*AmerenUE*
*Callaway Plant*

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March 28, 2006

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

Ladies and Gentlemen: ULNRC-05269

**DOCKET NUMBER 50-483**
**CALLAWAY PLANT**
**UNION ELECTRIC COMPANY**
**PROPOSED REVISION TO TECHNICAL SPECIFICATION 3.9.2 "UNBORATED WATER SOURCE ISOLATION VALVES" AND ASSOCIATED REVISIONS TO TECHNICAL SPECIFICATION 3.3.9 "BORON DILUTION MITIGATION SYSTEM (BDMS)"**
**(LICENSE AMENDMENT REQUEST OL 1238)**

Pursuant to 10 CFR 50.90, AmerenUE hereby requests an amendment to the Facility Operating License No. NPF-30 for Callaway Plant. The requested amendment would incorporate the attached changes into the Callaway Plant Technical Specifications. Specifically, the requested amendment would revise Technical Specifications (TS) 3.9.2, "Unborated Water Source Isolation Valves," to remove references to specific Chemical and Volume Control system (CVCS) isolation valves BGV0178 and BGV0601 and to relocate the references to the TS Bases. 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. Removing specific valve references makes the Specification generic and applicable for all unborated water source isolation valves. Proposed TS LCO 3.9.2 is also modified by two Notes to allow an exception for decontamination activities and an exception for CVCS resin vessel operation.

In an associated change, TS 3.3.9, "Boron Dilution Mitigation System (BDMS)" is revised to eliminate references to the specific isolation valves BGV0178 and BGV0601. The revisions make TS 3.3.9 consistent with TS 3.9.2. Removing specific valve references makes the Specification generic and applicable for all

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unborated water source isolation valves. TS 3.3.9 Required Actions B3 and C are modified by a Note that allows an exception for CVCS resin vessel operation.

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

In addition to the proposed TS changes and their associated Bases changes, specific Bases changes for TS 3.3.9 Condition A and Bases changes for TS 3.3.1, "Reactor Trip System (RTS) Instrumentation", Condition I and Condition K, are also provided for NRC information. These changes remove statements that were previously added to these Bases sections as enhancements, but which have now been determined to be unnecessary and overly restrictive. AmerenUE has determined that these Bases changes do not require prior NRC approval.

Essential information is provided in the attachments to this letter. Attachment 1 provides a detailed description and technical evaluation of the proposed changes, including AmerenUE's determination that the proposed changes involve no significant hazards consideration. Attachment 2 provides the existing TS pages marked-up to show the proposed changes. Attachment 3 provides a copy of the revised TS pages with the proposed changes incorporated (if approved). Attachment 4 provides the existing TS Bases pages marked-up to show the associated proposed Bases changes (for information only).

This letter identifies actions committed to by AmerenUE 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 5.

The Callaway Plant Review Committee and a subcommittee of the Nuclear Safety Review Board have reviewed and approved this amendment application. In addition, it has been determined that this amendment application involves no significant hazards consideration as determined per 10 CFR 50.92, and that pursuant to 10 CFR 51.22(b) no environmental assessment should be required to be prepared in connection with the issuance of this amendment.

AmerenUE respectfully requests approval of the proposed license amendment by November 30, 2006. 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.

Sincerely,

Executed on: March 28, 2006

Keith D. Young
Manager, Regulatory Affairs

DJW/jdg

Attachments:
1) Evaluation
2) Markup of Technical Specification pages
3) Retyped Technical Specification pages
4) Markup of Technical Specification Bases pages (For information only)
5) Summary of Regulatory Commitments

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# ULNRC-05269

# ATTACHMENT 1

# EVALUATION

# 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 delete references to specific Chemical and Volume Control system (CVCS) isolation valves BGV0178 and BGV0601 and to modify TS LCO 3.9.2 by two Notes to allow an exception for decontamination activities and an exception for CVCS resin vessel operation. These revisions ensure that all unborated water sources and their associated isolation valves, including others in the CVCS and its subsystem, the Boron Thermal Regeneration System (BTRS), and the Nuclear Sampling System (SJ), are included in TS 3.9.2. The proposed TS 3.9.2 precludes all inadvertent boron dilution events in Mode 6. In addition, the revisions adopt a version of TS 3.9.2 similar to the NUREG-1431, Standard Technical Specifications for Westinghouse Plants, Revision 3, version of TS 3.9.2.

In an associated change, TS 3.3.9, "Boron Dilution Mitigation System (BDMS)" is revised. TS 3.3.9 Required Actions for Conditions B3 and C are revised to eliminate references to the specific isolation valves BGV0178 and BGV0601. The revisions make TS 3.3.9 consistent with TS 3.9.2. The Required Actions B3 and C are also modified by a Note allowing an exception for CVCS resin vessel operation.

In addition to the proposed TS changes and their associated Bases changes, specific Bases changes for TS 3.3.9 Condition A and Bases changes for TS 3.3.1, "Reactor Trip System (RTS) Instrumentation", Condition I and Condition K, are also made as separate and additional changes. These changes remove statements that were previously added to these Bases sections as enhancements, but which have now been determined to be unnecessary and overly restrictive. AmerenUE has reviewed these Bases changes under the Callaway TS Bases and 50.59 review programs and are providing them for NRC information.

In summary, the proposed changes make TS 3.9.2 generic and maintain the plant in a safe condition by ensuring that all potential unborated water sources are isolated in Mode 6. The proposed changes also make TS 3.3.9 generic and maintain the plant in a safe condition by ensuring that all potential unborated water sources are isolated in upper modes of plant operation when both trains of BDMS are inoperable or when a condition of no RCS loop in operation exists. These changes assure plant compliance with the TS and plant operation within the bounds of the boron dilution accident analyses. The proposed changes do not alter design bases or technical requirements.

## 2.0 DESCRIPTION OF PROPOSED AMENDMENT

References to specific unborated water sources and their associated isolation valves (BGV0178 and BGV0601) are removed from the current TS 3.9.2 LCO and SURVEILLANCE 3.9.2.1 REQUIREMENT and are transferred to TS 3.9.2 Bases. A NOTE is added to proposed LCO 3.9.2 such that during refueling decontamination activities, an unborated water 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.

