inside the containment. The TSP volume of 560 ft^3 at the initial loading (i.e., prior to compaction and agglomeration) includes margin (about ~~15~~14%) to account for degradation of TSP during plant operation.

The periodic verification is required every 24 months, since access to the TSP baskets is only feasible during outages, and normal fuel cycles are scheduled for 24 months. Operating experience has shown this Surveillance Frequency acceptable due to the margin in the volume of TSP placed in the containment building.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.8.2

Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of TSP from one of the baskets in containment is submerged in 1.0 ± 0.01 liter of water at a boron concentration of ~~3014~~ 3050 ppm that has been heated to a temperature of 71 ± 5°C (160 ± 9°F). The solution is allowed to stand at this temperature for 4 hours without agitation. The solution is then cooled to 25 ± 5°C (77 ± 9°F) and the pH is measured. The solution pH should rise to ≥ 7.0. A TSP sample size of ~~2.14~~ 2.19 grams is used if the TSP volume is verified to be at least ~~480~~ 490 ft^3 (minimum required). However, a larger TSP sample size can be used if the measured volume is verified to be greater than the minimum. For example, if the TSP volume is verified to be 560 ft^3, then a representative sample of ~~2.41~~ 2.49 grams can be used.

Agitation of the test solution is prohibited, since an adequate standard for the agitation intensity cannot be specified. The time of 4 hours without agitation is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post LOCA sump area, rapid mixing would occur due to liquid flow, significantly decreasing the actual amount of time before the required pH is achieved.

* * *