AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

December 15, 2003

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Ladies and Gentlemen: ULNRC-04883

DOCKET NO. 50-483
UNION ELECTRIC COMPANY
CALLAWAY PLANT
PROPOSED REVISION TO TECHNICAL SPECIFICATION 3.9.2
"UNBORATED WATER SOURCE ISOLATION VALVES"
TO REVISE AND RENAME SPECIFICATION 3.9.2
"DILUTION SOURCE ISOLATION VALVES" AND ASSOCIATED
REVISION TO TECHNICAL SPECIFICATION
3.3.9 "BORON DILUTION MITIGATION SYSTEM (BDMS)"

Pursuant to 10 CFR 50.90, AmerenUE, requests an amendment to the Facility Operating License No. NPF-30 for Callaway Plant. The amendment application would revise Technical Specifications (TS) 3.9.2, "Unborated Water Source Isolation Valves," to remove the phrase "unborated water" throughout and replace it with the word "dilution", including renaming TS 3.9.2. In addition, the reference to specific Chemical and Volume Control system (CVCS) isolation valves BGV0178 and BGV0601 is deleted and replaced with the generic phrase "dilution source isolation valves". The generic reference to dilution source isolation valves ensures that all dilution sources and their associated isolation valves, including the Boron Thermal Regeneration System (BTRS) and the Nuclear Sampling System (SJ), are covered by the Specification. Revised TS 3.9.2 covers all inadvertent boron dilution events in Mode 6.

In an associated change, TS 3.3.9 REQUIRED ACTIONS for CONDITIONS B and C are also revised to substitute the word "dilution" for "unborated water" and to eliminate reference to specific isolation valves. The revisions make TS 3.3.9 consistent with TS 3.9.2. Specific isolation valves are not required in the Standard Technical Specifications, NUREG-1431. Removing them from the Specifications and relocating them in the appropriate TS Bases is an administrative only change and is consistent with the Standard Technical Specifications.

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Control rod withdrawal and diluting the reactor coolant system (RCS) boron concentration are the two principle means of inserting positive reactivity into the reactor core. Boron dilution can occur by two methods: (1) adding unborated, primary grade water from the reactor makeup water system (RWMS) into the RCS through the reactor makeup portion of the chemical and volume control system (CVCS) or, (2) removing boron from the CVCS stream prior to RCS return using the ion exchange capability of the BTRS.

TS 3.9.2 LCO identifies two specific valves (BGV0178 and BGV0601) to address the first boron dilution method. Current TS 3.9.2 does not contemplate the potential dilution source associated with flushing the CVCS letdown radiation monitor SJRE001 (a component of the SJ system) with unborated reactor makeup water. Current TS 3.9.2 also does not contemplate the effect of the BTRS as a potential boron dilution source. As a result, the Specification does not adequately address all potential dilution sources, and does not preclude all potential inadvertent dilution events in Mode 6. By generically referring to "dilution source isolation valves", the revised TS 3.9.2 LCO incorporates all dilution sources and associated isolation valves. References to specific valves are transferred to the TS 3.9.2 Bases.

In addition, TS 3.3.9 is made consistent with TS 3.9.2 by revising the "unborated water" source to "dilution" source and by moving specific isolation valve identification to TS Bases.

The appropriate TS Bases changes for the proposed specification revisions are included for information and reflect the proposed changes.

Attachment 1 to this submittal provides the required Affidavit. Attachment 2 provides a detailed description, safety analysis of the proposed changes, and the Callaway determination that the proposed change does not involve a significant hazard consideration. Attachment 3 provides the existing TS pages marked-up to show the proposed change. Attachment 4 provides a clean copy of the proposed Technical Specification pages. Attachment 5 provides the existing TS Bases pages marked-up to show the proposed changes (for information only). Finally, Attachment 6 provides FSAR revisions to incorporate the proposed changes (for information only).

This letter identifies actions committed to by AmerenUE and Callaway Plant in this submittal. Other statements are provided for information purposes and are not considered to be commitments. A summary of the regulatory commitments included in this submittal is provided in Attachment 7.

This amendment application was approved by the Callaway Plant Review Committee and the Nuclear Safety Review Board. It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10 CFR 50.92. In addition, pursuant to 10 CFR 51.22(b), no environmental assessment need be prepared in connection with the issuance of this amendment.

AmerenUE requests approval of this proposed License Amendment by September 1, 2004. The approved amendment will be implemented within 90 days of approval.

Pursuant to 10 CFR 50.91(b)(1), AmerenUE is providing the State of Missouri with a copy of this proposed amendment.

If you should have any questions on the above or attached, please contact Dave Shafer at (314) 554-3104 or Dwyla Walker at (314) 554-2126.

Very truly yours,

Keith D. Young
Manager, Regulatory Affairs

DJW/jdg

Attachment:
1) Affidavit
2) Evaluation
3) Markup of Technical Specification pages
4) Retyped Technical Specification pages
5) Markup of Technical Specification Bases pages (for information only)
6) Markup of Callaway FSAR pages (for information only)
7) Summary of Regulatory Commitments

cc: U. S. Nuclear Regulatory Commission (Original and 1 copy)
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Mr. Bruce S. Mallet
Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-4005

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Jack N. Donohew (2 copies)
Licensing Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop 7E1
Washington, DC 20555-2738

Manager, Electric Department
Missouri Public Service Commission
PO Box 360
Jefferson City, MO 65102

STATE OF MISSOURI)
) S S
COUNTY OF CALLWAY)

Keith D. Young, of lawful age, being first duly sworn upon oath says that he is Manager, Regulatory Affairs, for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Keith D. Young
Keith D. Young
Manager, Regulatory Affairs

SUBSCRIBED and sworn to before me this 15th day of December, 2003.

Cathy J. Crisp
Notary Public
State of Missouri
Expiration 1-29-06

ULNRC-04883

ATTACHMENT 2

EVALUATION

PROPOSED REVISION TO TECHNICAL SPECIFICATION 3.9.2, "UNABORATED WATER SOURCE ISOLATION VALVES" TO REVISE AND RENAME SPECIFICATION 3.9.2 "DILUTION SOURCE ISOLATION VALVES" AND ASSOCIATED REVISION TO TECHNICAL SPECIFICATION 3.3.9 "BORON DILUTION MITIGATION SYSTEM (BDMS)"

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EVALUATION

1.0 INTRODUCTION

This letter is a request to amend Operating License NPF-30 for Callaway Plant.

The amendment application would revise Technical Specifications (TS) 3.9.2, "Unborated Water Source Isolation Valves," to remove the phrase "unborated water" throughout and replace it with the word "dilution", including renaming TS 3.9.2 "Dilution Source Isolation Valves". In addition, the reference to specific Chemical and Volume Control system (CVCS) isolation valves BGV0178 and BGV0601 is deleted and replaced with the generic phrase "dilution source isolation valves". These changes to a generic Specification ensure that all dilution sources and their associated isolation valves, including the Boron Thermal Regeneration System (BTRS) and the Nuclear Sampling System (SJ), are included. The revised TS 3.9.2 precludes all inadvertent boron dilution events in Mode 6.

In an associated change, TS 3.3.9 REQUIRED ACTIONS for CONDITIONS B and C are also revised to substitute the word "dilution" for "unborated water" and to eliminate references to specific isolation valves. The revisions make TS 3.3.9 consistent with TS 3.9.2.

The proposed changes to a generic Specification maintain the plant in a safe condition by ensuring that all potential boron dilution sources are isolated in Mode 6. The proposed changes do not alter design bases or technical requirements.

