AmerenUE
Callaway Plant

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August 26, 2005

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

Ladies and Gentlemen: ULNRC-05197

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
REQUEST FOR APPROVAL OF CHANGES TO REACTOR COOLANT SYSTEM LEAKAGE DETECTION METHODOLOGY

Union Electric (AmerenUE) herewith transmits a request for approval of a change to the Reactor Coolant System (RCS) leak detection methodology employed for Callaway. This change was evaluated under 10 CFR 50.59 and it was concluded, pursuant to criterion viii of 10 CFR 50.59(c)(2), that the activity may be construed to be a departure from a method of evaluation described in the Final Safety Analysis Report (FSAR) that was used to establish the design bases or in the safety analyses for the facility.

This proposed amendment to the Callaway Plant license is being submitted per the guidance provided in 10 CFR 50.59(c). Implementation of the proposed change requires revising the Bases for TS 3.4.13, "RCS Operational LEAKAGE," Bases for Technical Specification (TS) 3.4.15, "RCS Leakage Detection Instrumentation," FSAR Appendix 3A, Section 5.2.5.2.3 and Table 5.2-6. These changes would clarify the requirements of the containment atmosphere gaseous radioactivity monitor with regard to its RCS leak detection capability and provide clarification that the monitor can be considered OPERABLE (in compliance with TS LCO 3.4.15) during all applicable MODES even when reactor coolant radioactivity levels are below the levels assumed in the original licensing basis for Callaway.

Attachments 1 through 4 provide the Evaluation, Markup of Technical Specification (TS) Bases, Markup of FSAR, and Summary of Regulatory Commitments, respectively, in

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support of this amendment request. TS Bases changes will be implemented pursuant to TS 5.5.14, "Technical Specification Bases Control Program," at the time the amendment is implemented.

It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10 CFR 50.92. Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment. The Callaway Plant Onsite Review Committee and the Nuclear Safety Review Board have reviewed and approved the attached licensing evaluations and have approved the submittal of this amendment application.

AmerenUE requests approval of this proposed License Amendment by March 2006.

The amendment will be implemented within 90 days after NRC approval. In accordance with 10 CFR 50.91, a copy of this amendment application is being provided to the designated Missouri State official.

If you have any questions on this amendment application, please contact Mr. David Shafer at (314) 554-3104.

Very truly yours,

Keith D. Young
Manager - Regulatory
Affairs

BFH/

Attachments: 1 – Evaluation
2 – Markup of Technical Specification Bases
3 – Markup of FSAR
4 – Summary of Regulatory Commitments

STATE OF MISSOURI)
) SS
COUNTY OF CALLAWAY)

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

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

SUBSCRIBED and sworn to before me this 26 day of AUGUST, 2005.

LORI L. TWILLMAN
Notary Public - Notary Seal
STATE OF MISSOURI
Callaway County
My Commission Expires: Aug. 3, 2007

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ATTACHMENT 1

EVALUATION

1.0 Description

2.0 Proposed Change

3.0 Background

4.0 Technical Analysis

5.0 Regulatory Safety Analysis

5.1 No Significant Hazards Consideration

5.2 Applicable Regulatory Requirements/Criteria

6.0 Environmental Consideration

7.0 References

EVALUATION

1.0 DESCRIPTION

The proposed change would revise the Bases for Technical Specification (TS) 3.4.13, "RCS Operational LEAKAGE," the Bases for Technical Specification 3.4.15,"RCS Leakage Detection Instrumentation," and Final Safety Analysis Report (FSAR) Appendix 3A, Section 5.2.5.2.3 and Table 5.2-6 (Reference 7.3) to clarify the design and OPERABILITY requirements of the containment atmosphere gaseous radioactivity monitor as a method of Reactor Coolant System (RCS) leak detection. Table 5.2-6 is revised to identify the capabilities and limitations of the containment atmosphere gaseous radioactivity monitors at low RCS activity levels.

Analyses have shown that the pre-existing containment radioactive gaseous background levels for which reliable detection is possible is dependent upon reactor power level, percent failed fuel, and containment purge operation. With primary coolant concentrations less than background equilibrium levels, such as during startup and operation with no fuel defects, the increase in detector count rate due to leakage will be partially masked by the statistical variation of the minimum detector background count rate, rendering reliable detection of a 1 gpm leak in one hour uncertain.

Operating experience has shown gaseous background radiation levels in containment at the Callaway Plant that would partially mask the detection of a 1 gpm leak. However, the monitor is capable of detecting an RCS to containment atmosphere leak if elevated reactor coolant gaseous activity is present above the background equilibrium levels.