Proposed TS 3.9.2 LCO is also modified by another Note allowing an exception for CVCS resin vessel operation. Plant chemistry controls may require some CVCS resin vessels to be configured with resin not intended for boron dilution or resin vessels that have been preconditioned with borated water with a boron concentration that is greater than or equal to the refueling water boron concentration. Because these resin vessels are not boron dilution sources, they are not required to be isolated. However, some CVCS resin vessels may be configured with resin intended for dilution and not preconditioned with borated water. These resin vessels would be isolated as required by TS LCO 3.9.2. However, the Note on the LCO allows these resin vessels to be unisolated when their operation is under administrative controls. The administrative controls include procedural requirements to precondition the resin vessels with borated water prior to their use; to monitor their effluent for boron concentration; and to assess the impact to plant reactivity management. The administrative controls ensure that the resin vessels are not dilution sources.

In an associated change, TS 3.3.9 REQUIRED ACTIONS B.3.1, B.3.2, C.1, and C.2 are revised to eliminate references to specific isolation valves (BGV0178 and BGV0601). 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. Proposed Required Actions B.3.1, B.3.2, C.1, and C.2 are also modified by the Note permitting an exception for CVCS resin vessel operation.

TS Bases 3.9.2 is revised to reflect the addition of the Notes to the LCO and to incorporate specific valve references. Specific isolation valves are identified for the isolation of unborated reactor makeup water (associated isolation valves BGV0178 and BGV0601), for isolation of CVCS resin vessels configured with resin for dilution (associated isolation valves BG8522A, BG8522B, BGV0039, BGV0043, BGV0051 and BGV0055), and for isolation of the CVCS letdown gamma radiation detector SJRE0001 purge line (associated isolation valve SJV0703). TS Bases 3.3.9 is revised to reflect the

proposed revisions to TS 3.3.9 Required Actions for Conditions B3 and C. Various other TS Bases are revised to reflect the proposed changes.

In addition to the proposed TS changes and their associated Bases changes, specific Bases changes for TS 3.3.9 Condition A and Bases changes for TS 3.3.1, "Reactor Trip System (RTS) Instrumentation", Condition I and Condition K, are made as separate and additional changes. TS 3.3.9 Condition A (Modes 2 (below P-6), 3, 4, and 5) results when one train of BDMS is inoperable. TS 3.3.1 Condition I (Mode 2 (below P-6)) and TS 3.3.1 Condition K (Modes 3, 4, and 5) result when one source range neutron flux channel is inoperable. The changes remove statements that were previously added to these Bases sections as enhancements, but which have now been determined to be unnecessary and overly restrictive. TS 3.3.1 Bases for Condition I and Condition K are revised to remove the following statement: "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." TS 3.3.9 Bases for Condition A is revised to remove the following statement: "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."

In summary, 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; and TS Bases 3.9.2, Unborated Water Source Isolation Valves.

Attachment 2 provides the proposed TS markups and Attachment 3 provides the clean copies of the proposed markups. Attachment 4 provides the TS Bases markups for information only.

## 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 Reactor Protection System (RPS) functions to limit the consequences of the boron dilution event by actuation of reactor trip with the plant capable of returning to operation following corrective action. In all plant operating conditions, an automatic alarm alerts the operators to the conditions of an inadvertent boron dilution event. The alarms allow operator action to (1) open the CVCS isolation valves from the refueling

water storage tank (RWST) in order to supply borated water to the RCS and (2) close unborated water source isolation valves to terminate the dilution flow.

In MODE 1, with the reactor under manual rod control, the overtemperature delta-T reactor trip signal serves as the alarm as well as initiating Rod Cluster Control Assemblies (RCCA) insertion. As plant conditions approach the overtemperature delta-T trip setpoint, a warning alarm alerts the operator. After this alarm actuates and once the trip setpoint is reached in two-out-of-four loops, the reactor trip signal is generated. In MODE 1, with the reactor under automatic rod control, the low and low-low rod insertion limit alarms from the rod control system as well as the axial flux difference alarm can alert the operator to the conditions of an inadvertent boron dilution event.

In MODE 2, the source range and power range neutron flux functions can provide the necessary alarm for conditions of an inadvertent boron dilution event, as well as initiate RCCA insertion. These signals are actuated when the trip setpoint is reached in one-out-of-two or two-out-of-four channels, respectively. The boron dilution accident analysis assumes that a reactor trip occurs on a source range neutron flux signal at about the time of the initiation of the dilution.

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. As discussed above, because an inadvertent boron dilution would be terminated by Overtemperature $\Delta T$ 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. With no reactor coolant loop in operation in these Modes, boron dilutions must be terminated and dilution sources isolated. The boron dilution accident analysis in these Modes takes

credit for the mixing volume associated with having at least one reactor coolant loop in operation.

Because the BDMS utilizes the source range instrumentation in its detection system, the OPERABILITY of that portion of the detection system is also part of the OPERABILITY of the Reactor Trip System. TS 3.3.1, "RTS Instrumentation" ensures the availability of the source range neutron flux trip function by requiring two channels of source range neutron flux to be OPERABLE in MODE 2 (below P-6 setpoint) and in MODES 3, 4, and 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

The source range neutron flux trip function and the BDMS are not applicable in MODE 6. Note, however, that in MODE 6, TS 3.9.3, "Nuclear Instrumentation" ensures that two source range neutron flux monitors are OPERABLE to provide continuous indication of core reactivity condition.

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. A boric acid blend system (via the CVCS boric acid blending tee) is available to allow the operator to match the makeup's boron concentration to that of the RCS during normal charging. Note that use of the term "mixing tee" or "blending tee" refers to the same CVCS component. Reactor makeup water is used for the blended flow from the blending tee. 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 Unborated Water Dilution Sources Identified

Callaway Plant has performed a review of plant systems and evaluated other potential unborated water dilution sources from primary system resin beds and other potential dilution paths for reactor makeup water to enter the RCS. As a result, additional unborated water 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. The CVCS controls the RCS chemistry conditions, activity levels, and boric acid concentrations. To perform these functions, a continuous feed and bleed flow is maintained between the RCS and the CVCS. Reactor coolant is first "letdown" from the RCS into the CVCS system. The letdown flow from the RCS to the CVCS may be diverted to CVCS resin vessels when boron concentration changes or other chemistry changes are desired. Note that the CVCS resin vessels include the resin vessels in the BTRS. The stream of letdown flow is processed through the CVCS resin vessels to achieve the desired chemistry conditions. After processing by the CVCS and BTRS, the stream is then returned to the letdown flow path and eventually returned to the RCS. Although the primary function is to compensate for xenon transients during load follow, the CVCS and BTRS subsystem are also used to handle boron changes during other modes of plant operation: startups and shutdown.