2.0 DESCRIPTION OF PROPOSED AMENDMENT

The amendment application revises Technical Specifications (TS) 3.9.2, "Unborated Water Source Isolation Valves," to remove the phrase "unborated water" throughout and replace it with the word "dilution", including renaming the TS 3.9.2. In addition, the reference to specific CVCS isolation valves BGV0178 and BGV0601 is deleted and replaced with the generic phrase "dilution source isolation valves". This ensures that all dilution sources and their associated isolation valves are included in the Specification, (including the potential dilution source associated with the BTRS anion resin vessels and the potential source associated with flushing the CVCS letdown gamma radiation detector SJRE001). The revised TS 3.9.2 precludes all inadvertent boron dilution events in Mode 6. References to specific dilution sources and their associated isolation valves are removed from the current TS 3.9.2 LCO and SURVEILLANCE REQUIREMENTS and are transferred to TS 3.9.2 Bases. A NOTE is added to the LCO such that during refueling decontamination activities, a dilution source path may be unisolated, when required, under administrative controls. Based on Amendment 97 to the Callaway Plant Operating License, administrative controls are used to limit the volume of unborated

water which can be added to the refueling pool for decontamination activities in order to prevent diluting the refueling pool boron concentration below TS limits.

In an associated change, TS 3.3.9 REQUIRED ACTIONS for CONDITIONS B and C are also revised to substitute the word "dilution" for "unborated water" and to eliminate reference to specific isolation valves. The revisions make TS 3.3.9 consistent with TS 3.9.2. Specific isolation valves are not required in the Standard Technical Specifications, NUREG-1431. Removing them from the Specifications and relocating them in the appropriate TS Bases is an administrative only change and is consistent with the Standard Technical Specifications.

Various TS Bases are revised to incorporate the generic use of the term "dilution sources". In addition, specific isolation valves are identified in various TS Bases for isolation of unborated reactor makeup water (associated isolation valves BGV0178 and BGV0601) as a dilution source, for isolation of BTRS anion resin vessels configured with anion resin (associated isolation valves BGV0039, BGV0043, BGV0051 and BGV0055), and isolation of CVCS letdown gamma radiation detector SJRE0001 purge line (associated isolation valve SJV0703) as additional dilution sources. The various revised TS Bases include TS Bases 3.3.1, RTS Instrumentation; TS Bases 3.3.9, Boron Dilution Mitigation System; TS Bases 3.4.5, RCS Loops-MODE 3; TS Bases 3.4.6, RCS Loops-MODE 4; TS Bases 3.4.7, RCS Loops-MODE 5, Loops Filled; TS Bases 3.4.8, RCS Loops-MODE 5, Loops Not Filled; TS Bases 3.9.1, Boron Concentration and TS Bases 3.9.2, Unborated Water Source Isolation Valves. Note that plant chemistry controls may require some BTRS anion resin vessels to be configured with resin not intended for boron dilution. In this case, isolation of these anion resin vessels is not required in Mode 6, if administrative controls ensure the resin is preconditioned with borated water that is equal to or greater than the refueling water concentration.

3.0 BACKGROUND

3.1 Boron Dilution Event and Mitigation

At Callaway, a design basis accident postulates a CVCS malfunction that results in a decrease in the boron concentration in the RCS – an inadvertent boron dilution event. The postulated inadvertent boron dilution event is considered for all phases of plant operation.

The Boron Dilution Mitigation System (BDMS) has the primary purpose to mitigate the consequences of the inadvertent addition of unborated primary grade water into the RCS when the plant is in MODES 2 (below P-6 setpoint), 3, 4, and 5. The P-6 setpoint relates to the Intermediate Range Neutron Flux interlock.

The BDMS functions with two channels of source range instrumentation. Each source range channel provides a signal to its microprocessor, which continuously records the counts per minute. The BDMS instrumentation senses abnormal increases in source

range counts per minute (flux rate) and actuates CVCS and refueling water storage tank valves in order to mitigate an inadvertent boron dilution event. Based on abnormal flux multiplication, BDMS sounds an alarm to alert the operator and also automatically initiates valve movement to terminate the dilution and start boration.

Plant specific analyses have demonstrated a wide range of dilution flow rates that are automatically covered by BDMS and the fact that the times involved allow credit for operator action to terminate the inadvertent dilution transient. Because an inadvertent boron dilution would be terminated by Overtemperature ΔT or by operator action, the BDMS is not required for MODES 1 and 2 (above P-6 setpoint).

TS 3.3.9, "Boron Dilution Mitigation System (BDMS)" ensures the availability of the BDMS by requiring two trains of BDMS instrumentation to be OPERABLE and one loop of RCS to be in operation during MODES 2 (below P-6 setpoint) through 5. The BDMS is not applicable in MODE 6.

In MODE 6, the inadvertent boron dilution is precluded by isolating the unborated water source from the RCS. The unborated water source contemplated is the addition of primary grade water from the reactor makeup water system (RWMS) into the RCS through the reactor makeup portion of the CVCS. Under the current TS 3.9.2, inadvertent dilution via the CVCS blending tee is prevented by administrative controls which isolate the RCS from this potential source of unborated water. Under current TS 3.9.2 the CVCS isolation valves BGV0178 and BGV0601 are locked closed during refueling operations. The Callaway Plant FSAR credits the physical barrier created by valve isolation to defeat the dilution source and preclude the possibility of an inadvertent boron dilution event. Also, in MODE 6, during refueling decontamination activities, per Amendment 97 to the Callaway Plant Operating License, administrative controls limit the volume of unborated water added to the refueling pool in order to prevent diluting the refueling pool below the limits specified in TS LCO 3.9.1. The administrative controls are discussed in TS Bases 3.9.1, APPLICABLE SAFETY ANALYSES.

3.2 Additional Dilution Sources Identified

Callaway Plant has performed a review of plant systems and evaluated other potential dilution sources from primary system resin beds and other potential dilution paths for reactor makeup water to enter the RCS. As a result, additional dilution sources have been identified and are discussed below.

CVCS and BTRS

The CVCS and its subsystem the BTRS are designed to vary the RCS boron concentration to compensate for xenon transients and other reactivity changes which occur when the reactor power changes during load following. Although the primary function is to compensate for xenon transients during load follow, the BTRS is also used to handle boron changes during other modes of plant operation: startups and shutdown. The letdown flow from the RCS to the CVCS may be diverted to the BTRS when boron

concentration changes are desired. After processing by the BTRS, the stream is returned to the letdown flow path.

Prior to the proposed amendment, the effect of the BTRS had been overlooked as a possible source of boron dilution. Administrative controls taken by Callaway Plant to isolate the potential RCS dilution source in Mode 6 did not include consideration of the BTRS as a dilution source. The CVCS cation resin bed location allows a portion of the BTRS to be used for normal operations and for RCS clean-up. As a dilution source the BTRS could potentially remove boron from the CVCS stream using the BTRS ion exchange capability prior to return to the RCS. The risk of an inadvertent boron dilution via the BTRS is related to the potential for the anion resin, contained in BTRS anion resin vessels, to dilute the RCS boron concentration as a result of equipment failure or human error. Depending on the condition of the anion resin, operation of the BTRS could equate to diluted borated water or to a worst-case pure water addition into the RCS.

Under the revised TS 3.9.2, deliberate steps are required to isolate the BTRS vessels containing anion resin, when necessary, to avoid an inadvertent boron dilution event in Mode 6. Should the BDMS be unavailable in higher modes of plant operation, then the BTRS vessels containing anion resin would be secured closed under administrative controls.

Flushing CVCS Letdown Gamma Radiation Detector SJRE001

The effect of purging the CVCS letdown gamma radiation detector SJRE001, by flushing the detector with unborated reactor makeup water, raises concern for a potential dilution path to the CVCS volume control tank (VCT) and the reactor coolant system. Based on plant experience, the detector SJRE001 often becomes fouled with boric acid, causing it to become plugged and resulting in an intolerable increase in the detector's background gamma radiation. Whenever this occurred in the past, the detector was routinely disassembled and decontaminated at the expense of personnel dose and time. A plant modification will be implemented to use existing piping to flush the detector with unborated reactor makeup water.

