VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

June 22, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 00-304
NL&OS/GSS/ETS R0
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
PROPOSED TECHNICAL SPECIFICATION CHANGES
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
REACTIVITY CONTROLS – RETURN OF ISOLATED RCS LOOPS TO SERVICE

In an August 4, 1999 letter (Serial No. 99-394), pursuant to 10 CFR 50.90, Virginia Electric and Power Company requested changes to the Technical Specifications (TS) to accommodate a vacuum-assisted fill technique for backfilling isolated loops from the active volume of the Reactor Coolant System. During a conference call with the NRC, additional information was requested to complete the review. Attachment 1 provides the responses to the questions in your Request for Additional Information. In response to the NRC questions, we have revised the August 4, 1999 Technical Specifications change request to provide additional limiting conditions for operation and surveillance requirements for the sources of borated water used during loop backfill and revise the reactivity controls for an isolated-filled loop. The proposed Technical Specifications changes are discussed in Attachment 2. The changes are provided as a mark-up in Attachment 3 and a typed version in Attachment 4. This package supercedes our August 4, 1999 Proposed Technical Specification Change submittal in its entirety, including the significant hazards consideration determination.

We have evaluated the changes and have determined that the proposed Technical Specifications changes do not involve a significant hazards consideration as defined in 10 CFR 50.92. The basis for our determination that the changes do not involve a significant hazards consideration is provided in Attachment 5. We have also determined that operation with the proposed changes will not result in any significant increases in the amounts of effluents that may be released offsite, and no significant increases in individual or cumulative occupational radiation exposure. Therefore, the proposed amendment is eligible for categorical exclusion as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed changes.

A001

Virginia Power requests approval of these changes by January 2001 with an implementation schedule of 30 days from approval of the amendments to the Technical Specifications.

If you have any further questions or require additional information, please contact us.

Very truly yours,

David A. Christian
Senior Vice President and
Chief Nuclear Officer

Attachments:

Attachment 1	Response to Request for Additional Information
Attachment 2	Discussion of Changes
Attachment 3	Mark-up of Technical Specifications Changes
Attachment 4	Proposed Technical Specifications Changes
Attachment 5	Significant Hazards Consideration Determination

Commitments made in this letter:

1. None

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COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Christian who is Senior Vice President and Chief Nuclear Officer of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 22nd day of June, 2000.

My Commission Expires: 3/31/04.

Maggie McClure
Notary Public

(SEAL)

Attachment 1

Response to Request for Additional Information

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company

NRC Request for Additional Information
Vacuum-Assist Loop Backfill TS Change

NRC Qestion

Surveillance Requirement 4.4.1.6.1 as modified could permit more than 4 hours between the surveillance and the time the loop stop valve is opened. "Commence backfill" could be defined as the start of seal injection. (The staff suggested that the requirement be returned to existing Technical Specification (TS) wording which would preclude exceeding the 4-hour period.)

Response

The surveillance requirement has been modified to require the loop be verified "drained" before the start of reactor coolant pump seal injection or initiating loop backfill. Therefore, the potential compliance issue has been eliminated. The original 2 hours for verification of an empty loop remains the same.

NRC Question

The submittal states that Seal Injection is approximately 5 gpm; however, this does not limit the flow rate to 5 gpm.

a. Provide a bounding calculation for maximum possible seal injection flow rate and/or a TS restriction for a maximum allowed seal injection flow rate.

b. Provide a bounding calculation for the maximum amount of water that could be in the isolated loop when the valve is opened, the lowest possible temperature of the water at the time the valve is opened and the effect of opening the valve with respect to the temperature and quantity of water on reactivity and Shutdown Margin (SDM).

c. Provide a TS limitation on the sources of injection to ensure the water injected into the isolated loop is at least at the same or higher Boron concentration than the active portion of the RCS.

Response:

The new and revised limiting conditions for operation and surveillance requirements will ensure that adequate shutdown margin is maintained for the active portion of the Reactor Coolant System during any method of returning a loop to service. The boron concentration of each makeup source is controlled by a TS requirement to ensure that an inadvertent/undetected positive reactivity event can not take place.

NRC Question

Please justify your requested changes with respect to the effect on the initial assumptions for SDM in the Safety Analysis.

Response

The new and revised limiting conditions for operation and surveillance requirements will ensure that adequate shutdown margin is maintained for the active portion of the Reactor Coolant System during any method of returning a loop to service. The boron concentration of each makeup source is controlled by a TS requirement to ensure that an inadvertent/undetected positive reactivity event can not take place.

Attachment 2

Discussion of Changes

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company

Discussion of Change

Introduction

To avoid numerous reactor coolant pump (RCP) starts to eliminate the entrapped air when filling a drained loop, a partial vacuum may be drawn on the loop prior to backfilling to assist in the loop fill. However, RCP seal injection is required to permit establishing a partial vacuum in the isolated loop. Seal injection involves a low flow-rate injection (approximately 5 gpm) of borated water from the charging system into the isolated-drained loop during the time period required to establish a partial vacuum in that loop and during the backfill evolution. Therefore, to facilitate the use of the vacuum-assisted fill technique and to eliminate a potential verbatim compliance issue while filling the drained loop, Virginia Electric and Power Company proposed changes to the Technical Specifications (TS) Bases Section 3/4.4.1, "Reactor Coolant System – Reactor Coolant Loops" and to Surveillance Requirement 4.4.1.6.1.

In an August 4, 1999 letter (Serial No. 99-394), Virginia Electric and Power Company requested changes to Technical Specifications to accommodate a vacuum-assisted fill technique for backfilling isolated loops from the active volume of the Reactor Coolant System (RCS). The vacuum-assisted backfill technique requires initiation of seal injection for the reactor coolant pump (RCP) in the isolated loop in order to allow the establishment of a partial vacuum. Seal injection results in a small flow rate (i.e., approximately 5 gpm) of borated water to the isolated-drained loop, which develops a verbatim compliance concern with Surveillance Requirement 4.4.1.6.1 which requires the loop be verified "drained" prior to opening the loop stop valve to fill the loop. Existing procedural controls were concluded to be adequate to ensure that the seal injection would not create an inadvertent/undetected boron dilution event.

During a telephone conference call with the NRC to discuss the proposed changes, additional information was requested to complete the NRC review. To address the NRC's request for additional information, the original Technical Specification change has been modified to include additional limiting conditions for operation and surveillance requirements for the source of borated water for seal injection to the RCPs and modified reactivity controls for an isolated-filled loop. The Bases have been revised to further discuss the additional controls for the loop backfill evolution. The proposed changes will ensure that an inadvertent/undetected positive reactivity addition does not occur. This package supercedes our August 4, 1999 proposed Technical Specifications change in its entirety, including a new significant hazards consideration determination.

The proposed Technical Specifications changes do not create an unreviewed safety question. Adequate Technical Specifications controls have been established to ensure that an uncontrolled positive reactivity addition will not occur during or following a loop backfill evolution. The proposed controls ensure that the boron concentration of the water used for reactor coolant pump seal injection will be greater than or equal to the boron concentration corresponding to the shutdown margin requirements for the applicable Mode.

Licensing and Design Bases

On November 6, 1996, Virginia Electric and Power Company proposed changes to the Technical Specifications to permit returning an isolated and drained Reactor Coolant System loop to service during Modes 5 and 6 by backfilling from the active portion of the Reactor Coolant System. On October 30, 1998, the NRC issued Technical Specification Amendment 215 for Unit 1 and 196 for Unit 2 to approve the proposed changes. The new method permits filling an isolated-drained loop via backfill from the Reactor Coolant System through a partially opened loop stop valve. New controls were also imposed to ensure adequate reactivity and coolant inventory control during the loop backfill evolution.

The current Technical Specifications permit returning an isolated RCS loop to service by either of two methods. The first method, when the loop is isolated but not drained, requires the isolated loop to be operated on recirculation flow for a specified period of time prior to returning the loop to service. This activity serves to equalize reactor coolant temperature and boron concentration among the isolated and operating loops in a controlled manner. The second method, when a loop is isolated and drained, permits returning the loop to service by backfilling the loop from the active portion of the Reactor Coolant System volume with specific controls in place to ensure reactivity control and to prevent loss of shutdown cooling.

Discussion

The philosophy of the Startup of an Inactive Loop accident analysis centers on avoidance of the preconditions for the accident (i.e., reduced boron concentration and/or temperature in the isolated loop). The proposed Technical Specifications changes modify the current Technical Specifications to permit establishing RCP seal injection into the isolated-drained loop to establish a partial vacuum in the isolated loop. As described below, the proposed revised Technical Specifications explicitly consider the potential effects of RCP seal injection into the isolated loop, and include LCOs and surveillance requirements that will continue to preclude the preconditions for a Startup of an Inactive Loop accident.