This change was evaluated under 10 CFR 50.59 and it was concluded, pursuant to criterion viii of 10 CFR 50.59(c)(2), that the activity may be construed to be a departure from a method of evaluation described in the FSAR that was used to establish the design bases or in the safety analyses for the facility. This method of evaluation is described in USAR Section 5.2.5.2.3, "Component Operation," for the containment atmosphere gaseous radioactivity monitor. However, based on the RCS activity being lower than the primary coolant radioactivity concentration assumption in Regulatory Guide 1.45, the results of the current method of evaluation are non-conservative since a one gpm leak can not be reliably detected in one hour. The proposed use of the containment atmosphere gaseous radioactivity monitor with low RCS activity levels (based on continuous fuel improvements) is construed to be a departure from a method of evaluation described in the FSAR used in establishing the design bases or in the safety analyses.

2.0 PROPOSED CHANGE

The proposed changes would clarify the design and OPERABILITY requirements of the containment atmosphere gaseous radioactivity monitor as a method for RCS leakage detection as described in TS 3.4.13 and 3.4.15 Bases and FSAR Section 5.2.5 and Appendix 3A. Table 5.2-6 is revised to indicate that containment atmosphere gaseous radioactivity monitors provide reliable leak detection capabilities provided that the equilibrium activity of the containment atmosphere is below the level that would mask the change in activity corresponding to a 1 gpm leak in one hour. All of the changes are more specifically described as follows.

The following changes are proposed to the Bases for TS 3.4.13:

Bases for TS 3.4.13, SR 3.4.13.1 are revised to indicate that early detection of pressure boundary LEAKAGE or unidentified LEAKAGE is provided by systems that monitor containment atmosphere particulate radioactivity and containment sump level.

The following changes are proposed to the Bases for TS 3.4.15:

Bases for TS 3.4.15, BACKGROUND, are revised to separate the discussion of the containment atmosphere particulate radioactivity monitor and the containment atmosphere gaseous radioactivity monitor as a method for RCS leakage detection. In addition text was added to discuss the limitations of the containment atmosphere gaseous radioactivity monitor as a method for RCS leakage detection with low levels of radioactivity in the RCS.

Bases for TS 3.4.15, LCO, are revised to include additional text discussing the OPERABILITY requirements for the containment atmosphere gaseous radioactivity monitor. In particular, this section will be revised to state that, given the limitations of the monitor at low reactor coolant radioactivity levels, OPERABILITY of the gaseous radioactivity monitors is based on the monitor's ability to meet the required surveillances and not on it ability to indicate a 1 gpm RCS boundary leakage in one hour.

The following changes are proposed to the FSAR:

Appendix 3A is revised to indicate an exception to Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage," (Reference 7.2) as specified in Table 5.2-6.

FSAR Section 5.2.5.2.2 is revised to include additional discussion on the limitations on the use of the containment atmosphere gaseous radioactivity monitor as a method of RCS leakage detection.

FSAR Table 5.2-6, item 5, is revised to include text identifying the capabilities of the containment atmosphere radioactivity monitor for meeting the requirements of Position C.5 of Regulatory Guide 1.45.

Attachments 2 and 3 provide the TS Bases and FSAR markups, respectively, in support of this amendment request. TS Bases changes will be implemented pursuant to TS 5.5.14, "Technical Specification Bases Control Program," at the time the amendment is implemented.

3.0 BACKGROUND

On October 16, 2003, the Callaway Plant-Nuclear Regulatory Commission (NRC) Integrated Inspection Report 05000483/2003005 issued noncited violation (NCV) 50-483/0305-04 for failure to assure that applicable regulatory requirements and the design basis for the containment radiation gas monitors were correctly translated into plant calculation used to determine setpoints. This issue was entered into and evaluated under our corrective action program (CAR 200302806). That evaluation determined that due to improved fuel integrity and the resultant reduced RCS radioactivity levels, the containment atmosphere gaseous radioactivity monitors have become less effective for RCS leakage detection. The evaluation concluded that the capability of the containment atmosphere gaseous radioactivity monitors can no longer promptly detect a small RCS leak under all operating conditions. On November 16, 2003, Callaway administratively placed the containment atmosphere gaseous radioactivity monitors on the equipment out of service log (ESOL) and considered them inoperable for the purpose meeting LCO 3.4.15, pending resolution of this issue. Considering the gaseous radioactivity monitors inoperable was based on the regulatory concern identified in the inspection report and ensuring compliance with LCO 3.4.15. The containment atmosphere gaseous radioactivity monitors were designed in accordance with the sensitivities specified in Regulatory Guide 1.45. The monitor has been set to indicate a 1 gpm RCS leakage based on Regulatory Guide 1.45 assumptions. The monitors are fully functioning in accordance with specified design requirements and are meeting the current TS surveillance requirements.