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

Under the proposed TS 3.9.2, deliberate steps are required to isolate the CVCS resin vessels containing resin for dilution, when necessary, to avoid an inadvertent boron dilution event in Mode 6. Proposed TS 3.3.9 ensures that in higher modes of plant operation, the CVCS resin vessels configured with resin for dilution would be secured closed under administrative controls, should both trains of BDMS be unavailable or should a condition of no reactor coolant loop in operation exist.

## 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 was 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 proposed TS 3.9.2, securing valve SJV0703 closed precludes the flushing activity and the potential of the dilution event. Based on plant experience, a need to flush the detector during refueling activities is unlikely. In higher modes of plant operation, under proposed TS 3.3.9, purging the CVCS radiation detector SJRE001 would be precluded, should both trains of the BDMS be unavailable or should the condition of no reactor coolant loop in operation exist. 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. Proposed TS 3.9.2 requires the same degree of control for the CVCS resin vessels and isolation of the purge line for flushing the CVCS letdown gamma radiation detector SJRE001. Deliberate steps are taken to isolate the CVCS resin vessels configured with resin for dilution and to isolate the purge line for detector SJRE001, when necessary, to avoid an inadvertent boron dilution event in Mode 6.

In higher modes of plant operation, when both trains of BDMS are unavailable or when a condition exists where no RCS loop is in operation, current TS 3.3.9 requires deliberate steps taken to isolate the reactor makeup water valves connected to the RCS to prevent inadvertent boron dilution. Proposed TS 3.3.9 requires deliberate steps taken to isolate the reactor makeup water valves connected to the RCS when both trains of BDMS are unavailable or when a condition of no RCS loop in operation exists. In addition, proposed TS 3.3.9 ensures isolation of CVCS resin vessels configured with resin for dilution and isolation of the purge line for detector SJRE001, when necessary, to avoid an inadvertent boron dilution event

## 4.0 TECHNICAL ANALYSIS

### 4.1 Revisions to TS 3.9.2 and TS 3.3.9 to Include Additional Unborated Water Dilution Sources

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 CVCS resin vessels as potential dilution sources. 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 CVCS resin 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 proposed revisions to TS 3.9.2 will ensure that the CVCS resin vessels are isolated in MODE 6, if required.

Isolation of the CVCS resin vessels, if needed, to avoid a boron dilution event in higher modes of plant operation is ensured by proposed TS 3.3.9. When both trains of BDMS are inoperable, the operators are aware of the loss of safety function for automatically mitigating an inadvertent boron dilution event. When there are no RCS loops in operation, the operators are aware of the reduced mixing volume available for an inadvertent boron dilution event. Therefore, should both trains of the BDMS become unavailable, or should a condition of no RCS loop in operation exist, proposed TS 3.3.9 will ensure that the CVCS resin vessel isolation valves are secured closed under administrative controls. The administrative controls include procedural requirements to precondition the resin vessels with borated water prior to their use; to monitor their effluent for boron concentration; and to assess the impact to plant reactivity management. The administrative controls ensure that the resin vessels are not dilution sources and thus preclude a potential boron dilution event.

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. Proposed TS 3.9.2 will preclude the flushing activity and a potential boron dilution event in MODE 6. In higher modes of plant operation, an inadvertent boron dilution event due to flushing the detector is precluded by proposed TS 3.3.9. Should both trains of the BDMS become unavailable, or a condition of no RCS loop in operation exist, the valve SJV0703 is secured closed. 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 CVCS 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 proposed TS 3.3.9 and TS 3.9.2 ensure that isolation requirements are met.

## 4.2 Discussion of Bases Changes for TS 3.3.1 Condition I and Condition K and Bases Changes for TS 3.3.9 Condition A

In addition to the proposed TS changes and their associated Bases changes, specific Bases changes for TS 3.3.9 Condition A and Bases changes for TS 3.3.1, "Reactor Trip System (RTS) Instrumentation", Condition I and Condition K, are made as separate and additional changes. Note that these TS Bases changes are made under the Callaway TS Bases and 50.59 review programs and are provided to NRC for information only.

TS 3.3.9 Condition A (Modes 2 (below P-6), 3, 4, and 5) results when one train of BDMS is inoperable. TS 3.3.1 Condition I (Mode 2 (below P-6)) and TS 3.3.1 Condition K (Modes 3, 4, and 5) result when one source range neutron flux channel is inoperable. The changes remove statements that were previously added to these Bases sections as enhancements, but which have now been determined to be unnecessary and overly restrictive. The statements disallow the introduction of reactor makeup water into the RCS from the CVCS mixing tee when in the TS 3.3.1 Condition I or Condition K or in TS 3.3.9 Condition A.

Inoperability of one train of BDMS or inoperability of one source range neutron flux channel does not by itself prevent mitigation of an inadvertent boron dilution event. The other train of BDMS remains available or the other source range neutron flux channel remains available to provide the necessary function to automatically mitigate an inadvertent

boron dilution event. When in TS 3.3.1 Condition I or Condition K or in TS 3.3.9 Condition A, in each case the remaining operable BDMS train or the remaining operable source range neutron flux channel provides the BDMS automatic mitigating safety function in the event of an inadvertent boron dilution event. Removing the overly restrictive statements does not adversely impact the BDMS safety function or the LCO 3.3.1 and LCO 3.3.9 requirements that both source range neutron flux channels are operable and that both trains of BDMS are operable.

Based on current plant procedures for evolutions to borate or dilute using the CVCS blending tee and based on requirements to maintain shutdown margin, these statements are not needed and are overly restrictive. Concentrated boric acid held in boric acid storage tanks is blended with reactor makeup water to yield a lower boric acid concentration to the volume control tank or charging pump suction. Blended boric acid can be added to the CVCS system manually by the control room operator or automatically. The control room operator selects the desired boric acid concentration from the main control room panel and monitors plant parameters for the expected results. Administrative controls, control room annunciations, and the CVCS, RMWS, and boric acid storage tanks system designs make an inadvertent boron dilution event highly unlikely. Plant procedures require verification of the settings for use of the reactor makeup water, the boric acid storage tanks, and the blend process. The CVCS and RMWS are designed to limit the potential rate of dilution by providing control room annunciation to the operators and by automatically terminating makeup flow when outside deviation limits. In addition dilution evolutions are finite processes that are performed to completion under the continual observance of operators. Disallowing use of the blending tee when one BDMS train is inoperable or when one source range neutron flux channel is inoperable is unnecessary.

In addition to being overly restrictive, these TS Bases statements are not consistent with current TS 3.3.1 Condition I or Condition K or with TS 3.3.9 Condition A. Because the statement of the requirement is located in the TS Bases only and is not in the TS, the requirement is not consistent with the TS and could result in a potential violation of TS.