The existing Technical Specifications provide protection against a Startup of an Inactive Loop accident when isolated-drained loops are restored by non-vacuum-assisted back-fill operations, or isolated-filled loop are restored by recirculation. As described in the bases for TS 3/4.4.1, the filled loop recirculation activity ensures equilibration of the isolated loop's boron concentration and temperature with the active portion of the RCS. Non-vacuum-assisted backfill operations preclude the preconditions for a Startup of an Inactive Loop accident by requiring 1) the loop to be verified drained before commencing backfill of the loop from the active volume of RCS, 2) operable source range instrumentation to provide secondary indication of any RCS makeup boron

concentration discrepancy, and 3) a minimum RCS volume to ensure adequate decay heat removal capability. The proposed Technical Specifications provide protection against a Startup of an Inactive Loop accident under these conditions, and also when loops are restored to service by vacuum-assisted back-fill operations. The proposed Technical Specifications governing vacuum-assisted back-filling of isolated-drained loops preclude the preconditions for a Startup of an Inactive loop accident by requiring 1) the source of water used for reactor coolant pump seal injection to be adequately borated to meet the shutdown margin requirements for the applicable mode of operation, 2) operable source range instrumentation, and 3) a minimum RCS volume to ensure decay heat removal. These controls (boron concentration, nuclear instrumentation, and RCS volume) have been established for each phase of returning an isolated-drained loop to service. Additionally, conservatively bounding analyses demonstrate that the reactivity effects of temperature differences between the isolated and non-isolated portions of the RCS will not result in a significant reactivity insertion.

During the backfill evolution, make-up flow to the active Reactor Coolant System volume is provided from the reactor cavity, the Refueling Water Storage Tank (RWST), or from the Boric Acid Storage Tank (BAST). The latter is blended with unborated water from the primary grade (PG) water storage tank. During shutdown operations, the primary grade water valves are locked closed except during controlled dilution and/or Reactor Coolant System makeup activities. Make-up flow is introduced to the active Reactor Coolant System volume by normal charging into the Loop B cold leg, and by auxiliary spray into the pressurizer on the Loop C hot leg. As a result of establishing RCP seal injection to permit a partial vacuum to be drawn on the isolated and drained loop, a small flow rate (approximately 5 gpm) of makeup is also introduced directly into the isolated and drained loop. Compliance with the existing Technical Specifications precludes the possibility of an inadequate boron concentration if makeup flow is derived from the reactor cavity or RWST.

The proposed Technical Specifications changes require sampling of the RCP seal injection source (if blended makeup is used) prior to commencing RCP seal injection to establish the partial vacuum in the isolated-drained loop and then repeatedly during the evolution. Sampling will ensure that an adequate boron concentration of the makeup source is maintained to eliminate the potential for inadvertent under-boration due to improper blending and adequate shutdown margin is maintained for the applicable Mode. An additional requirement to sample the loop prior to fully opening the valves in the backfilled loop is also included to provide an additional barrier to an inadvertent dilution accident.

The time constraints for boron concentration sampling are being established at one hour prior to the activities that could affect reactivity (i.e., initiation of seal injection using blended makeup, or opening the loop stop valves after backfill). The current time constraint for sampling the boron concentration in an isolated-filled loop is 30 minutes. One hour is being proposed for consistency throughout the specification and to ensure that adequate time is provided to complete sampling/analyzing and open the loop stop valves. The following times are representative of the times required to perform each

step: 1) get the sample (10-15 minutes), 2) analyze the sample (15-20 minutes), and 3) open loop stop valves (10-15 minutes to manually un-torque the hot leg loop stop valve before electrically opening). The one-hour constraint provides sufficient time for unanticipated delays while providing adequate assurance that the boron concentration of the isolated loop or blended makeup is greater than the required concentration.

In addition to the proposed changes to control the vacuum-assisted loop fill evolution, changes are being proposed to the reactivity controls for an isolated-filled loop. The proposed changes establish the boron concentration requirements for an isolated-filled loop to be greater than or equal to the boron concentration which meets the mode-dependent shutdown margin requirements of the active portion of the RCS. These changes will establish consistent reactivity control for returning either an isolated-filled loop or isolated-drained loop to service, and will eliminate potential operational concerns with overborating the RCS prior to returning the loop to service. The proposed changes will continue to provide adequate reactivity control to prevent an inadvertent and undetected reactivity addition event due to loop boron concentrations.

The bases for the associated Technical Specifications are being revised to discuss how the factors affecting reactivity were accounted for, including makeup source controls, temperature effects and stratification concerns in the loop being backfilled.

Virginia Electric and Power Company has considered the implications of the proposed changes on the safe operation of the North Anna units. The focus of the proposed change is to avoid the possibility of an inadvertent and undetected introduction of under-borated water into an isolated loop prior to returning the isolated loop to service. The design and licensing basis focuses on restoring isolated and drained loops to service using borated water sources of known concentration to preclude the pre-condition for a Startup of an Inactive Loop (SUIL) accident.

Technical Specifications Changes

Technical Specification changes are proposed to:

- modify the isolated loop boron concentration requirement to be greater than or equal to the boron concentration that satisfies the mode-dependent shutdown margin requirement,
- impose sampling requirements to ensure that, when blended makeup is used as the source for reactor coolant pump seal injection flow, the boron concentration of the blended makeup is greater than or equal to the boron concentration that satisfies the mode-dependent shutdown margin requirement,
- increase the allowable time interval for sampling prior (a) to initiation of seal injection using blended makeup flow or (b) opening the loop stop valves after loop backfill from 30 minutes to 1 hour, and
- restrict returning an isolated and drained reactor coolant loop to service by loop backfill by requiring that loop backfill must be accomplished through the cold leg loop

stop valves to ensure mixing of seal injection flow with coolant from the active portion of the RCS.

The specific Technical Specification changes are as follows:

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Revise Limiting Condition for Operation (LCO) 3.4.1.4 as follows:

From:
The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration of the operating loops, unless the loop has been drained for maintenance.

To:
The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration **corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System**, unless the loop has been drained for maintenance.

Revise Surveillance Requirement 4.4.1.4 as follows:

From:
The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration of the operating loops at least once per 24 hours and within 1 hour prior to opening either the hot or cold leg stop valves of an isolated loop.

To:
The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration **corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System** at least once per 24 hours and within **one hour** prior to opening either the hot leg or cold leg stop valves of an isolated loop.

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Revise Limiting Condition for Operation (LCO) 3.4.1.6 as follows:
From:
Whenever a reactor coolant loop is isolated and drained, A. C. power shall be removed from the loop stop valves and the associated breakers locked open.
To:
Whenever a reactor coolant loop is isolated and drained, A. C. power shall be removed from the loop stop valves and the associated breakers locked open. **When returning an isolated and drained loop to service the following conditions shall be met:**

Revise existing LCO 3.4.1.6.a and b as follows:

From:

a. The valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System, once the following conditions are met:
   1. The isolated loop shall be drained.
   2. Pressurizer water volume shall be at least 450 cubic feet.
   3. A source range neutron flux monitor shall be operable.

b. During backfilling of the isolated loop.
   1. Pressurizer water volume shall be maintained at or above 450 cubic feet.
   2. The source range neutron flux count rate shall be no more than a factor of 2 above the initial count rate.
   3. The hot and cold leg stop valves shall be fully opened within 2 hours after the backfill of the isolated loop has been completed.

To:

a. Seal injection may be initiated to the reactor coolant pump in the isolated loop provided that:
   1. The isolated loop is drained
   2. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

b. The **cold leg stop** valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System **provided that**:
   1. The isolated loop **is** drained **or the conditions of Specification 3.4.1.6.a above are met.**
   2. Pressurizer water volume **is** ≥ 450 cubic feet.
   3. A source range neutron flux monitor **is** operable.

c. Backfilling of the isolated loop **may continue provided that:**
   1. Pressurizer water volume **is** maintained at or above 450 cubic feet.
   2. The source range neutron flux count rate **is** no more than a factor of 2 above the initial count rate.
   3. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

d. When the isolated loop is full, the loop stop valves can be fully opened provided that:
   1. The boron concentration in the loop is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.
   2. The hot and cold leg stop valves are fully opened within 2 hours after backfill of the isolated loop has been completed.

Revise Action Statements 3.4.1.6.a

From:
If the isolated loop is not drained then it must be fully drained before initiating backfilling.

To:
If the isolated loop is not drained then it must be fully drained before initiating **seal injection to the reactor coolant pump in the loop or initiating loop backfill**.

Revise Action Statements 3.4.1.6.c to 'e' and as follows:

From:
If the loop stop valves are not fully open within 2 hours after the loop is filled, then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

To:
If the loop stop valves are not fully open within 2 hours after the loop is filled **or Surveillance Requirement 4.4.1.6.5 is not met,** then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

Establish new Action Statement 3.4.1.6.c

New Action:
If the boron concentration of the reactor coolant pump seal injection makeup source is not maintained ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode, then the loop stop valve on the loop being backfilled shall be closed and the loop drained or apply Specification 3.4.1.4 and 3.4.1.5.

Revise Surveillance Requirement 4.4.1.6.1 as noted below:

From:
The isolated loop shall be verified drained within 2 hours prior to opening the loop stop valve for backfilling the loop from the RCS.