Approval of this proposed amendment will clarify the design and OPERABILITY requirements for the containment atmosphere gaseous radioactivity monitor as a method of RCS leak detection, and that the monitor may still be regarded as OPERABLE during all applicable MODES, even when reactor coolant radioactivity levels are low, as long as the monitor otherwise meets Regulatory Guide 1.45 requirements (for detector sensitivity, etc.) and can meet their surveillance requirements. The changes are based on a change to the methodology described in Regulatory Guide 1.45 as effected thru appropriate changes to the FSAR.

Leak Detection System Design

The diverse reactor coolant pressure boundary leakage detection system consists of the containment sump level and flow monitoring system, the containment air particulate monitoring system, the containment radioactive gas monitoring system, and the containment cooler condensate measuring system. The sump level and flow monitoring system indicates leakage by monitoring increases in sump level. The containment cooler condensate measuring system detects leakage from the release of steam or water to the containment atmosphere. The air particulate and radioactive gas monitoring systems detect leakage from the release of radioactive materials to the containment atmosphere. OPERABILITY requirements for these systems are specified in the plant TSs. Each of these systems is described in further detail below.

In addition to the above systems, the containment humidity measuring system is also available as an indirect indication of leakage to the containment. Further, reactor coolant pressure boundary leakage can also be indicated by increasing charging pump flow rate compared with reactor coolant system inventory changes and by unscheduled increases in reactor makeup water usage.

CONTAINMENT SUMP LEVEL AND FLOW MONITORING SYSTEM - Since a leak in the primary system would result in reactor coolant flowing into the containment normal or instrument tunnel sumps, leakage would be indicated by a level increase in the sumps. Indication of increasing sump level is transmitted from the sump to the control room level indicator by means of a sump level transmitter. The system provides measurements of low leakages by monitoring level increase versus time. A sensitivity of 1 gpm in 1 hour can be achieved assuming that the water from the leak is collected in the sump.

The minimum detectable change in the containment normal sump level is 5 gallons and in the instrument tunnel sump level is 15 gallons. When the instrument tunnel sump is completely dry, the initial minimum detectable level change is 25 gallons. The levels are scanned by the Plant computer once per minute, and the normal background rate of increase in sump level is subtracted to determine the leakage rate. The actual reactor coolant leakage rate can be established from the increase above the normal rate of change of sump level after consideration of 35 percent of the high temperature leakage which initially evaporates but may be condensed by the containment coolers and then is routed to the sump. A check of other instrumentation would be required to eliminate possible leakage from nonradioactive systems as a cause of an increase in sump level.

CONTAINMENT AIR PARTICULATE MONITOR - An air sample is drawn outside the containment into a closed system by a sample pump and is then consecutively passed through a particulate filter with detector, an iodine cartridge with detector, and a gaseous monitor chamber with detector. The particulate monitor has a range of 10^{-12} to $10^{-7}\mu$Ci/cc and a minimum detectable concentration of $10^{-11}\mu$Ci/cc.

Particulate activity is determined from the containment free volume and the coolant fission and corrosion product particulate activity concentrations. Any increase of more than two standard deviations above the count rate for background would indicate a possible leak. The total particulate activity concentration above background, due to an abnormal leak and natural decay, increases almost linearly with time for the first several hours after the beginning of a leak. With 0.1-percent failed fuel, containment background airborne particulate radioactivity equivalent to 10^{-4} percent/day, and a partition factor equal to 0.2, a 1-gpm leak would be detected in 1 hour.

CONTAINMENT COOLER CONDENSATE MONITORING SYSTEM - The condensate monitoring system permits measurements of the liquid runoff from the containment cooler units. It consists of a containment cooler drain collection header, a vertical standpipe, valving, and standpipe level instrumentation for each cooler.

The condensate flow rate is a function of containment humidity, essential service water temperature leaving the coolers, and containment purge rate. The water vapor dispersed by a 1 gpm leak is much greater than the water vapor brought in with the outside air. Air brought in from the outside is heated to 50°F before it enters the containment.

After the air enters the containment, it is heated to 100-120°F so that the relative humidity drops. The water vapor brought in with the outside air does not build up in the containment since it is continually purged. Level changes of as little as 0.25 inches in the cooler condensate standpipes can be detected. Increases in the condensation rates over normal background are monitored by the Plant computer based upon level checks each minute in order to determine the unidentified leakage. A sensitivity of 1 gpm in 1 hour can be achieved with cold essential service water temperature to the containment coolers or with initial background leakage.

CONTAINMENT GASEOUS RADIOACTIVITY MONITOR - The containment gaseous radioactivity monitor determines gaseous radioactivity in the containment by monitoring continuous air samples from the containment atmosphere. After passing through the gas monitor, the sample is returned via the closed system to the containment atmosphere. Each sample is continuously mixed in a fixed, shielded volume where its activity is monitored. The monitor has a range of 10^{-7} to 10^{-2} μCi/cc and a minimum detectable concentration of 2×10^{-7} μCi/cc.