Although flushing the detector with unborated reactor makeup water is effective, the activity creates a dilution source via the purge line discharge to the VCT. Nuclear sampling system valve SJV0703 isolates the reactor makeup water supply used to purge detector SJRE001. Because flushing the detector is not a requirement in MODE 6, valve SJV0703 may be secured closed to prevent the potential dilution path. Capability to flush the detector may be necessary at higher modes of operation, however, the flushing activity would be covered by the BDMS. In the event the BDMS is unavailable, the valve SJV0703 would be secured closed under administrative controls.

Under the revised TS 3.9.2, securing valve SJV0703 closed precludes the flushing activity and the possibility of the dilution event. Based on plant experience, a need to flush the detector during refueling activities is unlikely. In addition, if the BDMS should become unavailable in other plant modes, then purging the detector would be precluded

under administrative controls until BDMS would become available. The requirement to secure valve SJV0703 closed assures that the inadvertent dilution event would not occur.

3.3 Summary

In Mode 6, current TS 3.9.2 requires deliberate steps to isolate reactor makeup water valves connected to the RCS to prevent inadvertent dilution. Revised TS 3.9.2 requires the same degree of control for the BTRS anion resin vessels and isolation of the purge line for flushing the CVCS letdown gamma radiation detector SJRE001. Deliberate steps are taken to isolate the BTRS vessels containing anion resin and to isolate the purge line for detector SJRE001, when necessary, to avoid an inadvertent boron dilution event in Mode 6.

Various TS Bases and FSAR Section 15.4.6 are revised to reflect the potential boron dilution sources. These markups are included as attachments to reflect the proposed changes and are provided for information only.

4.0 TECHNICAL ANALYSIS

The amendment application revises Technical Specifications (TS) 3.9.2, "Unborated Water Source Isolation Valves," to remove the phrase "unborated water" throughout and replace it with the word "dilution", including renaming the TS 3.9.2 "Dilution Source Isolation Valves". In addition, the reference to specific CVCS isolation valves BGV0178 and BGV0601 is deleted and replaced with the generic phrase "dilution source isolation valves". These changes to a generic Specification ensure that all dilution sources and their associated isolation valves are included in the Specification. The revised TS 3.9.2 precludes all inadvertent boron dilution events in Mode 6.

In an associated change, TS 3.3.9 REQUIRED ACTIONS for CONDITIONS B and C are also revised to substitute the word "dilution" for "unborated water" and to eliminate reference to specific isolation valves. The revisions make TS 3.3.9 consistent with TS 3.9.2. Specific isolation valves are not required in the Standard Technical Specifications, NUREG-1431. Removing them from the Specifications and relocating them in the appropriate TS Bases is an administrative only change and is consistent with the Standard Technical Specifications.

In MODE 6, the inadvertent dilution event is avoided when TS 3.9.2 requirements are met. As stated in the Callaway FSAR, Section 15.4.6, inadvertent boron dilution via the CVCS blending tee is prevented by administrative controls which isolate the RCS from potential sources of unborated water. Under current TS 3.9.2 and plant administrative controls, the isolation valves BGV0178 and BGV0601 in the CVCS are locked closed during refueling operations to defeat a dilution source.

However, current TS 3.9.2 does not include consideration of the BTRS vessels as potential dilution source. Based on these omissions, the possibility exists for the

occurrence of an inadvertent boron dilution event. Plant compensatory actions have been taken to revise plant administrative procedures to include isolation of the BTRS anion vessels, if needed to avoid a boron dilution event. Procedural guidance requires flushing borated water through the resin beds and subsequent testing of the effluent prior to placing the vessel in service. The revised TS 3.9.2, "Dilution Source Isolation Valves", will ensure that the BTRS anion resin vessels are isolated in MODE 6, if required.

Further evaluations were conducted to determine the risk of inadvertent boron dilution events from other primary system resin beds. In all cases the resin beds are borated prior to service to match the influent stream concentration. Plant procedures govern these evolutions and implement the administrative controls important to reactivity management.

Current TS 3.9.2 also does not consider flushing the CVCS letdown gamma radiation detector SJRE001 with unborated reactor makeup water in Mode 6 as a potential dilution source. Valve SJV0703 isolates the reactor makeup water supply used to purge the detector SJRE001. During a purge cycle the unborated reactor makeup purge water flushes through the detector and discharges to the VCT. Plant procedures have been revised so that administrative controls are placed to isolate valve SJV0703 during refueling activities. This will preclude the flushing activity and a potential boron dilution event in MODE 6. Flushing the detector in higher modes of plant operation is covered by the BDMS. Should the BDMS become unavailable, the valve SJV0703 is secured closed under administrative controls. The flushing activity is precluded as well as a potential boron dilution event.

Based on a review of plant systems and an evaluation of other potential dilution sources from primary system resin beds, and other potential dilution paths for reactor makeup water to enter the RCS, there are no other "overlooked" unborated water systems connected to the RCS that could become a credible potential dilution source.

Recognizing that the BTRS anion resin vessels and flushing the CVCS letdown gamma radiation detector SJRE001 are potential boron dilution sources does not alter the original FSAR analysis, conclusion, and consequences evaluated for the inadvertent boron dilution event during MODE 6. The proposed changes are acceptable and the revised administrative controls assure that TS 3.3.9 and TS 3.9.2 requirements are met.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

AmerenUE has evaluated whether or not a significant hazards consideration is involved with the proposed changes by focusing on the three standards set forth in 10 CFR 50.92(c) as discussed below:

1. Do the proposed changes involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed changes do not involve a significant increase in the probability or consequences of an inadvertent boron dilution accident by isolating the BTRS anion resin vessels in MODE 6 or by isolating the purge line for detector SJRE001 during flushing activities in MODE 6. By recognizing these potential dilution sources and by making TS 3.3.9 and TS 3.9.2 more generic for consideration of all potential dilution sources, plant administrative controls are revised such that the plant is put in a safer condition than before. Specific isolation valves are removed from TS 3.3.9 and TS 3.9.2. They are relocated from the Specifications to the appropriate TS Bases. This is an administrative only change and is consistent with the Standard Technical Specification, NUREG-1431. Allowing a dilution source path to be unisolated under administrative controls, described in TS Bases 3.9.1 during refueling decontamination activities, is acceptable as allowed by Amendment 97 to the Callaway Operating License and does not involve a significant increase in the probability or consequences of an inadvertent boron dilution accident.

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

2. Do the proposed changes create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The proposed changes do not create the possibility of a new or different kind of accident. Although other potential dilution sources are identified for administrative control, the evaluation of a MODE 6 dilution event remains unchanged. Isolating the BTRS anion vessels or isolating the purge line for detector SJRE001 during flushing activities in MODE 6 and making TS 3.3.9 and TS 3.9.2 more generic does not impact the operability of any safety related equipment required for plant operation. No new equipment will be added and no new limiting single failures are created. The plant will continue to be operated within the envelope of the existing safety analysis. In addition specific isolation valves are removed from TS 3.3.9 and TS 3.9.2. They are relocated from the Specifications to the appropriate TS Bases. This is an administrative only change and is consistent with the Standard Technical Specification, NUREG-1431. Allowing a dilution source path to be unisolated under administrative controls, described in TS Bases 3.9.1 during refueling decontamination activities, is acceptable as allowed by Amendment 97 to the Callaway Operating License and does not create the possibility of a new or different kind of inadvertent boron dilution accident.

   Therefore, the proposed changes do not create a new or different kind of accident from any accident previously evaluated.

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

Response: No

The proposed changes do not reduce the margin of safety. Although other potential dilution sources are identified for administrative control and TS 3.3.9 and TS 3.9.2 are made more generic for consideration of all potential dilution sources, the evaluated margin of safety for a dilution event in MODE 6 remains the same. Recognition of other potential dilution sources, isolation of the BTRS anion resin beds and the purge line for detector SJRE001 during flushing activities in MODE 6, places the plant in a safer condition than before. In addition specific isolation valves are removed from TS 3.3.9 and TS 3.9.2. They are relocated from the Specifications to the appropriate TS Bases. This is an administrative only change and is consistent with the Standard Technical Specification, NUREG-1431. Finally, allowing a dilution source path to be unisolated under administrative controls, described in TS Bases 3.9.1 during refueling decontamination activities, is acceptable as allowed by Amendment 97 to the Callaway Operating License and does not involve a significant reduction in a margin of safety due to an inadvertent boron dilution accident.