To:
The isolated loop shall be verified drained within 2 hours prior to **initiating seal injection to the reactor coolant pump in the isolated loop or** opening the loop stop valve for backfilling the loop from the **Reactor Coolant System**.

Establish new Surveillance Requirements:

New Requirement:

4.4.1.6.4 If blended makeup is used as the source for reactor coolant pump seal injection, the boron concentration shall be verified to be ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

a. **within one hour prior to initiating seal injection to the reactor coolant pump in the isolated loop, and**
b. **once every hour after initiating seal injection to the reactor coolant pump.**

4.4.1.6.5 The backfilled loop's boron concentration shall be verified to be ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode within one hour prior to fully opening the cold leg stop valve or opening the hot leg loop stop valve in the isolated loop.

Revise TS Bases 3/4.4.1 7th/6 th (U-1/U-2) paragraph, first sentence as noted below:

The requirement to maintain the boron concentration of an isolated loop greater than or equal to **the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System** ensures that no **uncontrolled** reactivity addition to the core could occur during startup of an isolated loop.

Revise TS Bases 3/4.4.1 9th/8th (-1/-2) paragraph as noted below:

From:

An initially isolated and drained reactor coolant loop may be returned to service by partially opening the loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. Prior to partially opening the loop stop valves, the following measures are required to ensure no sudden positive reactivity addition or loss of Reactor Coolant System inventory occurs:

To:

An initially isolated and drained reactor coolant loop may be returned to service by partially opening the **cold leg** loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. **To eliminate numerous reactor coolant pump jogs to completely fill a drained loop, a partial vacuum may be established in the isolated loop prior to commencing filling from the active volume of the Reactor Coolant System. The vacuum-assist loop fill evolution requires initiating seal injection to the reactor coolant pump to permit establishing an adequate vacuum in the isolated loop. A portion of the reactor coolant pump seal injection enters the isolated loop. To eliminate the reactivity concerns associated with the water injected into the isolated and drained loop from the seal injection, a water source of known boron concentration is used.**

Prior to **initiating seal injection to the reactor coolant pump in an isolated and drained loop or** partially opening the **cold leg** loop stop valves**,** the following measures are required to ensure no **uncontrolled** positive reactivity addition or loss of Reactor Coolant System inventory occurs:

a) The isolated loop is verified to be drained, **prior to the initial addition of water to return a loop to service, thus preventing the dilution of the Reactor Coolant System boron concentration by liquid present in the loop. Therefore, the verification of the loop being drained must occur either prior to initiation of seal injection to the Reactor Coolant Pump if the vacuum-assist backfill method is used or prior to opening the cold leg loop stop valve if the vacuum-assist backfill method is not used.**
b) Pressurizer level is verified to be greater than or equal to 450 cubic feet **prior to opening the cold leg loop stop valve** to ensure Reactor Coolant System inventory is maintained for decay heat removal. In addition, the backfill evolution is limited to one isolated loop at a time. ~~Pressurizer level is required to be maintained greater than or equal to the 450 cubic feet during the backfill evolution.~~
c) The water source for reactor coolant pump seal injection is sampled to ensure the boron concentration of the source is greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.
d) A source range neutron flux monitor channel is required to be monitored to detect any unexpected positive reactivity addition due to an inadvertent mismatch between Reactor Coolant System and blended makeup concentration.

Establish additional TS Bases with new 3/4.4.1 Add new paragraph as noted below:

Added Paragraph:
During the loop fill evolution, the following measures are implemented to ensure no positive reactivity additions or sudden loss of Reactor Coolant System inventory occur:

a. Pressurizer level is maintained at greater than or equal to 450 cubic feet.

b. Makeup to the active portion of the Reactor Coolant System is through a flowpath that will ensure makeup flow is mixed with the reactor coolant in the active portion of the Reactor Coolant System and flows through the core prior to entering the loop being filled.

c. Blended makeup flow from the Boric Acid Storage Tank and the Primary Grade Water Tank, which is also a source for RCP seal injection, is periodically sampled to ensure the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System are maintained.

d. **The source range neutron flux monitor is monitored to provide a secondary indication of any possible dilution.**

The potential reactivity effects due to Reactor Coolant System cooldown during and following loop backfill are limited to acceptable levels by the small absolute value of isothermal temperature coefficient of reactivity that exists at cold and refueling shutdown conditions. If steam generator secondary temperature is higher than the active portion of the Reactor Coolant System, a conservative heat transfer analysis demonstrates that 1) the pressurizer insurge rates that could result from heatup are easily accommodated by available relief capacity, and 2) the total integrated insurge due to heatup following backfill is very small, i.e. less than the unmeasured pressurizer volume above the upper level tap.

Reactivity effects due to boron stratification in the backfilled loop are not a concern since stratification is not expected to take place at the normal shutdown boron concentrations (2000-2400 ppm) and temperatures (40°F-200°F).

Safety Significance

Virginia Electric and Power Company has reviewed the proposed Technical Specification changes in the aggregate and has determined that the proposed changes do not pose an unreviewed safety question. These changes modify the limiting conditions for operation, surveillance requirements and the Bases for Technical Specifications 3.4.4.1.4 and 3.4.4.1.6 to ensure that an inadvertent/undetected positive reactivity addition event will not occur during a loop backfill evolution the using vacuum-assist technique. Operation of the North Anna Power Station in accordance with the proposed Technical Specification and Basis changes will not:

1. Involve an increase in the probability or consequences of an accident previously evaluated.

   The proposed Technical Specification Limiting Conditions for Operation and Surveillance Requirements ensure that the initiation of seal injection in order to allow a partial vacuum to be established in an isolated and drained loop will not create the potential for an inadvertent/undetected introduction of under-borated water into an isolated loop prior to returning the isolated loop to service. Adequate Technical Specification controls are established to preclude an undetected boron dilution event. In addition, the proposed controls prevent any additions of makeup or seal injection that would violate the existing shutdown margin requirements for the active portion of the Reactor Coolant System. Therefore, there is no increase in the probability or consequences of any accident previously evaluated.

2. Create the possibility of a new or different kind of accident from any accident previously evaluated.

   There are no modifications to the plant as a result of the changes. The proposed Technical Specification Limiting Conditions for Operation and Surveillance Requirements ensure that the initiation of seal injection will not create an undetected positive reactivity addition. No new accident or event initiators are created by the initiation of seal injection for the RCP in the isolated loop in order to establish a partial vacuum in that isolated and drained loop. Therefore, the proposed changes do not create the possibility of any accident or malfunction of a different type previously evaluated.

3. Involve a significant reduction in the margin of safety as defined in the bases on any Technical Specifications.

   The proposed changes have no effect on safety analyses assumptions. Rather, the proposed changes acknowledge the establishment of seal injection for the RCP in the isolated and drained loop as a prerequisite for the vacuum-assisted backfill technique. The proposed Technical Specification Limiting Conditions for Operation and Surveillance Requirements ensure that the initiation of seal injection in order to allow a partial vacuum to be established in an isolated and drained loop will not create the potential for an inadvertent/undetected introduction of under-borated

water into an isolated loop prior to returning the isolated loop to service. Adequate Technical Specifications controls are established to preclude an undetected boron dilution event. In addition, the proposed controls prevent any additions of makeup or seal injection that would violate the existing shutdown margin requirements for the active portion of the Reactor Coolant System. Therefore, the proposed changes do not result in a reduction in a margin of safety.

Environmental Assessment

The proposed Technical Specification changes establish consistent limiting conditions for operation and surveillance requirements for isolated loops and returning the loops to service. Specifically, Technical Specifications requirements are being established to control the source of borated water for seal injection to the RCPs and to address reactivity control of an isolated and filled loop. The proposed changes have no environmental impact or increase in the individual or cumulative occupational radiation exposure. Adequate controls exist to ensure that the Reactor Coolant System loop backfill evolution is performed safely. No new effluents or effluent release paths are created as a result of the proposed Technical Specifications changes to the Reactor Coolant System loop backfill process. The proposed changes will continue to ensure that core reactivity management is adequately addressed and therefore, there is no environmental impact as a result of the proposed Technical Specifications changes.

Attachment 3

Mark-up of Unit 1 and Unit 2 Technical Specifications Changes

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company

UNIT 1

LIMITING CONDITION FOR OPERATION

3.4.1.4 The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration ~~of the operating loops~~ corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System, unless the loop has been drained for maintenance.

APPLICABILITY: MODES 3, 4 and 5.

ACTION:

With the requirements of the above specification not satisfied, do not open the isolated loop's stop valves; either increase the boron concentration of the isolated loop to within the limits within 4 hours or borate the unisolated portion of the RCS to a SHUTDOWN MARGIN equivalent to at least 1.77% Δk/k at 200°F within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.4 The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration ~~of the operating loops~~ at least once per 24 hours and within ~~30 minutes~~ 1 hour prior to opening either the hot leg or cold leg stop valves of an isolated loop.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - FILLED

LIMITING CONDITION FOR OPERATION

3.4.1.5 A reactor coolant loop cold leg stop valve on an undrained loop shall remain closed with A.C. power removed and its breaker locked open* unless:

a. The isolated loop has been operating on a recirculation flow of greater than or equal to 125 gpm for at least 90 minutes and the temperature at the cold leg of the isolated loop is within 20°F of the highest cold leg temperature of the operating loops, and

b. The reactor is subcritical by at least 1.77 percent Δk/k, or

c. The loop is being backfilled in accordance with Specification 3.4.1.6.