Gaseous radioactivity is determined from the containment free volume and the gaseous activity concentration of the reactor coolant. Any increase more than two standard deviations above the count rate for background would indicate a possible leak. The total gaseous activity level above background (after 1 year of normal operation) increases almost linearly for the first several hours after the beginning of the leak. With 0.1-percent failed fuel, containment background airborne gaseous radioactivity equivalent to 1 percent/day, and a partition factor equal to 1 (NUREG-0017 assumptions), a 1-gpm leak would be detected within 1 hour.

Need for the Amendment

Although the detection capabilities of the containment gaseous radioactivity monitor are consistent with its design basis, the level of radioactivity in the reactor coolant at the Callaway Plant has become much lower than what is assumed in the FSAR analysis. As such, the containment atmosphere gaseous radioactivity monitors will not respond within 1 hour to a 1 gpm leak with low RCS activity levels.

Approval of this proposed amendment will clarify the design and OPERABILITY requirements for the containment atmosphere gaseous radioactivity monitor as an acceptable method of RCS leak detection.

4.0 TECHNICAL ANALYSIS

RCS leakage detection requirements are given in TS 3.4.15 which requires the following RCS leakage detection instrumentation to be OPERABLE.

a. The containment sump level and flow monitoring system;
b. One containment atmosphere particulate radioactive monitor; and
c. The containment cooler condensate monitoring system or one containment atmosphere gaseous radioactivity monitor.

The Bases for TS 3.4.15 state that GDC 30 of Appendix A to 10 CFR 50 requires means for detecting and, to the extent practical, identifying the location of the source of RCS LEAKAGE. Regulatory Guide 1.45 describes acceptable methods for selecting leakage detection systems. In addition the Bases discusses that leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure.

In NUREG-0830, "Safety Evaluation Report Related to the Operation of Callaway Plant, Unit No. 1", Section 5.2.5, the NRC acknowledged that the installed RCS leakage detection systems are in compliance with the guidance found in Regulatory Guide 1.45 such that leakage of one gpm in one hour can be detected, satisfy the criteria of GDC 30 and are therefore acceptable. This criterion continues to be met by the diverse RCS leakage detection system consisting of the containment sump level and flow monitoring system, the containment air particulate radioactivity monitor, the containment cooler condensate monitoring system and the containment atmosphere gaseous radioactivity monitor under certain operating conditions.

The detection of RCS leakage using radiation monitors is affected by the type and quantity of isotopes that are contained in the reactor coolant and the background level of radiation affecting / influencing the detectors. Regulatory Guide 1.45 guidance on analyzing the sensitivity of radiation monitors used for RCS leakage detection recommends that a realistic primary coolant radioactivity concentration assumption be used. The Regulatory Guide further defines the realistic primary coolant concentration as the values used in the plant environmental report. For the Callaway Plant these concentration values are based on a 0.12% fuel defect from the Callaway Plant Environmental Report - Operating Licensing Stage (Reference 7.4). With the level of radioactivity in the reactor coolant assumed in the Callaway Plant Environmental Report - Operating Licensing Stage, the containment atmosphere particulate and gaseous radioactivity detectors are capable of detecting a one gpm leak in one hour. However, operational history of the plant has shown the level of radioactivity in the reactor coolant with no fuel defects is much lower than what is assumed in the FSAR. The regulatory guide acknowledges the limitations of radiation monitoring for leak detection when the RCS activity is low. Further, the regulatory guide recommends a sensitivity of $1\text{x } 10^{-6}$ µCi/cc for gaseous radioactivity monitors used for leak detection. The existing containment atmosphere gaseous radioactivity channel has a sensitivity of $2 \text{ x } 10^{-7}$ µCi/cc and a range of 10^{-7} to 10^{-2} µCi/cc, which meets the criteria specified in Regulatory Guide 1.45.

Given the level of radioactivity in the reactor coolant at Callaway Plant with no or minor fuel cladding defects, analysis has shown that the containment atmosphere gaseous radioactivity monitors would not promptly detect a one gpm leak in one hour. This conclusion is based on a realistic nominal detector background level, with the typical RCS gaseous activity associated with no fuel cladding defects. For these lower RCS activity levels, the increase in detector count rate due to leakage will be partially masked by the statistical variation of the minimum detector background count rate, rendering reliable detection of a 1 gpm leak in one hour uncertain. At elevated RCS activity/failed fuel conditions as discussed in Regulatory Guide 1.45, a one gpm leak would be detectable within one hour, even at higher detector background.