Therefore, the proposed changes do not involve a significant reduction in the margin of safety.

Based on the above evaluations, AmerenUE concludes that the activities associated with the above described changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92 and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The regulatory basis for TS 3.9.2, discussed in Callaway FSAR Section 15.4.6, is to ensure that an uncontrolled boron dilution transient will not occur in MODE 6. Inadvertent dilution via the CVCS blending tee is prevented by administrative controls which isolate the RCS from potential sources of unborated water. Valves BGV0178 and BGV0601 in the CVCS are locked closed during refueling operations, creating physical barriers, via valve isolation, to defeat a dilution source and preclude the possibility of an inadvertent boron dilution event.

NUREG-0800, "U. S. NRC Standard Review Plan," Section 15.4.6, provides guidance to the NRC staff for the review and evaluation of system design features and plant procedures provided for the mitigation of Chemical and Volume Control System malfunctions that result in a decrease in boron concentration in the RCS.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 10, "Reactor Design," requires that the RCS is provided with appropriate margin to assure that specified

acceptable fuel design limits are not exceeded during normal operations including anticipated operational occurrences.

GDC 15, "Reactor Coolant System Design," assures the RCS and its associated auxiliaries are provided with appropriate margin to assure that the pressure boundary will not be breeched during normal operations including anticipated operational occurrences.

GDC 26, "Reactivity Control System Redundancy and Capability," relates to the reliable control of reactivity changes to assure that specified acceptable fuel design limits are not exceeded, including anticipated operational occurrences. This is accomplished by assuring that appropriate margin for malfunctions, such as stuck rods, are accounted for.

The applicable regulatory requirements and criteria must be satisfied for all conditions of plant operation. As discussed above, in MODES 1 and 2 (above P-6 setpoint) an inadvertent boron dilution event would be terminated by Overtemperature ΔT or by operator action. In MODES 2 (below P-6 setpoint) or in MODES 3 through 5 adherence to TS 3.3.9, "Boron Dilution Mitigation System (BDMS)", would terminate an inadvertent boron dilution event.

As discussed in the sections above, the proposed changes and associated administrative controls assure that the applicable regulatory requirements and criteria are satisfied in MODE 6 of plant operation. Adherence to revised TS 3.9.2, "Dilution Source Isolation Valves" would preclude an inadvertent boron dilution event in MODE 6. In the revised TS 3.3.9 and TS 3.9.2, based on generic requirements, all potential dilution sources are considered. Specifically, inadvertent dilution via the BTRS is addressed by requiring controls which include isolation of the BTRS anion resin beds as potential sources for diluted borated or unborated water.

Providing isolation of valves associated with dilution sources, specifically those affected valves in the CVCS, associated with reactor makeup water and the BTRS, during refueling operations, creates physical barriers needed to defeat a potential boron dilution source. This accounts for any potential operational malfunction and precludes the possibility of an inadvertent boron dilution event.

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

6.0 ENVIRONMENTAL CONSIDERATION

10 CFR 51.22(b) specifies the criteria for categorical exclusion from the requirements for a specific environmental assessment per 10 CFR 51.21. This amendment request meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9).

AmerenUE has determined that the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational gamma radiation exposure. As demonstrated above the amendment involves "no significant hazards consideration". The requested amendment does not change the facility and does not involve any change in manner of operation of any plant systems. The requested amendment does not increase the gamma radiation dose resulting from the operation of any plant system. Furthermore, implementation of the proposed change does not contribute to occupational gamma radiation exposure.

Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 PRECEDENTS

There are no precedents for the proposed amendment.

8.0 REFERENCES

8.1 FSAR Section 15.4.6, "Chemical and Volume Control System Malfunction that Results in a Decrease in the Boron Concentration in the Reactor Coolant System."

8.2 NUREG-0800, Standard Review Plan, Section 15.4.6, Rev. 1, July 1981.

8.3 FSAR Section 9.3.4., "Chemical and Volume Control System."

8.4 FSAR Section 9.3.4.2.1.4, "Boron Thermal Regeneration System."

8.5 TS and Bases 3.3.9, "Boron Dilution Mitigation System (BDMS)."

8.6 TS and Bases 3.9.2, "Unborated Water Source Isolation Valves."

8.7 TS and Bases 3.3.1,"RTS Instrumentation".

8.8 TS and Bases 3.4.5, "RCS Loops-MODE 3".

8.9 TS and Bases 3.4.6, "RCS Loops-MODE 4".

8.10 TS and Bases 3.4.7, "RCS Loops-MODE 5, Loops Filled".

8.11 TS and Bases 3.4.8, "RCS Loops-MODE 5, Loops Not Filled".

8.12 Standard Technical Specifications, NUREG-1431.

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ATTACHMENT 3

MARKUP OF TECHNICAL SPECIFICATION PAGES

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Perform SR 3.1.1.1.	1 hour AND Once per 12 hours thereafter
	AND	
	B.3.1 Close and secure unborated water source isolation valves, BGV0178 and BGV0601.	4 hours
	AND	
	B.3.2 Verify unborated water source isolation valves, BGV0178 and BGV0601, are closed and secured.	Once per 31 days
C. No RCS loop in operation.	C.1 Close and secure unborated water source isolation valves, BGV0178 and BGV0601.	4 hours
	AND	
	C.2 Verify unborated water source isolation valves, BGV0178 and BGV0601, are closed and secured.	Once per 31 days

dilution

OL #1238

3.9 REFUELING OPERATIONS

3.9.2 ~~Unborated Water~~ DILUTION Source Isolation Valves

LCO 3.9.2 Each valve used to isolate ~~unborated water~~ DILUTION sources ~~BGV0178 and BGV0691~~ shall be secured in the closed position.

INSERT A

OL # 1238

APPLICABILITY: MODE 6.

ACTIONS

NOTE

Separate Condition entry is allowed for each ~~unborated water~~ DILUTION source isolation valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. NOTE Required Action A.3 must be completed whenever Condition A is entered.	A.1 Suspend CORE ALTERATIONS. AND	Immediately
One or more valves not secured in closed position.	A.2 Initiate actions to secure valve in closed position. AND	Immediately
	A.3 Perform SR 3.9.1.1.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.2.1	Verify each valve that isolates ~~unborated water~~ DILUTION sources ~~BGV0178 and BGV0691~~ is secured in the closed position.	31 days

OL#1238

INSERT A

---NOTE---

Dilution source path valves may be unisolated, as required during refueling decontamination activities, under administrative controls.

ULNRC- 04883

ATTACHMENT 4

RETYPED MARKUP OF TECHNICAL SPECIFICATION PAGES

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued)	B.2	Perform SR 3.1.1.1.	1 hour AND Once per 12 hours thereafter
	AND		
	B.3.1	Close and secure dilution source isolation valves.	4 hours
	AND		
	B.3.2	Verify dilution source isolation valves are closed and secured.	Once per 31 days
C. No RCS loop in operation.	C.1	Close and secure dilution source isolation valves.	4 hours
	AND		
	C.2	Verify dilution source isolation valves are closed and secured.	Once per 31 days

3.9 REFUELING OPERATIONS

3.9.2 Dilution Source Isolation Valves

LCO 3.9.2 Each valve used to isolate dilution sources shall be secured in the closed position.

---NOTE---
Dilution source path valves may be unisolated, as required during refueling decontamination activities, under administrative controls
---

APPLICABILITY: MODE 6.