APPLICABILITY: MODES 3, 4, 5 and 6.

ACTION:

With the requirements of the above specification not satisfied, suspend startup of the isolated loop. A.C. power shall be removed from the valve and the breaker locked open within 2 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.5.1 The isolated loop cold leg temperature shall be determined to be within 20°F of the highest cold leg temperature of the operating loops within 30 minutes prior to opening the cold leg stop valve.

4.4.1.5.2 The reactor shall be determined to be subcritical by at least 1.77 percent Δk/k within 30 minutes prior to opening the cold leg stop valve.

NO CHANGE INFORMATION ONLY

* A cold leg stop valve in a reactor coolant loop may be closed for up to two hours for valve maintenance or testing. If the stop valve is not opened within two hours, A.C. power shall be removed from the valve and the breaker locked open.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - DRAINED

LIMITING CONDITION FOR OPERATION

When returning an isolated drained loop to service the following conditions shall be met:

3.4.1.6 Whenever a reactor coolant loop is isolated and drained, A.C. power shall be removed from the loop stop valves and the associated breakers locked open.

b.a. The cold leg stop valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System, ~~once the following conditions are met:~~ provided that:

1. The isolated loop is ~~shall be~~ drained.
2. Pressurizer water volume is ≥ ~~shall be at least~~ 450 cubic feet.
3. A source range neutron flux monitor is ~~shall be~~ operable.

c.b. ~~During~~ backfilling of the isolated loop may continue provided that:

1. Pressurizer water volume shall be maintained at or above 450 cubic feet.
2. The source range neutron flux count rate is ~~shall be~~ no more than a factor of 2 above the initial count rate.

2.b. The hot and cold leg stop valves are ~~shall be~~ fully opened within 2 hours after the backfill of the isolated loop has been completed.

APPLICABILITY: MODES 5 and 6.

ACTION:

a. If the isolated loop is not drained then it must be fully drained before initiating backfill~~ing~~ or initiating seal injection to the reactor coolant pump in the loop.

b. If the pressurizer water volume is not maintained at 450 cubic feet or greater, then the loop stop valves on the loop being backfilled shall be closed, A.C. power shall be removed from the loop stop valves and the breakers locked open.

e.c. If the loop stop valves are not fully open within 2 hours after the loop is filled or Surveillance Requirement 4.4.1.6.5 is not met, then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

d. If the source range count rate increases by a factor of two over the initial count rate, then the hot and cold leg loop stop valves shall be reclosed, power removed from the breakers and the breakers locked open. No attempt shall be made to reopen the loop stop valves until the reason for the count rate increase has been determined.

LCO d. When the isolated loop is full the loop stop valves can be fully opened provided that:

1. The boron concentration in the loop is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

ACTION e. If the boron concentration of the RCP seal injection make up source is not maintained ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode, then the loop stop value on the loop being backfilled shall be closed and the loop drained or apply Specification 3.4.1.4 or 3.4.1.5.

1. The isolated loop is drained
2. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - DRAINED

SURVEILLANCE REQUIREMENTS

initiating seal injection to the reactor coolant pump in the isolated loop or

4.4.1.6.1 The isolated loop shall be verified drained within 2 hours prior to opening the loop stop valve for backfilling the loop from the ~~RCS~~. Reactor Coolant System.

4.4.1.6.2 The pressurizer water volume shall be verified to be ≥ 450 cubic feet at least once per 15 minutes during filling of the isolated loop.

4.4.1.6.3 The source range neutron flux monitor shall be demonstrated OPERABLE by performance of:

a. A CHANNEL FUNCTIONAL TEST within 8 hours prior to commencing isolated loop backfill, and

b. A CHANNEL CHECK at least once per 15 minutes during backfilling of an isolated loop.

4.4.1.6.4 If using blended makeup flow as the source for reactor coolant pump seal injection, the boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode.

a. Within 1 hour prior to initiating seal injection to the reactor coolant pump in the isolated loop, and

b. once every hour after initiating seal injection to the reactor coolant pump.

4.4.1.6.5 The backfilled loop's boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode within 1 hour prior to fully opening the cold leg loop stop valve or opening the hot leg loop stop valve in the isolated loop.

3/4.4.1 REACTOR COOLANT LOOPS

The plant is designed to operate with all reactor coolant loops in operation and maintain the DNBR above the design limit during all normal operations and anticipated transients. In MODES 1 and 2 with one reactor coolant loop not in operation, this specification requires that the plant be in at least HOT STANDBY within 1 hour.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat, but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two RHR loops to be OPERABLE.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 235°F are provided to prevent RCS pressure transients, caused by energy additions from the secondary system which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

The operation of one Reactor Coolant Pump or one RHR pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reduction will therefore be within the capability of operator recognition and control.

The requirement to maintain the boron concentration of an isolated loop greater than or equal to ~~the boron concentration of the operating loops~~ the boron concentration in the active portion of the Reactor Coolant System ensures that no uncontrolled reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratification.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is

within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

An initially isolated (cold leg) and drained reactor coolant loop may be returned to service by partially opening the loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. (INSERT A) New Prior to partially opening the (Cold leg) loop stop valves, the following measures are required to ensure no ~~sudden~~ (uncontrolled) positive reactivity addition or loss of Reactor Coolant System inventory occurs: (initiating seal injection to the reactor coolant pump in an isolated loop or)

(INSERT B)

a) ~~The isolated loop is verified to be drained, thus preventing the dilution of Reactor Coolant System boron concentration by liquid present in the loop.~~

b) Pressurizer level is verified to be greater than or equal to 450 cubic feet (prior to opening the cold leg loop stop valve) to ensure Reactor Coolant System inventory is maintained for decay heat removal. ~~Pressurizer level is required to be maintained greater than or equal to 450 cubic feet during the backfill evolution.~~ In addition, the backfill evolution is limited to one isolated loop at a time.

(d.c) A source range neutron flux monitor channel is ~~required to be~~ monitored to detect any unexpected positive reactivity addition due to an inadvertent mismatch between RCS and blended makeup concentration. (INSERT C)

After an initially drained loop is filled from the Reactor Coolant System by partially opening the loop stop valves, the loop is no longer considered to be isolated. Thus, the requirements for returning an isolated and filled loop to service are not applicable and the loop stop valves may be fully opened without restriction within two hours of completing the loop backfill evolution.

The initial pressurizer level requirement has been established such that, even if the stop valves are suddenly opened on all three loops with all of them drained, one of them under vacuum and no makeup available, the Reactor Coolant System water level will not drop below the middle of the reactor vessel nozzles. This ensures continued adequate suction conditions for the residual heat removal pumps.

The safety analysis assumes a minimum shutdown margin as an initial condition. Violation of the limiting conditions for loop stop valve operation could result in the shutdown margin being reduced to less than that assumed in the safety analysis. In addition, violation of the limiting conditions could cause a loss of shutdown decay heat removal.

c) The water source for reactor coolant pump seal injection is sampled to ensure the boron concentration of the source is greater than or equal to the boron concentration corresponding to the shutdown ~~Margin~~ requirements for the active portion of the Reactor Coolant System

Insert A – Boron

To eliminate numerous reactor coolant pump jogs to completely fill a drained loop, a partial vacuum may be established in the isolated loop prior to commencing filling from the active volume of the Reactor Coolant System. The vacuum-assist loop fill evolution requires initiating seal injection to the reactor coolant pump to permit establishing an adequate vacuum in the isolated loop. A portion of the reactor coolant pump seal injection enters the isolated loop. To eliminate the reactivity concerns associated with the water injected into the isolated and drained loop from the seal injection, a water source of known boron concentration is used.

Insert B -Drained

a) The isolated loop is verified drained prior to the initial addition of water to return a loop to service, thus preventing the dilution of the Reactor Coolant System boron concentration by liquid present in the loop. Therefore, the verification of the loop being drained must occur either prior to initiation of seal injection to the reactor coolant pump if the vacuum-assist backfill method is used or prior to opening the cold leg loop stop valve if the vacuum-assist backfill method is not used.

Insert C – Backfill controls

During the loop fill evolution, the following measures are implemented to ensure no positive reactivity additions or sudden loss of Reactor Coolant System inventory occur:

a. Pressurizer level is maintained at greater than or equal to 450 cubic feet.

b. Makeup to the active portion of the Reactor Coolant System is through a flowpath that will ensure makeup flow is mixed with the reactor coolant in the active portion of the Reactor Coolant System and flows through the core prior to entering the loop being filled.

c. Blended makeup flow from the Boric Acid Storage Tank and the Primary Grade Water Tank, which is also a source for RCP seal injection, is periodically sampled to ensure the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d. The source range neutron flux monitor is monitored to provide a secondary indication of any possible dilution.