Regulatory Guide 1.45, Section B, discusses the selection of diverse leak detection methods given that the methods differ in sensitivity and response time. Prudent selection of detection methods should include sufficient systems to assure effective monitoring during periods when some detection systems may be ineffective or inoperable. The Bases for TS 3.4.15 thus state, "This LCO is satisfied when diverse monitoring methods are available."

Impact on Leak Before Break Analysis for Callaway

In light of the RCS leakage detection capabilities of the containment atmosphere gaseous radioactivity monitors described above, the technical bases for applying leak-before-break (LBB) analyses to the Callaway Plant is still valid due to the selection of diverse leak detection methods. The LBB approach is the application of fracture mechanics technology to demonstrate that high energy piping is very unlikely to experience catastrophic ruptures or failures. The NRC LBB guidance is provided in NUREG-1061, "Report of the U.S. Nuclear Regulatory Commission Piping Review Committee," Volume 3 (Reference 7.1), "Evaluation of Potential for Pipe Breaks," requires the following criteria to be satisfied: 1) the leakage flaw size should be large enough so that the leakage is assured of detection with at least a margin of 10 using the minimum installed leak detection capability when the pipe is subjected to normal operational loads; 2) under normal plus safe shutdown earthquake (SSE) loads there should be a margin of 2.0 between the leakage size flaw and the critical-size flaw which could propagate to piping failure to account for the uncertainties inherent in the analyses and the leakage detection capability; and 3) flaw stability must be demonstrated. In addition, NUREG-1061, Volume 3, specifies that the RCS leakage detection capability should meet the criteria established in Regulatory Guide 1.45.

As stated in NUREG-1061, Volume 3, licensees and applicants have the option of requesting a decrease in leakage margin provided they could confirm that their leakage detection systems are sufficiently reliable, redundant, diverse, and sensitive. The basis for the NRC's approval of previous LBB analysis for the Callaway Plant continues to be supported by the overall RCS leakage detection capability of the diverse methods described in Section 3.0 above.

Conclusion

In summary, while the proposed amendment will clarify the design and OPERABILITY requirements of the containment atmosphere gaseous radioactivity monitor as a method of RCS leak detection and identifies the specific exception to position C.5 of Regulatory Guide 1.45 for this method of RCS leak detection. In addition, this change will add wording to the LCO Bases for TS 3.4.15 to make OPERABILITY of the containment atmosphere gaseous radioactivity monitor dependent on meeting the sensitivity and other requirements of Regulatory Guide 1.45 and not dependent on being capable of detecting a 1 gpm leak in one hour for all conditions. The proposed amendment continues to require diverse methods of RCS leakage detection, to satisfy the intent of Regulatory Guide 1.45, with the capability to detect and measure RCS leakage with sufficient degree of accuracy to support the technical basis for the Callaway Plant.

5.0 REGULATORY ANALYSIS

5.1 NO SIGNIFICANT HAZARDS CONSIDERATION

The proposed change would revise TS Bases 3.4.13 and 3.4.15, and Final Safety Analysis Report (FSAR) Appendix 3A, Section 5.2.5 and Table 5.2-6 to clarify the design and OPERABILITY requirements of the containment atmosphere gaseous radioactivity monitor as an instrument for Reactor Coolant System (RCS) leakage detection. Table 5.2-6 is revised to indicate that containment atmosphere gaseous radioactivity monitors provide reliable leak detection capabilities provided that the equilibrium activity of the containment atmosphere is below the level that would mask the change in activity corresponding to a 1 gpm leak in one hour.

The proposed change do not involve a significant hazards consideration for the Callaway Plant based on the three standards set forth in 10 CFR 50.92(c) as discussed below:

(1) **The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.**

The proposed change has been evaluated and determined to not increase the probability or consequences of an accident previously evaluated. The proposed change does not make any hardware changes and does not alter the configuration of any plant system, structure, or component (SSC). The proposed change only clarifies the design and OPERABILITY requirements for the containment atmosphere gaseous radioactivity monitor and identifies the capabilities of the containment atmosphere gaseous radioactivity monitors at low RCS activity levels. The containment radiation monitors are not initiators of any accident; therefore, the probability of occurrence of an accident is not increased. The FSAR and TS will continue to require diverse means of leakage detection equipment, thus ensuring that leakage due to cracks would continue to be identified prior to propagating to the point of a pipe break. Therefore, the consequences of an accident are not increased.