Note that with the loss of both trains of BDMS or loss of both source range neutron flux channels or with the no reactor coolant loop in operation, the plant is in a more degraded condition and with increased vulnerability to a boron dilution accident. Loss of both trains of BDMS or both source range neutron flux channels results in the loss of safety function for automatically mitigating an inadvertent boron dilution event. With a condition of no reactor coolant loop in operation, a reduced mixing volume results for an inadvertent boron dilution event. Proposed TS 3.3.9 ensures that all unborated water source isolation valves are closed and secured and precludes the potential for an inadvertent boron dilution event. Removing the TS Bases statements does not adversely impact plant protection from an inadvertent boron dilution event.

## 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 CVCS 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. Allowing an exception for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by the LCO Note, these vessels may be unisolated under administrative controls. The administrative controls ensure that the resin vessels are not dilution sources. These changes do not involve a significant increase in the probability or consequences of an inadvertent boron dilution accident.

The proposed changes do not involve a significant increase in the probability or consequences of an inadvertent boron dilution accident by requiring the isolation of all unborated water source isolation valves in higher plant modes when both trains of BDMS are inoperable or when a condition of no reactor coolant loop in operation exists. Proposed TS 3.3.9 Required Actions B3 and C are generic and remain consistent with the plant accident analyses. Allowing exceptions for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by exception Notes, these vessels may be unisolated under

administrative controls. The administrative controls ensure that the resin vessels are not dilution sources.

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 CVCS resin 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. Allowing an exception for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by the LCO Note these vessels may be unisolated under administrative controls. The administrative controls ensure that the resin vessels are not dilution sources. These changes do not create the possibility of a new or different kind of accident from an inadvertent boron dilution accident previously evaluated.

Requiring the isolation of unborated water source isolation valves in higher plant modes when both trains of BDMS are inoperable or when a condition of no RCS loop in operation exists, does not create the possibility of a new or different kind of inadvertent boron dilution accident. Proposed TS 3.3.9 is generic and remains consistent with the plant accident analyses. Allowing exceptions for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by exception Notes, these vessels may be unisolated under

administrative controls. The administrative controls ensure that the resin vessels are not dilution sources.

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 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 CVCS resin vessels 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. Allowing an exception for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by the LCO Note these vessels may be unisolated under administrative controls. The administrative controls ensure that the resin vessels are not dilution sources. This change does not involve a significant reduction in a margin of safety due to an inadvertent boron dilution accident.

Requiring the isolation of all unborated water source isolation valves in higher plant modes when both trains of BDMS are inoperable or when no reactor coolant loop is in operation does not involve a significant reduction in the margin of safety. The changes to the Specifications make it generic and while it remains consistent with the plant accident analyses. Allowing exceptions for CVCS resin vessel operation is acceptable because chemistry controls may require some CVCS resin vessels to be configured with resin intended for boron dilution. Plant conditions may warrant their use. As allowed by these exception Notes, these vessels may be unisolated under administrative controls. The administrative controls ensure that the resin vessels are not dilution sources.

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.

The major regulatory requirements for designing plant systems are the General Design Criteria (GDCs) contained in 10 CFR Part 50, Appendix A. They are also discussed in Section 3.1 of the Callaway FSAR. Those that apply specifically to the mitigation of the boron dilution event are presented below.

GDC 10, Reactor Design, "The reactor core and associated coolant, control, and protection systems shall be designed with an appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences." GDC 10 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, "The reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences." GDC 15 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 20, Protection System Functions, "The protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety." GDC 20 assures the reactor protection system automatically initiates a reactor trip when any variable monitored by the system or combination of monitored variables exceeds the normal operating range. Setpoints are designed to provide an envelope of safe operating conditions with adequate margin for uncertainties to ensure that the fuel design limits are not exceeded.

GDC 25, Protection System Requirements for Reactivity Control Malfunctions, "The protection system shall be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection or dropout) of control rods." GDC 25 assures the protection system is designed to limit reactivity transients so that the fuel design limits are not exceeded. Analyses of the effects of possible malfunctions are discussed in FSAR Chapter 15. The analyses show that for postulated boron dilution during refueling, startup, manual or automatic operation at power, hot standby, or cold shutdown, the operator has ample time to determine the cause of dilution, terminate the source of dilution, and initiate reboration before shutdown margin is lost. Either manual or automatic controls can be used to terminate dilution and initiate boration. The analyses show that acceptable fuel damage limits are not exceeded even in the event of a single malfunction of either system.

GDC 26, Reactivity Control System Redundancy and Capability, " Two independent reactivity control systems of different design principles shall be provided. One of the systems shall use control rods, preferably including positive means for inserting the rods, and shall be capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded. The second reactivity control system shall be capable or reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure that the acceptable fuel design limits are not exceeded. One of the systems shall be capable of holding the reactor core subcritical under cold conditions." GDC 26 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. Two reactivity control systems are provided. At Callaway, the rod cluster control assemblies (RCCAs) and chemical shim (boric acid) provide two reactivity control systems.

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 proposed TS 3.9.2, "Unborated Water Source Isolation Valves" would preclude an inadvertent boron dilution event in MODE 6. Based on proposed TS 3.3.9 and TS 3.9.2 and based on their generic requirements, all potential unborated water dilution sources are considered. Specifically, inadvertent dilution via the CVCS and its subsystem the BTRS is addressed by requiring controls which include isolation of the CVCS resin vessels as potential sources for diluted borated or unborated water. Inadvertent dilution via the purge line used during flushing of CVCS letdown radiation monitor SJRE001 is also addressed by requiring controls which include isolation.

Providing isolation of valves associated with unborated water dilution sources, specifically those affected valves in the CVCS, associated with reactor makeup water; or those affected by operation of the CVCS resin vessels; or those associated with the purge line used during flushing of CVCS monitor SJRE001, 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.

In addition, in higher plant modes, proposed TS 3.3.9 requires all unborated water source isolation valves are closed and secured when both BDMS trains are inoperable, or when there is no reactor coolant loop in operation. These isolations create physical barriers to prevent 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

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.

As discussed above, the proposed changes do not involve a significant hazards consideration and the consequences from an inadvertent boron dilution accident remain bounded by the FSAR analysis. There is no increase in occupational radiation exposure related to the changes. 10 CFR 51.22(b) specifies the criteria for categorical exclusion from the requirements for a specific environmental assessment per 10 CFR 51.21. Accordingly, the proposed changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9).

Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.

## 7.0 PRECEDENTS

Callaway is unaware of any 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 2

# MARKUP OF TECHNICAL SPECIFICATION PAGES

For Information Only



## 3.3 INSTRUMENTATION

### 3.3.9 Boron Dilution Mitigation System (BDMS)

LCO 3.3.9 Two trains of the BDMS shall be OPERABLE and one RCS loop shall be in operation.

APPLICABILITY: MODES 2 (below P-6 (Intermediate Range Neutron Flux) interlock), 3, 4, and 5.

---NOTE---
The boron dilution flux multiplication signal may be blocked in MODES 2 (below P-6 (Intermediate Range Neutron Flux) interlock) and 3 during reactor startup.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. One train inoperable. | A.1 | Restore train to OPERABLE status. | 72 hours |
| B. Two trains inoperable.<br><br>OR<br><br>Required Action and associated Completion Time of Condition A not met. | B.1 | ---NOTE---<br>Plant temperature changes are allowed provided the temperature change is accounted for in the calculated SDM.<br>---<br><br>Suspend operations involving positive reactivity additions. | Immediately |
| | AND | | |

(continued)

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| B. (continued) | B.2 | Perform SR 3.1.1.1. | 1 hour<br>AND<br>Once per 12 hours thereafter |
| | AND | | |
| INSERT 1 TS 3.3.9 | 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 |
| INSERT 2 | AND | | |
| | C.2 | Verify unborated water source isolation valves, BGV0178 and BGV0601, are closed and secured. | Once per 31 days |

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**INSERT1**
**TS 3.3.9**

| | | |
|---|---|---|
| ----------NOTE---------- CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. ---------- | | |
| B.3.1 | Close and secure unborated water source isolation valves. | 4 hours |
| AND | | |
| B.3.2 | Verify unborated water source isolation valves are closed and secure. | Once per 31 days |

**INSERT2**
**TS 3.3.9**

| | | |
|---|---|---|
| ----------NOTE---------- CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. ---------- | | |
| C.1 | Close and secure unborated water source isolation valves. | 4 hours |
| AND | | |
| C.2 | Verify unborated water source isolation valves are closed and secure. | Once per 31 days |

## 3.9 REFUELING OPERATIONS

### 3.9.2 Unborated Water Source Isolation Valves

LCO 3.9.2 Each valve used to isolate unborated water sources ~~BGV0178 and BGV0601~~ shall be secured in the closed position.

INSERT LCO 3.9.2

APPLICABILITY: MODE 6.

ACTIONS

NOTE

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

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

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SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.2.1 | Verify each valve that isolates unborated water sources ~~BGV0178 and BGV0601~~ is secured in the closed position. | 31 days |

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## INSERT LCO 3.9.2

----------NOTE----------

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

2. CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration.

---

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# ATTACHMENT 3

# RETYPED MARKUP OF TECHNICAL SPECIFICATION PAGES

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| B. (continued) | B.2 Perform SR 3.1.1.1. | 1 hour<br>AND<br>Once per 12 hours thereafter |
| | AND<br>----------NOTE----------<br>CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration.<br>---------- | |
| | B.3.1 Close and secure unborated water source isolation valves, | 4 hours |
| | AND | |
| | B.3.2 Verify unborated water source isolation valves are closed and secured. | Once per 31 days |

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. No RCS loop in operation. | ----------NOTE----------<br>CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration.<br>---------- | |
| | C.1 Close and secure unborated water source isolation valves.<br><br>AND<br><br>C.2 Verify unborated water source isolation valves are closed and secured. | 4 hours<br><br><br><br>Once per 31 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.3.9.1 | Perform CHANNEL CHECK. | 12 hours |
| SR 3.3.9.2 | ---------- NOTE ----------<br>Only required to be performed in MODE 5.<br>----------<br><br>Verify BGV0178 is secured in the closed position. | 31 days |
| SR 3.3.9.3 | ---------- NOTE ----------<br>Not required to be performed until 4 hours after reducing power below P-6 interlock.<br>----------<br><br>Perform COT and verify nominal flux multiplication setpoint of 1.7. | 184 days |
| SR 3.3.9.4 | ---------- NOTE ----------<br>Neutron detectors are excluded from CHANNEL CALIBRATION.<br>----------<br><br>Perform CHANNEL CALIBRATION. | 18 months |
| SR 3.3.9.5 | Verify the centrifugal charging pump suction valves from the RWST open and the CVCS volume control tank discharge valves close in less than or equal to 30 seconds on a simulated or actual actuation signal. | 18 months |
| SR 3.3.9.6 | Verify one RCS loop is in operation. | 12 hours |

## 3.9 REFUELING OPERATIONS

### 3.9.2 Unborated Water Source Isolation Valves

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

----------NOTE----------

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

2. CVCS resin vessels may be unisolated intermittently under administrative controls when the vessel resin is not preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration.

---

APPLICABILITY: MODE 6.

ACTIONS

----------NOTE----------

Separate Condition entry is allowed for each unborated water 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. | Immediately |
| | AND | | |
| | A.2 | Initiate actions to secure valve in closed position. | Immediately |
| | AND | | |
| | 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 sources is secured in the closed position. | 31 days |

## 3.9 REFUELING OPERATIONS

### 3.9.3 Nuclear Instrumentation

LCO 3.9.3 Two source range neutron flux monitors shall be OPERABLE.

APPLICABILITY: MODE 6.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. One required source range neutron flux monitor inoperable. | A.1 | Suspend CORE ALTERATIONS. | Immediately |
| | AND | | |
| | A.2 | Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1. | Immediately |
| B. Two required source range neutron flux monitors inoperable. | B.1 | Initiate action to restore one source range neutron flux monitor to OPERABLE status. | Immediately |
| | AND | | |
| | B.2 | Perform SR 3.9.1.1. | Once per 12 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.3.1 | Perform CHANNEL CHECK. | 12 hours |
| SR 3.9.3.2 | ----------NOTE----------<br>Neutron detectors are excluded from CHANNEL CALIBRATION.<br>----------<br><br>Perform CHANNEL CALIBRATION. | <br><br><br><br>18 months |

## 3.9 REFUELING OPERATIONS

### 3.9.4 Containment Penetrations

LCO 3.9.4 The containment penetrations shall be in the following status:

a. The equipment hatch closed and held in place by four bolts, or if open, capable of being closed;

b. One door in the emergency air lock and one door in the personnel air lock capable of being closed; and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere either:

1. closed by a manual or automatic isolation valve, blind flange, or equivalent, or

2. capable of being closed by an OPERABLE Containment Purge Isolation valve.