The potential reactivity effects due to Reactor Coolant System cooldown during and following loop backfill are limited to acceptable levels by the small absolute value of isothermal temperature coefficient of reactivity that exists at cold and refueling shutdown conditions. If steam generator secondary temperature is higher than the active portion of the Reactor Coolant System, a conservative heat transfer analysis

demonstrates that 1) the pressurizer insurge rates that could result from heatup are easily accommodated by available relief capacity, and 2) the total integrated insurge due to heatup following backfill is very small, i.e. < the unmeasured pressurizer volume above the upper level tap.

Reactivity effects due to boron stratification in the backfilled loop are not a concern since stratification is not expected to take place at the normal shutdown boron concentrations (2000-2400 ppm) and temperatures (40°F-200°F).

UNIT 2

LIMITING CONDITION FOR OPERATION

3.4.1.4 The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration ~~of the operating loops~~, unless the loop has been drained for maintenance.

Corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System

APPLICABILITY: MODES 3, 4 and 5.

ACTION:

With the requirements of the above specification not satisfied, do not open the isolated loop's stop valves; either increase the boron concentration of the isolated loop to within the limits within 4 hours or borate the unisolated portion of the RCS to a SHUTDOWN MARGIN equivalent to at least 1.77% Δk/k at 200°F within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.4 The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration ~~of the operating loops~~ at least once per 24 hours and within ~~30 minutes~~ 1 hour prior to opening either the hot leg or cold leg stop valves of an isolated loop.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - FILLED

LIMITING CONDITION FOR OPERATION

3.4.1.5 A reactor coolant loop cold leg stop valve on an undrained loop shall remain closed with A.C. power removed and its breaker locked open* unless:

a. The isolated loop has been operating on a recirculation flow greater than or equal to 125 gpm for at least 90 minutes and the temperature at the cold leg of the isolated loop is within 20°F of the highest cold leg temperature of the operating loops, and

b. The reactor is subcritical by at least 1.77 percent Δk/k, or

c. The loop is being backfilled in accordance with Specification 3.4.1.6.

APPLICABILITY: MODES 3, 4, 5 and 6.

ACTION:

With the requirements of the above specification not satisfied, suspend startup of the isolated loop. A.C. power shall be removed from the valve and the breaker locked open within 2 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.5.1 The isolated loop cold leg temperature shall be determined to be within 20°F of the highest cold leg temperature of the operating loops within 30 minutes prior to opening the cold leg stop valve.

4.4.1.5.2 The reactor shall be determined to be subcritical by at least 1.77 percent Δk/k within 30 minutes prior to opening the cold leg stop valve.

NO CHANGE INFORMATION ONLY

* A cold leg stop valve in a reactor coolant loop may be closed for up to two hours for valve maintenance or testing. If the stop valve is not opened within two hours, A.C. power shall be removed from the valve and the breaker locked open.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - DRAINED

LIMITING CONDITION FOR OPERATION

When returning an isolated drained loop to service the following conditions shall be met:

3.4.1.6 Whenever a reactor coolant loop is isolated and drained, A.C. power shall be removed from the loop stop valves and the associated breakers locked open.

b. ~~a.~~ The cold leg stop valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System, ~~once the following conditions are met:~~ provided that:

1. The isolated loop is ~~shall be~~ drained.
2. Pressurizer water volume is ≥ ~~shall be at least~~ 450 cubic feet.
3. A source range neutron flux monitor is ~~shall be~~ operable.

c. ~~b.~~ ~~During~~ backfilling of the isolated loop may continue provided that:

1. Pressurizer water volume shall be maintained at or above 450 cubic feet.
2. The source range neutron flux count rate is ~~shall be~~ no more than a factor of 2 above the initial count rate.

2. ~~c.~~ The hot and cold leg stop valves are ~~shall be~~ fully opened within 2 hours after the backfill of the isolated loop has been completed.

a. Seal injection may be initiated in the isolated loop provided that:
1. The isolated loop is drained
2. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

APPLICABILITY: MODES 5 and 6.

ACTION:

a. If the isolated loop is not drained then it must be fully drained before initiating seal injection to the reactor coolant pump in the loop or initiating backfilling.

b. If the pressurizer water volume is not maintained at 450 cubic feet or greater, then the loop stop valves on the loop being backfilled shall be closed, A.C. power shall be removed from the loop stop valves and the breakers locked open.

e. ~~c.~~ If the loop stop valves are not fully open within 2 hours after the loop is filled or surveillance requirement 4.4.1.6.5 is not met, then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

d. If the source range count rate increases by a factor of two over the initial count rate, then the hot and cold leg loop stop valves shall be reclosed, power removed from the breakers and the breakers locked open. No attempt shall be made to reopen the loop stop valves until the reason for the count rate increase has been determined.

reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

LCO d. When the isolated loop is full the loop stop valves can be fully opened provided that:
1. The boron concentration in the loop is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

ACTION c If the boron concentration of the RCP seal injection makeup source is not maintained ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode, then the loop stop valve on the loop being backfilled shall be closed and the loop drained or apply Specification 3.4.1.4 or 3.4.1.5

initiating seal injection to the reactor coolant pump in the isolated Loop or

SURVEILLANCE REQUIREMENTS

4.4.1.6.1 The isolated loop shall be verified drained within 2 hours prior to opening the loop stop valve for backfilling the loop from the ~~RCS~~ Reactor Coolant System.

4.4.1.6.2 The pressurizer water volume shall be verified to be ≥ 450 cubic feet at least once per 15 minutes during filling of the isolated loop.

4.4.1.6.3 The source range neutron flux monitor shall be demonstrated OPERABLE by performance of:

a. A CHANNEL FUNCTIONAL TEST within 8 hours prior to commencing isolated loop backfill, and

b. A CHANNEL CHECK at least once per 15 minutes during backfilling of an isolated loop.

4.4.1.6.4 If using blended makeup flow as the source for reactor coolant pump seal injection, the boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the Applicable Mode.

a. Within 1 hour prior to initiating seal injection to the reactor coolant pump in the isolated Loop, and

b. once every hour after initiating seal injection to the reactor coolant pump.

4.4.1.6.5 The backfilled loop's boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode within 1 hour prior to fully opening the cold leg loop stop valve or opening the hot leg loop stop valve in the isolated loop.

3/4.4.1 REACTOR COOLANT LOOPS

The plant is designed to operate with all reactor coolant loops in operation and maintain the DNBR above design limit during all normal operations and anticipated transients. In MODES 1 and 2 with one reactor coolant loop not in operation, this specification requires that the plant be in at least HOT STANDBY within 1 hour.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat, but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two RHR loops to be OPERABLE.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 270°F are provided to prevent RCS pressure transients, caused by energy additions from the secondary system which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

The boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System

The requirement to maintain the boron concentration of an isolated uncontrolled loop greater than or equal to the boron concentration of the operating loops ensures that no reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratifications.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

3/4.4 REACTOR COOLANT SYSTEM

BASES

An initially isolated (cold leg) and drained reactor coolant loop may be returned to service by partially opening the loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. (INSERT A) Prior to (New III) partially opening the (cold leg) loop stop valves, the following measures are required to ensure no ~~sudden~~ (uncontrolled) positive reactivity addition or loss of Reactor Coolant System inventory occurs: initiating seal injection to the reactor coolant pump in an isolated loop or

(INSERT B)

a) ~~The isolated loop is verified to be drained, thus preventing the dilution of Reactor Coolant System boron concentration by liquid present in the loop.~~

b) Pressurizer level is verified to be greater than or equal to 450 cubic feet (prior to opening the cold leg loop stop valve) to ensure Reactor Coolant System inventory is maintained for decay heat removal. ~~Pressurizer level is required to be maintained greater than or equal to 450 cubic feet during the backfill evolution~~. In addition, the backfill evolution is limited to one isolated loop at a time.

(d c) A source range neutron flux monitor channel is ~~required to be~~ monitored to detect any unexpected positive reactivity addition due to an inadvertent mismatch between RCS and blended makeup concentration. (INSERT C)

After an initially drained loop is filled from the Reactor Coolant System by partially opening the loop stop valves, the loop is no longer considered to be isolated. Thus, the requirements for returning an isolated and filled loop to service are not applicable and the loop stop valves may be fully opened without restriction within two hours of completing the loop backfill evolution.

The initial pressurizer level requirement has been established such that, even if the stop valves are suddenly opened on all three loops with all of them drained, one of them under vacuum and no makeup available, the Reactor Coolant System water level will not drop below the middle of the reactor vessel nozzles. This ensures continued adequate suction conditions for the residual heat removal pumps.

The safety analysis assumes a minimum shutdown margin as an initial condition. Violation of the limiting conditions for loop stop valve operation could result in the shutdown margin being reduced to less than that assumed in the safety analysis. In addition, violation of the limiting conditions could cause a loss of shutdown decay heat removal.

(a) The water source for the reactor coolant pump seal injection is sampled to ensure the boron concentration of the source is greater than or equal to the boron concentration corresponding to the Shutdown Margin requirements for the active portion of the Reactor Coolant System.