(2) **The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.**

The proposed change does not involve the use or installation of new equipment and the currently installed equipment will not be operated in a new or different manner. No new or different system interactions are created and no new processes are introduced. The proposed changes will not introduce any new failure mechanisms, malfunctions, or accident initiators not already considered in the design and licensing bases. The proposed change does not affect any SSC associated with an accident initiator. Based on this evaluation, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) **The proposed change does not involve a significant reduction in a margin of safety.**

The proposed change does not alter any RCS leakage detection components. The proposed change only clarifies the design and OPERABILITY requirements for the containment atmosphere gaseous radioactivity monitor and identifies the capabilities of the containment atmosphere gaseous radioactivity monitors at low RCS activity levels. This change is required since the level of radioactivity in the Callaway Plant reactor coolant has become much lower than what was assumed in the FSAR and the gaseous channel can no longer promptly detect a small RCS leak under all operating conditions. The proposed amendment continues to require diverse means of leakage detection equipment with capability to promptly detect RCS leakage. Although not required by TS, additional diverse means of leakage detection capability are available as described in the FSAR Section 5.2.5. Early detection of leakage, as the potential indicator of a crack(s) in the RCS pressure boundary, will thus continue to be in place so that such a condition is known and appropriate actions taken well before any such crack would propagate to a more severe condition. Based on this evaluation, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above evaluation, AmerenUE concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c).

5.2 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 4, "Environmental and dynamic effects design bases," requires that structures, systems, and components important to safety be designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with the normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, discharging fluids that may result from equipment failures, and from events and conditions outside the nuclear power unit. However, dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping. Criterion 4 is mentioned here for reference only since RCS leak detection instrumentation evaluated in the leak-before-break evaluations are involved.

10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 30, "Quality of reactor coolant pressure boundary," requires that means be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage. The various means for detecting reactor coolant leakage at the Callaway Plant were previously discussed in Section 3.0, "Background."

The Callaway Plant design, with certain clarifications and exceptions, conforms to Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," dated May 1973. Regulatory Guide 1.45 describes acceptable methods for implementing the requirement of Criterion 30 (above) with regard to the selection of leakage detection systems for the reactor coolant pressure boundary. The specific attributes of the reactor coolant leakage detection systems are outlined in Regulatory Position 1 through 9 of Regulatory Guide 1.45. The Callaway Plant conformance with Regulatory Guide 1.45 is described in FSAR Appendix 3A and Table 5.2-6.

NUREG-0800, Standard Review Plan, Draft Section 3.6.3, "Leak-Before-Break Evaluation Procedures," 52 FR 32626-32633, August 28, 1987, provides NRC staff guidance for evaluation of leakage detection systems to support leak-before-break evaluations. Leak detection systems equivalent to those recommended in Regulatory Guide 1.45 are required for piping inside containment. As stated above, the Callaway Plant design, with certain clarifications and exceptions, conforms to Regulatory Guide 1.45. The diverse RCS Leakage Detection Instrumentation continues to satisfy the Regulatory Guide 1.45 criteria.

10 CFR 50.36, "Technical Specifications," paragraph (c)(2)(ii)(A), specifies that a TS limiting condition for operation of a nuclear reactor must be established for installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary. Currently, the instrumentation addressed in TS 3.4.15 satisfies this requirement.

There will be no changes such that compliance with any of the regulatory requirements and guidance documents above would come into question. The evaluations performed by AmerenUE confirm that Callaway Plant will continue to comply with all applicable regulatory requirements.

6.0 ENVIRONMENTAL CONSIDERATION

AmerenUE has determined that the proposed amendment would change requirements with respect to the installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, AmerenUE has evaluated the proposed amendment and has determined that the amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amount of effluent that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22 (c)(9). Therefore, pursuant to 10 CFR 51.22 (b), an environmental assessment of the proposed amendment is not required.

7.0 REFERENCES

7.1 NUREG-1061, Volume 3, "Report of the U.S. Nuclear Regulatory Commission Piping Review Committee - Evaluation of Potential for Pipe Breaks," November 1984.

7.2 Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," May 1973.

7.3 Callaway Plant Final Safety Analysis Report, Revision OL-14.

7.4 Callaway Plant Environmental Report - Operating Licensing Stage

MARKUP OF TECHNICAL SPECIFICATION BASES

BASES

ACTIONS

B.1 and B.2 (continued)

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 5, the pressure stresses acting on the RCPB are much lower, and further deterioration is much less likely.

SURVEILLANCE REQUIREMENTS

SR 3.4.13.1

Verifying RCS LEAKAGE to be within the LCO limits ensures the integrity of the RCPB is maintained. Pressure boundary LEAKAGE would at first appear as unidentified LEAKAGE and can only be positively identified by inspection. It should be noted that LEAKAGE past seals, gaskets, and instrumentation lines is not pressure boundary LEAKAGE. Unidentified LEAKAGE and identified LEAKAGE are determined by performance of an RCS water inventory balance. Primary to secondary LEAKAGE is also measured by performance of an RCS water inventory balance in conjunction with secondary side sampling and monitoring.

The RCS water inventory balance must be met with the reactor at steady state operating conditions (stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows). Therefore, a Note is added allowing that this SR is not required to be performed until 12 hours after establishing steady state operation. The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established.