---NOTE---
Penetration flow path(s) providing direct access from the containment atmosphere to the outside atmosphere may be unisolated under administrative controls.
---

APPLICABILITY: During CORE ALTERATIONS,
During movement of irradiated fuel assemblies within containment.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. One or more containment penetrations not in required status. | A.1 | Suspend CORE ALTERATIONS. | Immediately |
| | AND | | |
| | A.2 | Suspend movement of irradiated fuel assemblies within containment. | Immediately |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.4.1 | Verify each required containment penetration is in the required status. | 7 days |
| SR 3.9.4.2 | ----------NOTE----------<br>Only required for an open equipment hatch.<br>----------<br><br>Verify the capability to install the equipment hatch | 7 days |
| SR 3.9.4.3 | Verify each required containment purge isolation valve actuates to the isolation position on a manual actuation signal. | 18 months |

## 3.9 REFUELING OPERATIONS

### 3.9.5 Residual Heat Removal (RHR) and Coolant Circulation - High Water Level

LCO 3.9.5 One RHR loop shall be OPERABLE and in operation.

----------NOTE----------
The required RHR loop may be removed from operation for ≤ 1 hour per 8 hour period, provided no operations are permitted that would cause introduction into the Reactor Coolant System, coolant with boron concentration less than that required to meet the minimum required boron concentration of LCO 3.9.1.
---

APPLICABILITY: MODE 6 with the water level ≥ 23 ft above the top of reactor vessel flange.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. RHR loop requirements not met. | A.1 | Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1. | Immediately |
| | AND | | |
| | A.2 | Suspend loading irradiated fuel assemblies in the core. | Immediately |
| | AND | | |
| | | | (continued) |

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. RHR loop requirements not met. (continued) | A.3 | Initiate action to satisfy RHR loop requirements. | Immediately |
| | AND | | |
| | A.4 | Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.5.1 | Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of ≥ 1000 gpm. | 12 hours |

## 3.9 REFUELING OPERATIONS

### 3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level

LCO 3.9.6 Two RHR loops shall be OPERABLE, and one RHR loop shall be in operation.

APPLICABILITY: MODE 6 with the water level < 23 ft above the top of reactor vessel flange.

ACTIONS

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. Less than the required number of RHR loops OPERABLE. | A.1 | Initiate action to restore required RHR loops to OPERABLE status. | Immediately |
| | OR | | |
| | A.2 | Initiate action to establish ≥ 23 ft of water above the top of reactor vessel flange. | Immediately |

(continued)

ACTIONS (continued)

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| B. No RHR loop in operation. | B.1 | Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet the boron concentration of LCO 3.9.1. | Immediately |
| | AND | | |
| | B.2 | Initiate action to restore one RHR loop to operation. | Immediately |
| | AND | | |
| | B.3 | Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.6.1 | Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of ≥ 1000 gpm. | 12 hours |
| SR 3.9.6.2 | Verify correct breaker alignment and indicated power available to the required RHR pump that is not in operation. | 7 days |

## 3.9 REFUELING OPERATIONS

### 3.9.7 Refueling Pool Water Level

LCO 3.9.7 Refueling pool water level shall be maintained ≥ 23 ft above the top of reactor vessel flange.

APPLICABILITY: During movement of irradiated fuel assemblies within containment.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Refueling pool water level not within limit. | A.1 Suspend movement of irradiated fuel assemblies within containment. | Immediately |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.9.7.1 | Verify refueling pool water level is ≥ 23 ft above the top of reactor vessel flange. | 24 hours |

# ULNRC- 05269

# ATTACHMENT 4

# PROPOSED TECHNICAL SPECIFICATION BASES CHANGES

**(for information only)**

BASES

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

5. Source Range Neutron Flux

The LCO requirement for the Source Range Neutron Flux trip Function ensures that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup (automatic rod withdrawal is no longer available). This trip Function provides redundant protection to the Power Range Neutron Flux - Low and Intermediate Range Neutron Flux trip Functions. In MODES 3, 4, and 5, administrative controls also prevent the uncontrolled manual withdrawal of rods. The NIS source range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS source range detectors do not provide any inputs to control systems. The source range trip is the only RTS automatic protection function required in MODES 3, 4, and 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. Therefore, the functional capability at the Trip Setpoint is assumed to be available.

The LCO requires two channels of Source Range Neutron Flux to be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. This Function uses one-out-of-two trip logic. The Trip Setpoint is ≤ 1.0 E5 cps. The outputs of the Function to RTS logic are not required OPERABLE in MODE 6 or when all rods are fully inserted and the Rod Control System is incapable of rod withdrawal.

The Source Range Neutron Flux trip Function provides protection for control rod withdrawal from subcritical ~~boron dilution~~ and control rod ejection events.

INSERT 1
B 3.3.1

In MODE 2 when below the P-6 setpoint, the Source Range Neutron Flux trip must be OPERABLE. Above the P-6 setpoint, the Intermediate Range Neutron Flux trip and the Power Range Neutron Flux - Low trip will provide core protection for reactivity accidents. Above the P-6 setpoint, the NIS source range neutron flux reactor trip may be manually blocked. When the source range trip is blocked, the high voltage to the detectors is also removed.

In MODES 3, 4, and 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted, the Source Range Neutron Flux trip Function must also be OPERABLE. If the Rod Control System is capable of rod withdrawal, the Source Range Neutron Flux trip must be OPERABLE to provide core protection against a rod withdrawal accident. If the Rod Control

(continued)

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**INSERT1**
**B 3.3.1**

In MODE 2 credit is also taken for a reactor trip being initiated by this trip Function to alert the control room operators to manually mitigate an inadvertent boron dilution event.

BASES

ACTIONS

G.1 and G.2 (continued)

range channels or the neutron flux channels discussed in LCO 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," with action to reduce power below the count rate equivalent to the P-6 setpoint.

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~~

INSERT 2
B 3.3.1

(continued)

# TSBCN 02-016

## INSERT2
## B 3.3.1

See LCO 3.3.9, "Boron Dilution Mitigation System," for requirements related to the mitigation of inadvertent boron dilution events.

BASES

ACTIONS

I.1 (continued)

~~Chemical and Volume Control System mixing tee is not permitted when one source range neutron flux channel is inoperable.~~

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 reasonable considering the other source range channel remains OPERABLE to perform the safety function and given the low probability of an event occurring during this interval. 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.~~

INSERT 2
B 3.3.1

(continued)

# TSBCN 02-016

**INSERT2**
**B 3.3.1**

See LCO 3.3.9, "Boron Dilution Mitigation System," for requirements related to the mitigation of inadvertent boron dilution events.