ACTIONS

---NOTE---
Separate Condition entry is allowed for each dilution source isolation valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ---NOTE--- Required Action A.3 must be completed whenever Condition A is entered. --- One or more valves not secured in closed position.	A.1 Suspend CORE ALTERATIONS. AND A.2 Initiate actions to secure valve in closed position. AND A.3 Perform SR 3.9.1.1.	Immediately Immediately 4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.2.1	Verify each valve that isolates dilution sources is secured in the closed position.	31 days

ULNRC- 04883

ATTACHMENT 5

PROPOSED TECHNICAL SPECIFICATION BASES CHANGES

(for information only)

BASES

ACTIONS

G.1 and G.2 (continued)

Below P-6, the Source Range Neutron Flux channels will be able to monitor the core power level. The Completion Time of 2 hours will allow a slow and controlled power reduction to less than the P-6 setpoint and takes into account the low probability of occurrence of an event during this period that may require the protection afforded by the NIS Intermediate Range Neutron Flux trip.

Required Action G.1 is modified by a Note to indicate that normal plant control operations that individually add limited positive reactivity (i.e., temperature or boron concentration fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided the SDM limits specified in the COLR are met and the requirements of LCOs 3.1.5, 3.1.6, and 3.4.2 are met.

H.1

Not used.

I.1

Condition I applies to one inoperable Source Range Neutron Flux trip channel when in MODE 2 below the P-6 setpoint. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With one of the two channels inoperable, operations involving positive reactivity additions shall be suspended immediately.

This will preclude any power escalation. With only one source range channel OPERABLE, core protection is severely reduced and any actions that add positive reactivity to the core must be suspended immediately.

Required Action I.1 is modified by a Note to indicate that normal plant control operations that individually add limited positive reactivity (i.e., temperature or boron concentration fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided the SDM limits specified in the COLR are met, the requirements of LCOs 3.1.5, 3.1.6, and 3.4.2 are met, and the initial and critical boron concentration assumptions in FSAR Section 15.4.6 (Ref. 16) are satisfied. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when one source range neutron flux channel is inoperable.

TSB ON 02-016 INSERT A

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES

ACTIONS (continued)

J.1

Condition J applies to two inoperable Source Range Neutron Flux trip channels when in MODE 2 below the P-6 setpoint or in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With both source range channels inoperable, the Reactor Trip Breakers (RTBs) must be opened immediately. With the RTBs open, the core is in a more stable condition.

K.1, K.2.1, and K.2.2

Condition K applies to one inoperable source range channel in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With one of the source range channels inoperable, 48 hours is allowed to restore it to an OPERABLE status. If the channel cannot be returned to an OPERABLE status, action must be initiated within the same 48 hours to fully insert all rods. One additional hour is allowed to place the Rod Control System in a condition incapable of rod withdrawal (e.g., by de-energizing all CRDMs, by opening the RTBs, or de-energizing the motor generator (MG) sets). Once these ACTIONS are completed, the core is in a more stable condition. The allowance of 48 hours to restore the channel to OPERABLE status, and the additional hour to place the Rod Control System in a condition incapable of rod withdrawal, are justified in Reference 5. Normal plant control operations that individually add limited positive reactivity (i.e., temperature or boron concentration fluctuations associated with RCS inventory management or temperature control) are permitted provided the SDM limits specified in the COLR are met and the initial and critical boron concentration assumptions in FSAR Section 15.4.6 (Ref. 16) are satisfied. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when one source range neutron flux channel is inoperable.

L.1, L.2, and L.3

Not used.

INSERT A

TSB CN 02-016

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

B 3.3 INSTRUMENTATION

B 3.3.9 Boron Dilution Mitigation System (BDMS)

BASES

BACKGROUND

The primary purpose of the BDMS is to mitigate the consequences of the inadvertent addition of unborated primary grade water into the Reactor Coolant System (RCS) when the plant is in MODES 2 (below P-6 setpoint), 3, 4, and 5.

The BDMS utilizes two channels of source range instrumentation. Each source range channel provides a signal to its microprocessor, which continuously records the counts per minute. At the end of each discrete one-minute interval, an algorithm compares the average counts per minute value (flux rate) of that 1 minute interval with the average counts per minute value for the previous nine, 1 minute intervals. If the flux rate during a 1 minute interval is greater than or equal to 1.7 times the flux rate during any of the prior nine 1 minute intervals, the BDMS provides a signal to initiate mitigating actions.

Upon detection of a flux multiplication by either source range instrumentation train, an alarm is sounded to alert the operator and valve movement is automatically initiated to terminate the dilution and start boration. Valves that isolate the refueling water storage tank (RWST) are opened to supply borated water to the suction of the centrifugal charging pumps, and valves which isolate the Volume Control Tank are closed to terminate the dilution.

APPLICABLE SAFETY ANALYSES

The BDMS senses abnormal increases in source range counts per minute (flux rate) and actuates VCT and RWST valves to mitigate the consequences of an inadvertent boron dilution event as described in Reference 1. The accident analyses rely on automatic BDMS actuation to mitigate the consequences of inadvertent boron dilution events in MODES 3, 4, and 5. The MODE 2 analysis in Reference 1 credits the source range reactor trip function, in conjunction with operator action. The operation of one RCS loop in MODES 2 (below P-6 setpoint), 3, 4, and 5 provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the BDMS. With no reactor coolant loop in operation in the above MODES, boron dilutions must be terminated and dilution sources isolated. The boron dilution analysis in these MODES takes credit for the mixing volume associated with having at least one reactor coolant loop in operation.

space

all

TSB CN 02-016

(See Condition C).

(continued)

dilution sources

BDMS B 3.3.9

INSERT 3.3.9-A

APPLICABILITY (continued)

In MODE 6, a dilution event is precluded by locked valves (BGV0178 and BGV0801) that isolate the RCS from the potential source of unborated water (according to LCO 3.9.2, "Unborated Water Source Isolation Valves").

INSERT 3.3.9-AA

Dilution

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The Applicability is modified by a Note that allows the boron dilution flux multiplication signal to be blocked during reactor startup in MODE 2 (below P-6 setpoint) and MODE 3. Blocking the flux multiplication signal is acceptable during startup provided the reactor trip breakers are closed with the intent to withdraw rods for startup. The P-6 interlock provides a backup block signal to the source range flux multiplication circuit.

ACTIONS

The most common cause of channel inoperability is outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the unit specific calibration procedure. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination of setpoint drift is generally made during the performance of a COT when the process instrumentation is set up for adjustment to bring it to within specification. If the Trip Setpoint is less conservative than the tolerance specified by the calibration procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

A.1

With one train of the BDMS inoperable, Required Action A.1 requires that the inoperable train must be restored to OPERABLE status within 72 hours. In this Condition, the remaining BDMS train is adequate to provide protection. The 72 hour Completion Time is based on the BDMS Function and is consistent with Engineered Safety Feature Actuation System Completion Times for loss of one redundant train. Also, the remaining OPERABLE train provides continuous indication of core power status to the operator, has an alarm function, and sends a signal to both trains of the BDMS to assure system actuation.

Administrative controls require operator awareness during all reactivity manipulations. These administrative controls include:

- Reactivity management briefs of the Control Room Operations Staff (typically conducted at the beginning of each shift);
- Use of self-verification techniques by all licensed operators performing core reactivity manipulations;

(continued)

INSERT 3.3.9-A

for unborated reactor makeup water (BGV0178 and BGV0601), BTRS vessels configured with anion resin for dilution during normal operation (BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor SJRE001 (SJV0703)

INSERT 3.3.9-AA

Chemistry controls may require some BTRS vessels to be configured with resin not intended for boron dilution. Isolation of these vessels is not required for MODE 6 if steps are taken to precondition the resin with borated water equal to or greater than the refueling concentration.

BASES

ACTIONS A.1 (continued)

- Peer checks for all reactivity manipulations during routine operations and for all positive reactivity additions during transient or off-normal operations;
- Off-normal procedures are available that address reactor makeup control system (RMCS) malfunctions and potential loss of shutdown margin (SDM).