Insert A – Boron

To eliminate numerous reactor coolant pump jogs to completely fill a drained loop, a partial vacuum may be established in the isolated loop prior to commencing filling from the active volume of the Reactor Coolant System. The vacuum-assist loop fill evolution requires initiating seal injection to the reactor coolant pump to permit establishing an adequate vacuum in the isolated loop. A portion of the reactor coolant pump seal injection enters the isolated loop. To eliminate the reactivity concerns associated with the water injected into the isolated and drained loop from the seal injection, a water source of known boron concentration is used.

Insert B -Drained

a) The isolated loop is verified drained prior to the initial addition of water to return a loop to service, thus preventing the dilution of the Reactor Coolant System boron concentration by liquid present in the loop. Therefore, the verification of the loop being drained must occur either prior to initiation of seal injection to the reactor coolant pump if the vacuum-assist backfill method is used or prior to opening the cold leg loop stop valve if the vacuum-assist backfill method is not used.

Insert C – Backfill controls

During the loop fill evolution, the following measures are implemented to ensure no positive reactivity additions or sudden loss of Reactor Coolant System inventory occur:

a. Pressurizer level is maintained at greater than or equal to 450 cubic feet.

b. Makeup to the active portion of the Reactor Coolant System is through a flowpath that will ensure makeup flow is mixed with the reactor coolant in the active portion of the Reactor Coolant System and flows through the core prior to entering the loop being filled.

c. Blended makeup flow from the Boric Acid Storage Tank and the Primary Grade Water Tank, which is also a source for RCP seal injection, is periodically sampled to ensure the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d. The source range neutron flux monitor is monitored to provide a secondary indication of any possible dilution.

The potential reactivity effects due to Reactor Coolant System cooldown during and following loop backfill are limited to acceptable levels by the small absolute value of isothermal temperature coefficient of reactivity that exists at cold and refueling shutdown conditions. If steam generator secondary temperature is higher than the active portion of the Reactor Coolant System, a conservative heat transfer analysis

demonstrates that 1) the pressurizer insurge rates that could result from heatup are easily accommodated by available relief capacity, and 2) the total integrated insurge due to heatup following backfill is very small, i.e. < the unmeasured pressurizer volume above the upper level tap.

Reactivity effects due to boron stratification in the backfilled loop are not a concern since stratification is not expected to take place at the normal shutdown boron concentrations (2000-2400 ppm) and temperatures (40°F-200°F).

Attachment 4

Proposed Unit 1 and Unit 2 Technical Specifications Changes

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company

UNIT 1

TECH SPEC CHANGE REQUEST NO. 369A

TABULATION OF CHANGES

License No. NPF-4 / Docket No. 50-338

Summary of change:

This proposed change to the Technical Specifications is being made to facilitate the use of the vacuum-assisted fill technique and to eliminate a potential verbatim compliance issue.

DELETE	DATED	SUBSTITUTE
3/4 4-4	10-30-98	3/4 4-4
3/4 4-5a	10-30-98	3/4 4-5a
3/4 4-5b	10-30-98	3/4 4-5b
B 3/4 4-1	10-05-94	B 3/4 4-1
B 3/4 4-1a	10-30-98	B 3/4 4-1a

LIMITING CONDITION FOR OPERATION

3.4.1.4 The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System, unless the loop has been drained for maintenance.

APPLICABILITY: MODES 3, 4 and 5.

ACTION:

With the requirements of the above specification not satisfied, do not open the isolated loop's stop valves; either increase the boron concentration of the isolated loop to within the limits within 4 hours or borate the unisolated portion of the RCS to a SHUTDOWN MARGIN equivalent to at least 1.77% $\Delta k/k$ at 200°F within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.4 The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System at least once per 24 hours and within 1 hour prior to opening either the hot leg or cold leg stop valves of an isolated loop.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - FILLED

LIMITING CONDITION FOR OPERATION

3.4.1.5 A reactor coolant loop cold leg stop valve on an undrained loop shall remain closed with A.C. power removed and its breaker locked open* unless:

a. The isolated loop has been operating on a recirculation flow of greater than or equal to 125 gpm for at least 90 minutes and the temperature at the cold leg of the isolated loop is within 20°F of the highest cold leg temperature of the operating loops, and

b. The reactor is subcritical by at least 1.77 percent Δk/k, or

c. The loop is being backfilled in accordance with Specification 3.4.1.6.

APPLICABILITY: MODES 3, 4, 5 and 6.

ACTION:

With the requirements of the above specification not satisfied, suspend startup of the isolated loop. A.C. power shall be removed from the valve and the breaker locked open within 2 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.5.1 The isolated loop cold leg temperature shall be determined to be within 20°F of the highest cold leg temperature of the operating loops within 30 minutes prior to opening the cold leg stop valve.

4.4.1.5.2 The reactor shall be determined to be subcritical by at least 1.77 percent Δk/k within 30 minutes prior to opening the cold leg stop valve.

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* A cold leg stop valve in a reactor coolant loop may be closed for up to two hours for valve maintenance or testing. If the stop valve is not opened within two hours, A.C. power shall be removed from the valve and the breaker locked open.

3.4.1.6 Whenever a reactor coolant loop is isolated and drained, A.C. power shall be removed from the loop stop valves and the associated breakers locked open. When returning an isolated drained loop to service the following conditions shall be met:

a. Seal injection may be initiated to the reactor coolant pump in the isolated loop provided that:

   1. The isolated loop is drained.

   2. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

b. The cold leg stop valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System provided that:

   1. The isolated loop is drained.

   2. Pressurizer water volume is ≥ 450 cubic feet.

   3. A source range neutron flux monitor is operable.

c. Backfilling of the isolated loop may continue provided that:

   1. Pressurizer water volume shall be maintained at or above 450 cubic feet.

   2. The source range neutron flux count rate is no more than a factor of 2 above the initial count rate.

   3. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

d. When the isolated loop is full the loop stop valves can be fully opened provided that:

   1. The boron concentration in the loop is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

   2. The hot and cold leg stop valves are fully opened within 2 hours after the backfill of the isolated loop has been completed.

APPLICABILITY: MODES 5 and 6.

ACTION:

a. If the isolated loop is not drained then it must be fully drained before initiating seal injection to the reactor coolant pump in the loop or initiating backfill.

ACTION: (Continued)

b. If the pressurizer water volume is not maintained at 450 cubic feet or greater, then the loop stop valves on the loop being backfilled shall be closed, A.C. power shall be removed from the loop stop valves and the breakers locked open.

c. If the boron concentration of the RCP seal injection makeup source is not maintained ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode, then the loop stop valve on the loop being backfilled shall be closed and the loop drained or apply Specification 3.4.1.4 or 3.4.1.5.

d. If the source range count rate increases by a factor of two over the initial count rate, then the hot and cold leg loop stop valves shall be reclosed, power removed from the breakers and the breakers locked open. No attempt shall be made to reopen the loop stop valves until the reason for the count rate increase has been determined.

e. If the loop stop valves are not fully open within 2 hours after the loop is filled or Surveillance Requirement 4.4.1.6.5 is not met, then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

SURVEILLANCE REQUIREMENTS

4.4.1.6.1 The isolated loop shall be verified drained within 2 hours prior to initiating seal injection to the reactor coolant pump in the isolated loop or opening the loop stop valve for backfilling the loop from the Reactor Coolant System.

4.4.1.6.2 The pressurizer water volume shall be verified to be ≥ 450 cubic feet at least once per 15 minutes during filling of the isolated loop.

4.4.1.6.3 The source range neutron flux monitor shall be demonstrated OPERABLE by performance of:

a. A CHANNEL FUNCTIONAL TEST within 8 hours prior to commencing isolated loop backfill, and

b. A CHANNEL CHECK at least once per 15 minutes during backfilling of an isolated loop.

4.4.1.6.4 If using blended makeup flow as the source for reactor coolant pump seal injection, the boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode.

a. Within 1 hour prior to initiating seal injection to the reactor coolant pump in the isolated loop, and

b. once every hour after initiating seal injection to the reactor coolant pump.

4.4.1.6.5 The backfilled loop's boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode within 1 hour prior to fully opening the cold leg loop stop valve or opening the hot leg loop stop valve in the isolated loop.

3/4.4.1 REACTOR COOLANT LOOPS

The plant is designed to operate with all reactor coolant loops in operation and maintain the DNBR above the design limit during all normal operations and anticipated transients. In MODES 1 and 2 with one reactor coolant loop not in operation, this specification requires that the plant be in at least HOT STANDBY within 1 hour.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat, but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two RHR loops to be OPERABLE.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 235°F are provided to prevent RCS pressure transients, caused by energy additions from the secondary system which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

The operation of one Reactor Coolant Pump or one RHR pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reduction will therefore be within the capability of operator recognition and control.