B 3.3 INSTRUMENTATION

B 3.3.9 Boron Dilution Mitigation System (BDMS)

INSERT 1a
Bases 3.3.9

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

TSBCN 02-016

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 all 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

(see Condition C).

(continued)

# TSB CN 02-016

**INSERT 1a**
**Bases 3.3.9**

The addition of unborated primary grade water into the RCS results in boron dilution and a potential for an inadvertent boron dilution event. Other potential boron dilution sources have been identified. An inadvertent boron dilution path is created when flushing the Chemical and Volume Control system (CVCS) letdown gamma radiation detector, SJRE001, with unborated reactor makeup water. Boron dilution may also be accomplished by removing boron from the CVCS stream prior to RCS return using the ion exchange capability of the CVCS resin vessels. The CVCS resin vessels include the resin vessels of its subsystem, the boron thermal regeneration system.

INSERT 1
Base 3.3.9

BASES

APPLICABILITY (continued)

In MODE 6, a dilution event is precluded by locked valves ~~(BGV0178 and BGV0601)~~ that isolate the RCS from the potential ~~source~~ sources of unborated water (according to LCO 3.9.2, "Unborated Water Source Isolation Valves").

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 commence the withdrawal of control banks for startup. This Applicability Note can not be used to block BDMS prior to or during shutdown bank withdrawal. 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.

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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);

(continued)

# TSB CN 02-016

**INSERT1**
**Bases 3.3.9**

for unborated reactor makeup water (BGV0178 and BGV0601), CVCS resin vessels configured with resin for dilution during normal operation (BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor (SJV0703)

BASES

ACTIONS

A.1 (continued)

- Use of self-verification techniques by all licensed operators performing core reactivity manipulations;

- 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.~~

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

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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.

Required Action B.3.1 requires valves listed in the LCO Bases for LCO 3.9.2 ~~(Required Action A.2), BGV0178 and BGV0601~~ "Unborated Water Source Isolation Valves" 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.

INSERT 1b
Bases 3.3.9

(continued)

# TSB CN 02-016

## INSERT 1b
## Bases 3.3.9

A dilution event is precluded by locked valves for unborated reactor makeup water (BGV0178 and BGV0601), CVCS resin vessels configured with resin for dilution during normal operation (BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor (SJV0703) that isolate the RCS from potential sources of unborated water.

BASES

ACTIONS

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

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

INSERT 2 Bases 3.3.9

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.

INSERT 1b Bases 3.3.9

listed in the LCO Bases for LCO 3.9.2, "Unborated Water Source Isolation Valves"

Required Action C.1 requires that valves ~~BGV0178 and BGV0609~~ 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 Bases 3.3.9

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.

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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

(continued)

# TSB CN 02-016

## INSERT 1b
## Bases 3.3.9

A dilution event is precluded by locked valves for unborated reactor makeup water (BGV0178 and BGV0601), CVCS resin vessels configured with resin for dilution during normal operation (BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor (SJV0703) that isolate the RCS from potential sources of unborated water.

# TSB CN 02-016

## INSERT2
## Bases 3.3.9

Required Actions B.3.1 and B.3.2 are modified by a Note allowing an isolation exception for some CVCS resin vessels that may contain resin that is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. These vessels may be unisolated intermittently under administrative controls. The administrative controls are identified in TS Bases 3.9.2. Administrative controls include both plant procedural requirements and operational awareness. Plant procedures ensure shutdown margin is maintained by requiring CVCS resin vessel pre-service flushing with borated water for primary system resins until equilibrium is reached with the RCS boron concentration or the refueling concentration as required. The effluent is monitored for boron and its impact on plant reactivity management determined. Therefore CVCS resin vessel operation is permitted by the Note under these conditions until the CVCS resin vessel is borated and no longer a dilution source. Chemistry controls may also require some CVCS resin vessels to be configured with resin not intended for boron dilution or configured with resin that is preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. However, these vessels are not boron dilution sources and their isolation is not required per the Required Actions of Condition B.

## INSERT3
## Bases 3.3.9

Required Actions C.1 and C.2 are modified by a Note allowing an isolation exception for some CVCS resin vessels that may contain resin that is not preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. These vessels may be unisolated intermittently under administrative controls. The administrative controls are identified in TS Bases 3.9.2. Administrative controls include both plant procedural requirements and operational awareness. Plant procedures ensure shutdown margin is maintained by requiring CVCS resin vessel pre-service flushing with borated water for primary system resins until equilibrium is reached with the RCS boron concentration or the refueling concentration as required. The effluent is monitored for boron and its impact on plant reactivity management determined. Therefore CVCS resin vessel operation is permitted by the Note under these conditions until the CVCS resin vessel is borated and no longer a dilution source. Chemistry controls may also require some CVCS resin vessels to be configured with resin not intended for boron dilution or configured with resin that is preconditioned with borated water with a boron concentration equal to or greater than the reactor coolant system boron concentration. However, these vessels are not boron dilution sources and their isolation is not required per the Required Actions of Condition C.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.9.1 (continued)

verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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.

"Unborated Water Source Isolation Valves"

SR 3.3.9.2

LCO

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 184 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

(continued)

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 all 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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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 ≤ 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, 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)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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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INSERT A

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 ≥ 7% for required RCS loops. If the SG secondary side narrow range water level is < 7%, 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)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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 all at least one reactor coolant loop in operation. LCO 3.3.9, "Boron Dilution Mitigation System (BDMS)," contains the requirements for the BDMS.

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

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(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 ≤ 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

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 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 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, which has the minimum water level specified in SR 3.4.6.2.

(continued)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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 ≥ 7% for required RCS loops. If the SG secondary side narrow range water level is < 7%, 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)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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.

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

all

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 ≥ 86%. As shown in Reference 3, any narrow range level indication above 7% 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 ≥ 86%. 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

LCO (continued)

INSERT A

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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.

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 ≤ 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 ≤ 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. A SG can perform as a heat sink via natural circulation when it has an adequate water level and is OPERABLE.

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 ≥ 86%.

(continued)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

BASES

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 < 86%, 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.

INSERT A

TSBCN 02-016

(continued)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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.

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

all TSBCN 02-016

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 heat removal 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).

Since LCO 3.4.8 contains Required Actions with immediate Completion Times, it is not permitted to enter LCO 3.4.8 from either LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled" or from MODE 6 unless the requirements of LCO 3.4.8 are met.