During any and all rod motion, operators monitor all available indications of nuclear power. During RCS boron concentration change evolutions, operators observe the various indications and alarms provided in the RMCS design for monitoring proper system operation as discussed in FSAR Section 15.4.6 (Reference 1). Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when one BDMS train is inoperable.

INSERT A

B.1, B.2, B.3.1, and B.3.2

With two trains inoperable, or the Required Action and associated Completion Time of Condition A not met, the initial action (Required Action B.1) is to suspend all operations involving positive reactivity additions immediately. This includes withdrawal of control or shutdown rods and intentional boron dilution.

Required Action B.2 verifies the SDM according to SR 3.1.1.1 within 1 hour and once per 12 hours thereafter. This action is intended to confirm that no unintended boron dilution has occurred while the BDMS was inoperable, and that the required SDM has been maintained. The specified Completion Time takes into consideration sufficient time for the initial determination of SDM and other information available in the control room related to SDM.

the LCO Bases for LCO 3.9.2, "Dilution Source Isolation Valves,"

Required Action B.3.1 requires valves listed in LCO 3.9.2 (Required Action A.2) BGV0178 and BGV0601 to be secured to prevent the flow of unborated water into the RCS. Once it is recognized that two trains of the BDMS are inoperable, the operators will be aware of the possibility of a boron dilution, and the 4 hour Completion Time is adequate to complete the requirements of LCO 3.9.2. The recurring 31 day verification of Required Action B.3.2 ensures these valves remain closed for an extended Condition B entry.

isolate dilution sources.

Required Action B.1 is modified by a Note which permits plant temperature changes provided the temperature change is accounted for

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(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES

ACTIONS B.1, B.2, B.3.1, and B.3.2 (continued)

in the calculated SDM. Introduction of temperature changes, including temperature increases when a positive MTC exists, must be evaluated to ensure they do not result in a loss of required SDM.

C.1 and C.2

Condition C is entered with no RCS loop in operation. The operation of one RCS loop provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the Boron Dilution Mitigation System (BDMS). With no reactor coolant loop in operation, all dilution sources must be isolated. The boron dilution analysis takes credit for the mixing volume associated with having at least one reactor coolant loop in operation.

Required Action C.1 requires that valves BGV0178 and BGV0601 be closed and secured to prevent the flow of unborated water into the RCS. The 4 hour Completion Time is adequate to perform these local valve manipulations. The recurring 31 day verification of Required Action C.2, ensures these valves remain closed and secured for an extended Condition C entry.

INSERT 3.3.9-B

SURVEILLANCE REQUIREMENTS The BDMS trains are subject to a CHANNEL CHECK, valve closure in MODE 5, COT, CHANNEL CALIBRATION, and Response Time Testing. In addition, the requirement to verify one RCS loop in operation is subject to periodic surveillance.

SR 3.3.9.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of source range instrumentation has not occurred.

A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

(continued)

INSERT 3.3.9-B

(for unborated reactor makeup water (BGV0178 and BGV0601), BTRS vessels configured with anion resin for dilution during normal operation (BGV0039, BGV0043, BGV0051, and BGV0055) and the purge line used during flushing of CVCS letdown radiation monitor SJRE001 (SJV0703)). Chemistry controls may require some BTRS vessels to be configured with resin not intended for boron dilution. Isolation of these vessels is not required for MODE 6 if steps are taken to precondition the resin with borated water equal to or greater than the refueling concentration.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1 (continued)

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

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

SR 3.3.9.2

SR 3.3.9.2 requires that valve BGV0178 be secured and closed prior to entry into MODE 5. Specification 3.9.2 requires that this valve also be secured and closed in MODE 6. Closing BGV0178 satisfies the boron dilution accident analysis assumption that flow orifice BGFO0010 limits the dilution flow rate to no more than 150 gpm in MODE 5. This Surveillance demonstrates that the valve is closed through a system walkdown. SR 3.3.9.2 is modified by a Note stating that it is only required to be performed in MODE 5. This Note requires that the surveillance be performed prior to entry into MODE 5 and every 31 days while in MODE 5. The 31 day frequency is based on engineering judgment and is considered reasonable in view of other administrative controls that will ensure that the valve opening is an unlikely possibility.

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SR 3.3.9.3

SR 3.3.9.3 requires the performance of a COT every 92 days, to ensure that each train of the BDMS and associated trip setpoints are fully operational. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. This test shall include verification that the boron dilution flux multiplication setpoint is equal to or less than an increase of 1.7 times the count rate within a 10 minute period. The 1.7 flux multiplication setpoint is a nominal value. SR 3.3.9.3 is met if the measured setpoint is within a two-sided calibration tolerance band on either side of the nominal value. SR 3.3.9.3 is modified by a

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the Boron Dilution Mitigation System (BDMS). With no reactor coolant loop in operation in either MODES 3, 4, or 5, boron dilutions must be terminated and dilution sources isolated. The boron dilution analysis in these MODES takes credit for the mixing volume associated with having at least one reactor coolant loop in operation. LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)," contains the requirements for the BDMS.

Failure to provide decay heat removal may result in challenges to a fission product barrier. The RCS loops are part of the primary success path that functions or actuates to prevent or mitigate a Design Basis Accident or transient that either assumes the failure of, or presents a challenge to, the integrity of a fission product barrier.

RCS Loops - MODE 3 satisfy Criterion 3 of 10CFR50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least two RCS loops be OPERABLE. In MODE 3 with the Rod Control System capable of rod withdrawal, two RCS loops must be in operation. Two RCS loops are required to be in operation in MODE 3 with the Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

When the Rod Control System is not capable of rod withdrawal, only one RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure that redundancy for heat removal is maintained.

The Note permits all RCPs to be removed from operation for $\leq$ 1 hour per 8 hour period. The purpose of the Note is to perform tests that are required to be performed without flow or pump noise. One of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss of flow accident. This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve must be revalidated by conducting the test again.

(continued)

BASES

LCO (continued)

Utilization of the Note is permitted provided the following conditions are met, along with any other conditions imposed by test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, thereby maintaining the margin to criticality. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation. Boron dilution with coolant at boron concentrations less than required to assure the SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

INSERT A

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b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

An OPERABLE RCS loop consists of one OPERABLE RCP and one OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, which has the minimum water level specified in SR 3.4.5.2. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. The most stringent condition of the LCO, that is, two RCS loops OPERABLE and two RCS loops in operation, applies to MODE 3 with the Rod Control System capable of rod withdrawal. The least stringent condition, that is, two RCS loops OPERABLE and one RCS loop in operation, applies to MODE 3 with the Rod Control System not capable of rod withdrawal.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES

ACTIONS

D.1, D.2, and D.3 (continued)

sets). All operations involving introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended, and action to restore one of the RCS loops to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and defeating the Rod Control System removes the possibility of an inadvertent rod withdrawal. Suspending the introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation, consistent with Required Action C.1 of LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)." The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

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This SR requires verification every 12 hours that the required loops are in operation. Verification may include flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is $\geq$ 4% for required RCS loops. If the SG secondary side narrow range water level is < 4%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, either RCPs or RHR loops can be used to provide forced circulation. The intent of this LCO is to provide forced flow from at least one RCP or one RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that two paths be available to provide redundancy for decay heat removal.

APPLICABLE SAFETY ANALYSES

In MODE 4, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event.

The operation of one RCP in MODES 3, 4, and 5 provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the Boron Dilution Mitigation System (BDMS). With no reactor coolant loop in operation in either MODES 3, 4, or 5, boron dilutions must be terminated and dilution sources isolated. The boron dilution analysis in these MODES takes credit for the mixing volume associated with having at least one reactor coolant loop in operation. LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)," contains the requirements for the BDMS.

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RCS Loops - MODE 4 satisfies Criterion 4 of 10CFR50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO

The purpose of this LCO is to require that at least two loops be OPERABLE in MODE 4 and that one of these loops be in operation. The LCO allows the two loops that are required to be OPERABLE to consist of any combination of RCS loops and RHR loops. Any one loop in operation provides enough flow to remove the decay heat from the core with forced circulation. An additional loop is required to be OPERABLE to provide redundancy for heat removal.