The requirement to maintain the boron concentration of an isolated loop greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System ensures that no uncontrolled reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratification.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is

within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

An initially isolated and drained reactor coolant loop may be returned to service by partially opening the cold leg loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. To eliminate numerous reactor coolant pump jogs to completely fill a drained loop, a partial vacuum may be established in the isolated loop prior to commencing filling from the active volume of the Reactor Coolant System. The vacuum-assist loop fill evolution requires initiating seal injection to the reactor coolant pump to permit establishing an adequate vacuum in the isolated loop. A portion of the reactor coolant pump seal injection enters the isolated loop. To eliminate the reactivity concerns associated with the water injected into the isolated and drained loop from the seal injection, a water source of known boron concentration is used.

Prior to initiating seal injection to the reactor coolant pump in an isolated loop or partially opening the cold leg loop stop valves, the following measures are required to ensure no uncontrolled positive reactivity addition or loss of Reactor Coolant System inventory occurs:

a) The isolated loop is verified drained prior to the initial addition of water to return a loop to service, thus preventing the dilution of the Reactor Coolant System boron concentration by liquid present in the loop. Therefore, the verification of the loop being drained must occur either prior to initiation of seal injection to the Reactor Coolant Pump if the vacuum-assist backfill method is used or prior to opening the cold leg loop stop valve if the vacuum-assist backfill method is not used.

b) Pressurizer level is verified to be greater than or equal to 450 cubic feet prior to opening the cold leg loop stop valve to ensure Reactor Coolant System inventory is maintained for decay heat removal. In addition, the backfill evolution is limited to one isolated loop at a time.

c) The water source for reactor coolant pump seal injection is sampled to ensure the boron concentration of the source is greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d) A source range neutron flux monitor channel is monitored to detect any unexpected positive reactivity addition due to an inadvertent mismatch between RCS and blended makeup concentration.

During the loop fill evolution, the following measures are implemented to ensure no positive reactivity additions or sudden loss of Reactor Coolant System inventory occur:

a) Pressurizer level is maintained at greater than or equal to 450 cubic feet.

b) Makeup to the active portion of the Reactor Coolant System is through a flowpath that will ensure makeup flow is mixed with the reactor coolant in the active portion of the Reactor Coolant System and flows through the core prior to entering the loop being filled.

c) Blended makeup flow from the Boric Acid Storage Tank and the Primary Grade Water Tank, which is also a source for RCP seal injection, is periodically sampled to ensure the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d) The source range neutron flux monitor is monitored to provide a secondary indication of any possible dilution.

The potential reactivity effects due to Reactor Coolant System cooldown during and following loop backfill are limited to acceptable levels by the small absolute value of isothermal temperature coefficient of reactivity that exists at cold and refueling shutdown conditions. If steam generator secondary temperature is higher than the active portion of the Reactor Coolant System, a conservative heat transfer analysis demonstrates that 1) the pressurizer insurge rates that could result from heatup are easily accommodated by available relief capacity, and 2) the total integrated insurge due to heatup following backfill is very small, i.e. less than the unmeasured pressurizer volume above the upper level tap.

Reactivity effects due to boron stratification in the backfilled loop are not a concern since stratification is not expected to take place at the normal shutdown boron concentrations (2000-2400 ppm) and temperatures (40°F-200°F).

After an initially drained loop is filled from the Reactor Coolant System by partially opening the loop stop valves, the loop is no longer considered to be isolated. Thus, the requirements for returning an isolated and filled loop to service are not applicable and the loop stop valves may be fully opened without restriction within two hours of completing the loop backfill evolution.

The initial pressurizer level requirement has been established such that, even if the stop valves are suddenly opened on all three loops with all of them drained, one of them under vacuum and no makeup available, the Reactor Coolant System water level will not drop below the middle of the reactor vessel nozzles. This ensures continued adequate suction conditions for the residual heat removal pumps.

The safety analysis assumes a minimum shutdown margin as an initial condition. Violation of the limiting conditions for loop stop valve operation could result in the shutdown margin being reduced to less than that assumed in the safety analysis. In addition, violation of the limiting conditions could cause a loss of shutdown decay heat removal.

UNIT 2

TECH SPEC CHANGE REQUEST NO. 369A

TABULATION OF CHANGES

License No. NPF-7 / Docket No. 50-339

Summary of change:

This proposed change to the Technical Specifications is being made to facilitate the use of the vacuum-assisted fill technique and to eliminate a potential verbatim compliance issue.

DELETE	DATED	SUBSTITUTE
3/4 4-4	10-30-98	3/4 4-4
3/4 4-5a	10-30-98	3/4 4-5a
3/4 4-5b	10-30-98	3/4 4-5b
B 3/4 4-1	10-05-94	B 3/4 4-1
B 3/4 4-1a	10-30-98	B 3/4 4-1a

LIMITING CONDITION FOR OPERATION

3.4.1.4 The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System, unless the loop has been drained for maintenance.

APPLICABILITY: MODES 3, 4 and 5.

ACTION:

With the requirements of the above specification not satisfied, do not open the isolated loop's stop valves; either increase the boron concentration of the isolated loop to within the limits within 4 hours or borate the unisolated portion of the RCS to a SHUTDOWN MARGIN equivalent to at least 1.77% $\Delta k/k$ at 200°F within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.4 The boron concentration of an isolated, undrained loop shall be determined to be greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2 as applicable for the active volume of the Reactor Coolant System at least once per 24 hours and within 1 hour prior to opening either the hot leg or cold leg stop valves of an isolated loop.

REACTOR COOLANT SYSTEM

ISOLATED LOOP STARTUP - FILLED

LIMITING CONDITION FOR OPERATION

3.4.1.5 A reactor coolant loop cold leg stop valve on an undrained loop shall remain closed with A.C. power removed and its breaker locked open* unless:

a. The isolated loop has been operating on a recirculation flow greater than or equal to 125 gpm for at least 90 minutes and the temperature at the cold leg of the isolated loop is within 20°F of the highest cold leg temperature of the operating loops, and

b. The reactor is subcritical by at least 1.77 percent Δk/k, or

c. The loop is being backfilled in accordance with Specification 3.4.1.6.

APPLICABILITY: MODES 3, 4, 5 and 6.

ACTION:

With the requirements of the above specification not satisfied, suspend startup of the isolated loop. A.C. power shall be removed from the valve and the breaker locked open within 2 hours.

SURVEILLANCE REQUIREMENTS

4.4.1.5.1 The isolated loop cold leg temperature shall be determined to be within 20°F of the highest cold leg temperature of the operating loops within 30 minutes prior to opening the cold leg stop valve.

4.4.1.5.2 The reactor shall be determined to be subcritical by at least 1.77 percent Δk/k within 30 minutes prior to opening the cold leg stop valve.

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* A cold leg stop valve in a reactor coolant loop may be closed for up to two hours for valve maintenance or testing. If the stop valve is not opened within two hours, A.C. power shall be removed from the valve and the breaker locked open.

LIMITING CONDITION FOR OPERATION

3.4.1.6 Whenever a reactor coolant loop is isolated and drained, A.C. power shall be removed from the loop stop valves and the associated breakers locked open. When returning as isolated drained loop to service the following conditions shall be met:

a. Seal injection may be initiated to the reactor coolant pump in the isolated loop provided that:

   1. The isolated loop is drained.

   2. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

b. The cold leg stop valves may be energized and/or opened to fill the loop from the active volume of the Reactor Coolant System provided that:

   1. The isolated loop is drained.

   2. Pressurizer water volume is ≥ 450 cubic feet.

   3. A source range neutron flux monitor is operable.

c. Backfilling of the isolated loop may continue provided that:

   1. Pressurizer water volume shall be maintained at or above 450 cubic feet.

   2. The source range neutron flux count rate is no more than a factor of 2 above the initial count rate.

   3. The boron concentration of the reactor coolant pump seal injection source is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

d. When the isolated loop is full the loop stop valves can be fully opened provided that:

   1. The boron concentration in the loop is ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode.

   2. The hot and cold leg stop valves are fully opened within 2 hours after the backfill of the isolated loop has been completed.

APPLICABILITY: MODES 5 and 6.

ACTION:

a. If the isolated loop is not drained then it must be fully drained before initiating seal injection to the reactor coolant pump in the loop or initiating backfill.

LIMITING CONDITION FOR OPERATION

ACTION: (Continued)

b. If the pressurizer water volume is not maintained at 450 cubic feet or greater, then the loop stop valves on the loop being backfilled shall be closed, A.C. power shall be removed from the loop stop valves and the breakers locked open.

c. If the boron concentration of the RCP seal injection makeup source is not maintained ≥ the boron concentration requirements of Specification 3.9.1 or 3.1.1.2 for the applicable Mode, then the loop stop valve on the loop being backfilled shall be closed and the loop drained or apply Specification 3.4.1.4 or 3.4.1.5.

d. If the source range count rate increases by a factor of two over the initial count rate, then the hot and cold leg loop stop valves shall be reclosed, power removed from the breakers and the breakers locked open. No attempt shall be made to reopen the loop stop valves until the reason for the count rate increase has been determined.

e. If the loop stop valves are not fully open within 2 hours after the loop is filled or Surveillance Requirement 4.4.1.6.5 is not met, then the loop shall be isolated and drained or apply Specification 3.4.1.4 and 3.4.1.5.