(continued)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

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.

TSBCN 02-016 INSERT A

SURVEILLANCE REQUIREMENTS

SR 3.4.8.1

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)

**TSB CN 02-016**

**INSERT A**

, operation of CVCS resin vessels configured with resin for dilution during normal operation is not permitted, and operation of the purge line associated with flushing the CVCS letdown radiation monitor is not permitted

unborated water source

BASES

BACKGROUND

During MODE 6 operations, all isolation valves ~~for 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 1

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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~~ LCO 3.9.1, "Boron Concentration.")

INSERT 1A

the

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 that are connected to the RCS. These valves have the potential to indirectly allow dilution of the RCS boron concentration in MODE 6. By isolating all 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).

INSERT 2A

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 2

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.

space

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

(continued)

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## INSERT 1

Examples of isolation valves connected to the RCS include: (1) unborated reactor makeup water (BGV0178 and BGV0601), (2) CVCS resin vessels configured with resin for dilution during normal operation (BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, and BGV0055) and (3) unborated flushing water for the CVCS letdown radiation monitor (SJV0703). These isolation valves must be secured in the closed position.

Some dilution sources, that are not connected to RCS in their as-built configuration, can be temporarily configured (ex. flexible hose connected) to provide a direct path for unborated water into the RCS. A routine Mode 6 activity requiring this temporary configuration is decontamination of the refueling pool. Examples of isolation valves not connected to the RCS, but can be modified include: (1) BLV0078, (2) BLV0079 and (3) BLV0055.

## INSERT 2

dilution source flow paths connected to the RCS

## INSERT 2A

This LCO is modified by NOTE 1 to allow dilution sources, not connected to the RCS, to be used under administrative controls when temporary configurations are implemented.

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## INSERT 1A

Boron dilution may also be accomplished by removing boron from the Chemical and Volume Control system (CVCS) stream prior to RCS return using the ion exchange capability of the CVCS resin vessels. The CVCS resin vessels may be configured with resin designed for controlling RCS chemistry during normal operations and shutdown periods. The CVCS resin vessels include the resin vessels of its subsystem, the Boron Thermal Regeneration system (BTRS). During refueling operations, BTRS vessel operation may be required for RCS impurity removal to improve water clarity and to reduce refueling cavity dose rates for the fuel handlers. These situations require the BTRS resin vessels to be unisolated intermittently as required for system operation and use, and as allowed by LCO 3.9.2 for Mode 6. Plant procedures ensure shutdown margin is maintained by requiring pre-service flushing with borated water for primary system resins. This operation in Mode 6 is permitted under these conditions because the BTRS resin is borated and no longer a dilution source.

Chemistry controls may require some CVCS resin vessels to be configured with resin not intended for boron dilution or configured with resin that is preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. Because these vessels are not boron dilution sources, their isolation is not required. Some CVCS vessels may contain resin that is not preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. These vessels may be unisolated intermittently under administrative controls.

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. A plant modification was 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.

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**INSERT 2B**

During refueling activities, it may be necessary for a dilution source to be unisolated. Based on License Amendment 97, 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 TS Bases 3.9.1.

The following valves are excluded from the TS 3.9.2 LCO NOTE 1: BGV0178, BGV0601, BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, BGV0055 and SJV0703. The following valves are included under the LCO NOTE 1: BLV0078, BLV0079 AND BLV0055.

This LCO is modified by NOTE 2 allowing an isolation exception for some CVCS resin vessels that may contain resin that is not preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. These vessels may be unisolated intermittently under administrative controls.

Administrative controls include both plant procedural requirements and operational awareness. Plant procedures ensure shutdown margin is maintained by requiring CVCS resin vessel pre-service flushing with borated water for primary system resins until equilibrium is reached with the RCS boron concentration or the refueling concentration as required. The effluent is monitored for boron and its impact on plant reactivity management determined. Therefore CVCS resin vessel operation is permitted by Note 2 under these conditions until the CVCS resin vessel is borated and no longer a dilution source.

Chemistry controls may also require some CVCS resin vessels to be configured with resin not intended for boron dilution or configured with resin that is preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. However, these vessels are not boron dilution sources and their isolation is not required per this LCO.

ACTIONS

The ACTIONS table has been modified by a Note that allows separate Condition entry for each unborated water 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 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.

space

A.2

source

Preventing inadvertent dilution of the reactor coolant boron concentration is dependent on maintaining the unborated water isolation valves ~~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.

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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)

INSERT 3

SURVEILLANCE REQUIREMENTS

SR 3.9.2.1

after Flood-up

INSERT 3A

~~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.

Space

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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.

# TSB CN 02-016

## INSERT 3

Isolation valves for unborated reactor makeup water (BGV0178 and BGV0601), CVCS resin vessels configured with resin for dilution during normal operation (BG8522A, BG8522B, BGV0039, BGV0043, BGV0051, and BGV0055), and the purge line used during flushing of CVCS letdown radiation monitor (SJV0703)

## INSERT 3A

Chemistry controls may require some CVCS resin vessels to be configured with resin not intended for boron dilution or configured with resin that is preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. Because these vessels are not boron dilution sources, their isolation is not required. Some CVCS resin vessels may contain resin that is not preconditioned with borated water with a boron concentration equal to or greater than the refueling boron concentration. These vessels may be unisolated intermittently under administrative controls per LCO Note 2.

ULNRC- 05269

ATTACHMENT 5

SUMMARY OF REGULATORY COMMITMENTS

## SUMMARY OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by AmerenUE, Callaway Plant in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Dave E. Shafer, Superintendent, Licensing at AmerenUE, Callaway Plant, (314) 554-3104.

| COMMITMENT | Due Date/Event |
|---|---|
| The proposed amendment will be implemented within 90 days after approval | 90 days following NRC approval |
| Administrative controls consisting of written procedures will be established prior to the implementation of the proposed changes. The procedural controls require that in MODE 6 each valve used to isolate unborated water sources shall be secured in the closed position. | 90 days following NRC approval |
| Administrative controls consisting of written procedures will be established prior to the implementation of the proposed changes. The procedural controls require that when both BDMS trains are inoperable, or when no reactor coolant loop is in operation, and when in MODE 2 (below P-6 setpoint), 3, 4, and 5, each valve used to isolate unborated water sources shall be secured in the closed position. | 90 days following NRC approval |
| Identified TS Bases and Callaway FSAR changes will be incorporated into the TS Bases and the Callaway FSAR during implementation of the amendment. | During implementation of the amendment |