Steady state operation is preferred to perform a proper inventory balance since calculations during non-steady state conditions must account for the changing parameters. For RCS operational LEAKAGE determination by water inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows.

An early warning of pressure boundary LEAKAGE or unidentified LEAKAGE is provided by the automatic systems that monitor the containment atmosphere radioactivity and the containment sump level. It should be noted that LEAKAGE past seals, gaskets, and instrumentation lines is not pressure boundary LEAKAGE. These leakage detection systems are specified in LCO 3.4.15, "RCS Leakage Detection Instrumentation."

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.15 RCS Leakage Detection Instrumentation

BASES

BACKGROUND

GDC 30 of Appendix A to 10 CFR 50 (Ref. 1) requires means for detecting and, to the extent practical, identifying the location of the source of RCS LEAKAGE. Regulatory Guide 1.45 (Ref. 2) describes acceptable methods for selecting leakage detection systems.

Leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure. Thus, an early indication or warning signal is necessary to permit proper evaluation of all unidentified LEAKAGE.

Industry practice has shown that water flow changes of 0.5 to 1.0 gpm can be readily detected in contained volumes by monitoring changes in water level, in flow rate, or in the operating frequency of a pump. The containment sump level and flow monitoring system, used to collect unidentified LEAKAGE, and containment cooler condensate monitoring system are instrumented to alarm for increases of 0.5 to 1.0 gpm in the normal flow rates. This sensitivity is acceptable for detecting increases in unidentified LEAKAGE.

The reactor coolant contains radioactivity that, when released to the containment, can be detected by radiation monitoring instrumentation. Reactor coolant radioactivity levels will be low during initial reactor startup and for a few weeks thereafter, until activated corrosion products have been formed and fission products appear from fuel element cladding contamination or cladding defects. Instrument sensitivities of 10^{-9} μCi/cc radioactivity for particulate monitoring and of 10^{-6} μCi/cc radioactivity for gaseous monitoring are practical for these leakage detection systems. Radioactivity detection systems are included for monitoring both particulate and gaseous activities because of their sensitivities and rapid responses to RCS LEAKAGE.

An increase in humidity of the containment atmosphere would indicate release of water vapor to the containment. Dew point temperature measurements can thus be used to monitor humidity levels of the containment atmosphere as an indicator of potential RCS LEAKAGE. A 1°F increase in dew point is well within the sensitivity range of available instruments.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

the leakage from its source to an instrument location yields an acceptable overall response time.

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring RCS LEAKAGE into the containment area is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE provides quantitative information to the operators, allowing them to take corrective action should a leak occur detrimental to the safety of the unit and the public.

RCS leakage detection instrumentation satisfies Criterion 1 of 10CFR50.36(c)(2)(ii).

LCO

One method of protecting against large RCS leakage derives from the ability of instruments to rapidly detect extremely small leaks. This LCO requires instruments of diverse monitoring principles to be OPERABLE to provide a high degree of confidence that extremely small leaks are detected in time to allow actions to place the plant in a safe condition, when RCS LEAKAGE indicates possible RCPB degradation.

This LCO is satisfied when diverse monitoring methods are available. Thus, the containment sump level and flow monitoring system, one containment atmosphere particulate radioactivity monitor, and either the containment cooler condensate monitoring system or one containment atmosphere gaseous radioactivity monitor provide an acceptable minimum.

APPLICABILITY

Because of elevated RCS temperature and pressure in MODES 1, 2, 3, and 4, RCS leakage detection instrumentation is required to be OPERABLE.

In MODE 5 or 6, the temperature is required to be ≤ 200°F and pressure is maintained low or at atmospheric pressure. Since the temperatures and pressures are far lower than those for MODES 1, 2, 3, and 4, the likelihood of leakage and crack propagation are much smaller. Therefore, the requirements of this LCO are not applicable in MODES 5 and 6.

ACTIONS

The Actions are modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when: the required containment sump level and flow monitoring system is inoperable; the required containment atmosphere particulate radioactivity monitor is inoperable; or the required containment atmosphere gaseous radioactivity monitor and the required containment cooler condensate

(continued)

Insert 1

The sensitivity of the containment air particulate monitors for primary coolant leakage detection is dependent on both the primary coolant activity level and the background radiation level in containment which is dependent upon the power level, percent failed fuel, crud bursts, iodine spiking, and natural radioactivity brought in by the containment purge.

Shortly after startup and also during steady operation with low levels of fuel defects, the level of radioactivity in the reactor coolant is lower than what was assumed in the original design bases calculation. Using a reactor coolant source term based on representative real-time data, with no fuel defects, it was determined that the containment air particulate monitors are capable of detecting a one gpm leak in one hour.