SURVEILLANCE REQUIREMENTS

4.4.1.6.1 The isolated loop shall be verified drained within 2 hours prior to initiating seal injection to the reactor coolant pump in the isolated loop or opening the loop stop valve for backfilling the loop from the Reactor Coolant System.

4.4.1.6.2 The pressurizer water volume shall be verified to be ≥ 450 cubic feet at least once per 15 minutes during filling of the isolated loop.

4.4.1.6.3 The source range neutron flux monitor shall be demonstrated OPERABLE by performance of:

a. A CHANNEL FUNCTIONAL TEST within 8 hours prior to commencing isolated loop backfill, and

b. A CHANNEL CHECK at least once per 15 minutes during backfilling of an isolated loop.

4.4.1.6.4 If using blended makeup flow as the source for reactor coolant pump seal injection, the boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode.

a. Within 1 hour prior to initiating seal injection to the reactor coolant pump in the isolated loop, and

b. once every hour after initiating seal injection to the reactor coolant pump.

4.4.1.6.5 The backfilled loop's boron concentration shall be verified to be ≥ the boron concentration requirements of TS 3.9.1 or TS 3.1.1.2 for the applicable Mode within 1 hour prior to fully opening the cold leg loop stop valve or opening the hot leg loop stop valve in the isolated loop.

3/4.4.1 REACTOR COOLANT LOOPS

The plant is designed to operate with all reactor coolant loops in operation and maintain the DNBR above design limit during all normal operations and anticipated transients. In MODES 1 and 2 with one reactor coolant loop not in operation, this specification requires that the plant be in at least HOT STANDBY within 1 hour.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat, but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two RHR loops to be OPERABLE.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 270°F are provided to prevent RCS pressure transients, caused by energy additions from the secondary system which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

The requirement to maintain the boron concentration of an isolated loop greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System the boron concentration of the operating loops ensures that no uncontrolled reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratifications.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

An initially isolated and drained reactor coolant loop may be returned to service by partially opening the cold leg loop stop valves and filling the loop in a controlled manner from the Reactor Coolant System. To eliminate numerous reactor coolant pump jogs to completely fill a drained loop, a partial vacuum may be established in the isolated loop prior to commencing filling from the active volume of the Reactor Coolant System. The vacuum-assist loop fill evolution requires initiating seal injection to the reactor coolant pump to permit establishing an adequate vacuum in the isolated loop. A portion of the reactor coolant pump seal injection enters the isolated loop. To eliminate the reactivity concerns associated with the water injected into the isolated and drained loop from the seal injection, a water source of known boron concentration is used.

Prior to initiating seal injection to the reactor coolant pump in an isolated loop or partially opening the cold leg loop stop valves, the following measures are required to ensure no uncontrolled positive reactivity addition or loss of Reactor Coolant System inventory occurs:

a) The isolated loop is verified drained prior to the initial addition of water to return a loop to service, thus preventing the dilution of the Reactor Coolant System boron concentration by liquid present in the loop. Therefore, the verification of the loop being drained must occur either prior to initiation of seal injection to the Reactor Coolant Pump if the vacuum-assist backfill method is used or prior to opening the cold leg loop stop valve if the vacuum-assist backfill method is not used.

b) Pressurizer level is verified to be greater than or equal to 450 cubic feet prior to opening the cold leg loop stop valve to ensure Reactor Coolant System inventory is maintained for decay heat removal. In addition, the backfill evolution is limited to one isolated loop at a time.

c) The water source for reactor coolant pump seal injection is sampled to ensure the boron concentration of the source is greater than or equal to the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d) A source range neutron flux monitor channel is monitored to detect any unexpected positive reactivity addition due to an inadvertent mismatch between RCS and blended makeup concentration.

During the loop fill evolution, the following measures are implemented to ensure no positive reactivity additions or sudden loss of Reactor Coolant System inventory occur:

a) Pressurizer level is maintained at greater than or equal to 450 cubic feet.

b) Makeup to the active portion of the Reactor Coolant System is through a flowpath that will ensure makeup flow is mixed with the reactor coolant in the active portion of the Reactor Coolant System and flows through the core prior to entering the loop being filled.

c) Blended makeup flow from the Boric Acid Storage Tank and the Primary Grade Water Tank, which is also a source for RCP seal injection, is periodically sampled to ensure the boron concentration corresponding to the SHUTDOWN MARGIN requirements for the active portion of the Reactor Coolant System.

d) The source range neutron flux monitor is monitored to provide a secondary indication of any possible dilution.

The potential reactivity effects due to Reactor Coolant System cooldown during and following loop backfill are limited to acceptable levels by the small absolute value of isothermal temperature coefficient of reactivity that exists at cold and refueling shutdown conditions. If steam generator secondary temperature is higher than the active portion of the Reactor Coolant System, a conservative heat transfer analysis demonstrates that 1) the pressurizer insurge rates that could result from heatup are easily accommodated by available relief capacity, and 2) the total integrated insurge due to heatup following backfill is very small, i.e. less than the unmeasured pressurizer volume above the upper level tap.

Reactivity effects due to boron stratification in the backfilled loop are not a concern since stratification is not expected to take place at the normal shutdown boron concentrations (2000-2400 ppm) and temperatures (40°F-200°F).

After an initially drained loop is filled from the Reactor Coolant System by partially opening the loop stop valves, the loop is no longer considered to be isolated. Thus, the requirements for returning an isolated and filled loop to service are not applicable and the loop stop valves may be fully opened without restriction within two hours of completing the loop backfill evolution.

The initial pressurizer level requirement has been established such that, even if the stop valves are suddenly opened on all three loops with all of them drained, one of them under vacuum and no makeup available, the Reactor Coolant System water level will not drop below the middle of the reactor vessel nozzles. This ensures continued adequate suction conditions for the residual heat removal pumps.

The safety analysis assumes a minimum shutdown margin as an initial condition. Violation of the limiting conditions for loop stop valve operation could result in the shutdown margin being reduced to less than that assumed in the safety analysis. In addition, violation of the limiting conditions could cause a loss of shutdown decay heat removal.

Attachment 5

Significant Hazards Consideration Determination

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company

SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Virginia Electric and Power Company has reviewed the requirements of 10 CFR 50.92 as they relate to the proposed changes for the North Anna Units 1 and 2 and determined that a significant hazards consideration is not involved. The proposed Technical Specification establishes limiting conditions for operation and surveillance requirements for isolated loops backfill. Specifically, Technical Specifications requirements are being established to control the source of borated water for seal injection to the reactor coolant pumps (RCP) and to address reactivity control of an isolated and filled loop. The proposed controls ensure that the boron concentration of any source of water used for reactor coolant pump seal injection is greater than or equal to the boron concentration corresponding to the shutdown margin requirements for the applicable Mode. The proposed changes will establish consistent reactivity controls for isolated Reactor coolant systems (RCS) loops. The Bases has been revised to further discuss the additional controls for the loop backfill evolution. Adequate Technical Specifications controls have been established to ensure that an uncontrolled positive reactivity addition does not occur during a loop backfill evolution. The proposed changes will ensure that an inadvertent/undetected positive reactivity addition does not occur. The following is provided to support this conclusion.

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated.

   The proposed Technical Specification limiting conditions for operation and surveillance requirements ensure that the initiation of seal injection in order to allow a partial vacuum to be established in an isolated and drained loop will not create the potential for an inadvertent/undetected introduction of under-borated water into an isolated loop prior to returning the isolated loop to service. The proposed Technical Specification controls prevent any additions of makeup or seal injection that would violate the existing shutdown margin requirements for the active portion of the RCS. Thus, adequate Technical Specification controls are established to preclude an inadvertent/undetected boron dilution event. Therefore, there is no increase in the probability or consequences of any accident previously evaluated.

2. Create the possibility of a new or different kind of accident from any accident previously evaluated.

   There are no modifications to the plant as a result of the changes. The proposed Technical Specification Limiting Conditions for Operation and Surveillance Requirements ensure that the initiation of seal injection will not create an undetected positive reactivity addition. No new accident or event initiators are created by the initiation of seal injection for the RCP in the isolated loop in order to establish a partial vacuum in that isolated and drained loop. Therefore, the proposed changes do not create the possibility of any accident or malfunction of a different type previously evaluated.

3. Involve a significant reduction in the margin of safety as defined in the bases on any Technical Specifications.

The proposed changes have no effect on safety analyses assumptions. Rather, the proposed changes acknowledge the establishment of seal injection for the RCP in the isolated and drained loop as a prerequisite for the vacuum-assisted backfill technique. The proposed Technical Specification Limiting Conditions for Operation and Surveillance Requirements ensure that the initiation of seal injection in order to allow a partial vacuum to be established in an isolated and drained loop will not create the potential for an inadvertent/undetected introduction of under-borated water into an isolated loop prior to returning the isolated loop to service. Adequate Technical Specifications controls are established to preclude an inadvertent/undetected boron dilution event. In addition, the proposed controls prevent any additions of makeup or seal injection that would violate the existing shutdown margin requirements for the active portion of the Reactor Coolant System. Therefore, the proposed changes do not result in a reduction in a margin of safety.