Note 1 permits all RCPs or RHR pumps to be removed from operation for $\leq$ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are required to be performed without flow or pump noise. The 1 hour time period is adequate to perform the necessary testing, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of Note 1 is permitted provided the following conditions are met along with any other conditions imposed by test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, thereby maintaining the margin to criticality. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation. Boron dilution with coolant at boron concentrations less than required to assure the SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

INSERT A

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Note 2 requires that the secondary side water temperature of each SG be $\leq$ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature $\leq$ 275°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

An OPERABLE RCS loop is comprised of an OPERABLE RCP and an OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, which has the minimum water level specified in SR 3.4.6.2.

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES

ACTIONS (continued)

B.1 and B.2

If no loop is OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RCS or RHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation from at least one RCP for proper mixing so that inadvertent criticality can be prevented. Suspending the introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation, consistent with Required Action C.1 of LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)." The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

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INSERT A

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one RCS or RHR loop is in operation. Verification may include flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is $\geq$ 4% for required RCS loops. If the SG secondary side narrow range water level is < 4%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES (continued)

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event.

The operation of one RCP in MODES 3, 4, and 5 provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the Boron Dilution Mitigation System (BDMS). With no reactor coolant loop in operation in either MODES 3, 4, or 5, boron dilutions must be terminated and dilution sources isolated. The boron dilution analysis in these MODES takes credit for the mixing volume associated with having at least one reactor coolant loop in operation. LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)," contains the requirements for the BDMS.

all TSB CN 02-01

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10CFR50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least one of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or two SGs with secondary side wide range water level ≥ 66%. As shown in Reference 3, any narrow range level indication above 4% will ensure the SG tubes are covered. One RHR loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is two SGs with their secondary side wide range water levels ≥ 66%. Should the operating RHR loop fail, the SGs could be used to remove the decay heat via natural circulation.

Note 1 permits all RHR pumps to be removed from operation ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are required to be performed without flow or pump noise. The 1 hour time period is adequate to perform the necessary testing, and operating experience has shown that boron stratification is not likely during this short period with no forced flow.

Utilization of Note 1 is permitted provided the following conditions are met, along with any other conditions imposed by test procedures:

(continued)

BASES (continued)

LCO (continued)

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, thereby maintaining the margin to criticality. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation. Boron dilution with coolant at boron concentrations less than required to assure the SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

INSERT A

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b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

Note 2 allows one RHR loop to be inoperable for a period of up to 2 hours, provided that the other RHR loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 3 requires that the secondary side water temperature of each SG be $\leq$ 50°F above each of the RCS cold leg temperatures before the start of a reactor coolant pump (RCP) with any RCS cold leg temperature $\leq$ 275°F. This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 4 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of RHR loops from operation when at least one RCS loop is in operation. This Note provides for the transition to MODE 4 where an RCS loop is permitted to be in operation and replaces the RCS circulation function provided by the RHR loops.

RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink via natural circulation when it has an adequate water level and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY In MODE 5 with RCS loops filled, this LCO requires forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RHR provides sufficient circulation for these purposes. However, one additional RHR loop is required to be OPERABLE, or the secondary side wide range water level of at least two SGs is required to be $\geq$ 66%.

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES (continued)

APPLICABILITY (continued)

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.5, "RCS Loops - MODE 3";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

If one RHR loop is inoperable and the required SGs have secondary side wide range water levels < 66%, redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore the required SG secondary side water levels. Either Required Action A.1 or Required Action A.2 will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If no RHR loop is in operation, except during conditions permitted by Notes 1 and 4, or if no loop is OPERABLE, all operations involving introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RHR loop to OPERABLE status and operation must be initiated. To prevent inadvertent criticality during a boron dilution, forced circulation from at least one RCP is required to provide proper mixing. Suspending the introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation, consistent with Required Action C.1 of LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)." The immediate Completion Times reflect the importance of maintaining operation for heat removal.

(continued)

INSERT A
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INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.8 RCS Loops - MODE 5, Loops Not Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops not filled, the primary function of the reactor coolant is the removal of decay heat generated in the fuel, and the transfer of this heat to the component cooling water via the residual heat removal (RHR) heat exchangers. The steam generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the reactor coolant is to act as a carrier for the soluble neutron poison, boric acid.

In MODE 5 with loops not filled, only RHR pumps can be used for coolant circulation. The number of pumps in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR pump for decay heat removal and transport and to require that two paths be available to provide redundancy for heat removal.

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The flow provided by one RHR loop is adequate for decay heat removal.

The operation of one RCP in MODES 3, 4, and 5 provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during RCS boron concentration reductions. The reactivity change rate associated with boron reduction will, therefore, be within the transient mitigation capability of the Boron Dilution Mitigation System (BDMS). With no reactor coolant loop in operation in either MODES 3, 4, or 5, boron dilutions must be terminated and dilution sources isolated. The boron dilution analysis in these MODES takes credit for the mixing volume associated with having at least one reactor coolant loop in operation. LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)," contains the requirements for the BDMS.

all TSB CN 02-016

RCS loops in MODE 5 (loops not filled) satisfies Criterion 4 of 10CFR50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least two RHR loops be OPERABLE and one of these loops be in operation. An OPERABLE loop is one that has the capability of transferring heat from the reactor coolant at a controlled rate. Heat cannot be removed via the RHR System unless forced flow is used. A minimum of one running RHR pump meets the

(continued)

BASES

LCO (continued)

LCO requirement for one loop in operation. An additional RHR loop is required to be OPERABLE to meet single failure considerations.

Note 1 permits all RHR pumps to be removed from operation for ≤ 1 hour. The circumstances for stopping both RHR pumps are to be limited to situations when the outage time is short and core outlet temperature is maintained at least 10°F below saturation temperature. The Note prohibits boron dilution with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1 is maintained or draining operations when RHR forced flow is stopped. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when no RCS loop is in operation.

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Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours, provided that the other loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when these tests are safe and possible.

An OPERABLE RHR loop is comprised of an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

APPLICABILITY

In MODE 5 with loops not filled, this LCO requires core heatremoval and coolant circulation by the RHR System.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2";
LCO 3.4.5, "RCS Loops - MODE 3";
LCO 3.4.6, "RCS Loops - MODE 4";
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

The Applicability is modified by a Note stating that entry into MODE 5 with RCS loops not filled from MODE 5 with RCS loops filled is not permitted while LCO 3.4.8 is not met. This Note specifies an exception to LCO 3.0.4 and would prevent draining the RCS, which would eliminate the possibility of SG heat removal, while the RHR function was degraded.

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES (continued)

ACTIONS

A.1

If only one RHR loop is OPERABLE and in operation, redundancy for RHR is lost. Action must be initiated to restore a second loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If no required RHR loops are OPERABLE or in operation, except during conditions permitted by Note 1, all operations involving introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action must be initiated immediately to restore an RHR loop to OPERABLE status and operation. Boron dilution requires forced circulation from at least one RCP for proper mixing so that inadvertent criticality can be prevented. Suspending the introduction of coolant, into the RCS, with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. Introduction of reactor makeup water into the RCS from the Chemical and Volume Control System mixing tee is not permitted when the RCS loops are not filled or when no RCS loop is in operation, consistent with Required Action C.1 of LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)." The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must continue until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.8.1

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INSERT A

This SR requires verification every 12 hours that one loop is in operation. Verification may include flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RHR loop performance.

SR 3.4.8.2

Verification that a second RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay

(continued)

INSERT A

, BTRS vessels configured with anion resin for dilution during normal operation must be isolated, and the purge line associated with flushing CVCS letdown radiation monitor SJRE001 must be isolated,

BASES

BACKGROUND (continued)

and assist in maintaining uniform boron concentrations in the RCS and the refueling pool above the LCO limits. Administrative controls will limit the volume of unborated water that can be added to the refueling pool for decontamination activities in order to prevent diluting the refueling pool below the specified limits (Ref. 3).

APPLICABLE SAFETY ANALYSES

The boron concentration LCO limits are based on the core reactivity at the beginning of each fuel cycle (the end of refueling) and includes an uncertainty allowance.

The required boron concentration and the plant refueling procedures that verify the correct fuel loading plan (including full core mapping) ensure that the k_{eff} of the core will remain ≤ 0.95 during the refueling operation. Hence, at least a 5% $\Delta k/k$ margin of safety is established during refueling. Safety analyses assume a B-10 abundance of 19.9 atom % (Ref. 4). Administrative controls ensure that the reactivity insertion from the reactor coolant system and the refueling pool reflects this assumption.

During refueling, the water volume in the refueling pool and the reactor vessel form a single mass. As a result, the soluble boron concentration is relatively the same in each of these volumes having direct access to the reactor vessel.

Dilution TSB CN 02-016

The limiting boron dilution accident analyzed occurs in MODE 5 (Ref. 2). Boron dilution accidents are precluded in MODE 6 by isolating potential dilution flow paths. See LCO 3.9.2, "Unborated Water Source Isolation Valves." Unacceptable dilution from refueling pool decontamination activities is precluded by the following (Ref. 3):

1. The maximum allowable amount of unborated reactor makeup water that may be added to the refueling pool for decontamination activities is calculated for each refueling and will not cause the refueling pool boron concentration to fall below the LCO limits. This maximum allowable volume is based on initial pool boron concentration and one-half the RCS volume at mid-loop.

2. The refueling pool is drained to approximately one foot above the reactor cavity seal/shield ring. The refueling pool is then drained via the reactor coolant drain tank pumps or other available means (excluding the RHR system) until the level is below the seal/shield ring. This directs potentially diluted water at the top of the pool away from the reactor vessel and core.

(continued)

B 3.9 REFUELING OPERATIONS

B 3.9.2 ~~Unborated Water~~ DILUTION Source Isolation Valves

BASES

BACKGROUND

During MODE 6 operations, all isolation valves ~~of reactor makeup water sources containing unborated water~~ that are connected to the Reactor Coolant System (RCS) must be closed to prevent unplanned boron dilution of the reactor coolant. The isolation valves ~~(BGV0178 and BGV0601)~~ must be secured in the closed position. INSERT 1A

Administrative controls will limit the volume of unborated water that can be added to the refueling pool for decontamination activities in order to prevent diluting the refueling pool and RCS below the specified limits (Ref. 3). (See Bases for ~~Specification~~ 3.9.1).

APPLICABLE SAFETY ANALYSES

The possibility of an inadvertent boron dilution event (Ref. 1) occurring during MODE 6 refueling operations is precluded by adherence to this LCO, which requires that potential dilution sources be isolated. Closing the required valves during refueling operations prevents the flow of unborated water to the filled portion of the RCS. The valves are used to isolate ~~unborated water~~ sources. These valves have the potential to indirectly allow dilution of the RCS boron concentration in MODE 6. By isolating ~~unborated water~~ sources, a safety analysis for an uncontrolled boron dilution accident in accordance with the Standard Review Plan (Ref. 2) is not required for MODE 6.

The RCS boron concentration satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that flow paths via ~~BGV0178 and BGV0601 to the RCS from unborated water sources~~ be isolated to prevent unplanned boron dilution during MODE 6 and thus avoid a reduction in SDM. INSERT 2A INSERT 2B

APPLICABILITY

In MODE 6, this LCO is applicable to prevent an inadvertent boron dilution event by ensuring isolation of all sources of ~~unborated water~~ to the RCS.

For all other MODES, the boron dilution accident was analyzed and was found to be capable of being mitigated.

(continued)

INSERT 1

for unborated reactor makeup water (BGV0178 and BGV0601), BTRS vessels configured with anion resin for dilution during normal operation (BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor SJRE001 (SJV0703)

INSERT 1A

Chemistry controls may require some BTRS vessels to be configured with resin not intended for boron dilution. Isolation of these vessels is not required for MODE 6 if steps are taken to precondition the resin with borated water equal to or greater than the refueling concentration.

INSERT 2

unborated reactor makeup water (BGV0178 and BGV0601), BTRS vessels configured with anion resin for dilution during normal operation (BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor SJRE001 (SJV0703)

INSERT 2A

Chemistry controls may require some BTRS vessels to be configured with resin not intended for boron dilution. Isolation of these vessels is not required for MODE 6 if steps are taken to precondition the resin with borated water equal to or greater than the refueling concentration.

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INSERT 2B

The LCO is modified by a Note allowing dilution source path valves to be unisolated, as required during refueling decontamination activities, under administrative controls. During refueling activities, it may be necessary for a dilution source to be unisolated. Based on Reference 3, administrative controls are used to limit the volume of unborated water which can be added to the refueling pool for decontamination activities in order to prevent diluting the refueling pool boron concentration below TS limits. The administrative controls are identified in the Applicable Safety Analysis Bases for LCO 3.9.1, "Boron Concentration."

The following valves are excluded from the LCO Note: BGV0178, BGV0601, BGV0039, BGV0043, BGV0051, BGV0055 and SJV0703. The following valves are included under the LCO Note: BLV0078, BLV0079 and BLV0055.

BASES (continued)

ACTIONS

The ACTIONS table has been modified by a Note that allows separate Condition entry for each ~~unborated water~~ DILUTION source isolation valve.

A.1

Continuation of CORE ALTERATIONS is contingent upon maintaining the unit in compliance with this LCO. With any valve used to isolate ~~unborated water~~ DILUTION sources not secured in the closed position, all operations involving CORE ALTERATIONS must be suspended immediately. The Completion Time of "immediately" for performance of Required Action A.1 shall not preclude completion of movement of a component to a safe position.

Condition A has been modified by a Note to require that Required Action A.3 be completed whenever Condition A is entered.

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A.2

Preventing inadvertent dilution of the reactor coolant boron concentration is dependent on maintaining the ~~unborated water~~ isolation valves DILUTION source ~~BGV0178 and BGV0601~~ secured closed. Securing the valves in the closed position, under administrative controls, ensures that the valves are not inadvertently opened. The Completion Time of "immediately" requires an operator to initiate actions to close an open valve and secure the isolation valve in the closed position immediately. Once actions are initiated, they must be continued until the valves are secured in the closed position.

A.3

Due to the potential of having diluted the boron concentration of the reactor coolant, SR 3.9.1.1 (verification of boron concentration) must be performed whenever Condition A is entered to demonstrate that the required boron concentration exists. The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.9.2.1

INSERT 3

~~Valves BGV0178 and BGV0601~~ are to be secured closed to isolate possible dilution paths. The likelihood of a significant reduction in the boron concentration during MODE 6 operations is remote due to the large mass of borated water in the refueling pool and the fact that all ~~unborated~~ ~~water~~ sources are isolated, precluding a dilution. The boron concentration is checked every 72 hours during MODE 6 under SR 3.9.1.1. This Surveillance demonstrates that the valves are closed through a system walkdown. The 31 day Frequency is based on engineering judgment and is considered reasonable in view of other administrative controls that will ensure that the valve opening is an unlikely possibility.

INSERT 3A

after Flood-up

DILUTION

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REFERENCES

1. FSAR, Section 15.4.6.
2. NUREG-0800, Section 15.4.6.
3. Amendment 97 to Facility Operating License No. NPF-30, Callaway Unit 1, dated March 31, 1995.

INSERT 3

Isolation valves for unborated reactor makeup water (BGV0178 and BGV0601), BTRS vessels configured with anion resin for dilution during normal operation (BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor SJRE001 (SJV0703)

INSERT 3A

Chemistry controls may require some BTRS vessels to be configured with resin not intended for boron dilution. Isolation of these vessels is not required for MODE 6 if steps are taken to precondition the resin with borated water equal to or greater than the refueling concentration.