The measurement of containment atmosphere gaseous radioactivity is less sensitive than the measurement of particulate radioactivity for the purpose of detecting RCS leakage. Analyses have shown that the pre-existing containment radioactive gaseous background levels for which reliable detection is possible is dependent upon the reactor power level, percent failed fuel in the reactor, and natural radioactivity brought into the containment by the containment purge system. With primary coolant radionuclide concentrations less than equilibrium levels, such as during startup and operation with no fuel defects, the increase in detector count rate due to leakage will be partially masked by the statistical variation of the minimum detector background count rate, rendering reliable detection of a 1 gpm leak uncertain.

Operating experience has shown gaseous background radiation levels in containment that would partially mask the detection of a 1 gpm leak from the RCS with low radioactivity concentrations in the reactor coolant. However, the monitor is capable of detecting an RCS-to-containment atmosphere leak if elevated reactor coolant gaseous activity is present.

Insert 2

The measurement of containment atmosphere gaseous radioactivity is less sensitive than the measurement of particulate radioactivity for the purpose of detecting RCS leakage under very low RCS activity conditions. However, it will provide a positive indication of leakage in the event that high levels of reactor coolant gaseous activity exist as a result of fuel cladding defects. Given the potential limitations of the containment atmosphere gaseous radioactivity monitor at conditions when low radioactivity levels are present in the reactor coolant, OPERABILITY is based on the monitor's ability to meet the required surveillances and not on its ability to indicate a 1 gpm RCS boundary leakage in one hour.

MARKUP OF FSAR

DISCUSSION:

Westinghouse practices achieve the same purpose as Regulatory Guide 1.43 by requiring qualification of any "high heat input" processes, such as the submerged-arc wide-strip welding process and the submerged-arc 6-wire process used on ASME SA-508, Class 2, material, with a performance test as described in Regulatory Position C.2 of the guide. No qualifications are required by the regulatory guide for ASME SA-533 material and equivalent chemistry for forging grade ASME SA-508, Class 3, material.

The fabricator monitors and records the weld parameters to verify agreement with the parameters established by the procedure qualification as stated in Regulatory Position C.3.

Stainless steel weld cladding of low-alloy steel components is not employed on components outside the NSSS.

REGULATORY GUIDE 1.44 REVISION 0 DATED 5/73

Control of the Use of Sensitized Stainless Steel

DISCUSSION:

The recommendations of this regulatory guide are met as described in Table 6.1-4.

REGULATORY GUIDE 1.45 REVISION 0 DATED 5/73

Reactor Coolant Pressure Boundary Leakage Detection Systems

DISCUSSION:

The recommendations of this regulatory guide are met as described in Table 5.2-6

REGULATORY GUIDE 1.46 REVISION 0 DATED 5/73

Protection Against Pipe Whip Inside Containment

DISCUSSION:

The recommendations of this regulatory guide are met as described in Table 3.6-2 for the balance of plant and Section 3.6.1 for the NSSS.

REGULATORY GUIDE 1.47 REVISION 0 DATED 5/73

Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems concentration above background, due to an abnormal leak and natural decay, increases almost linearly with time for the first several hours after the beginning of a leak. As shown in Figure 5.2-2, with 0.1-percent failed fuel, containment background airborne particulate radioactivity equivalent to 10^{-4} percent/day, and a partition factor equal to 0.2, a 1-gpm leak would be detected in 1 hour. Larger leaks would be detected in proportionately shorter times (exclusive of sample transport time, which remains constant). The detection capabilities and response times are shown on Figure 5.2-2.

The leakage flow rate can be determined from the count rate when the specific background radioactivity present before the leakage begins is known. The background activity is dependent upon the power level, percent failed fuel, crud bursts, iodine spiking, and natural radioactivity brought in by the containment purge.

CONTAINMENT GASEOUS RADIOACTIVITY MONITOR - Gaseous radioactivity is determined from the containment free volume and the gaseous activity concentration of the reactor coolant. Any increase more than two standard deviations above the count rate for background would indicate a possible leak. The total gaseous activity level above background (after 1 year of normal operation) increases almost linearly for the first several hours after the beginning of the leak. As specified in Figure 5.2-2, with 0.1-percent failed fuel, containment background airborne gaseous radioactivity equivalent to 0.1 percent/day, and a partition factor equal to 1 (NUREG-0017 assumptions), a 1-gpm leak would be detected within 1 hour. Larger leaks would be detected in proportionately shorter times (exclusive of the sample transport time which remains constant). The detection capabilities and response times are shown on Figure 5.2-2.

The leakage flow rate can be determined from the count rate when the specific background radioactivity present before the leakage begins is known. The background activity is dependent upon the power level, percent failed fuel, and natural radioactivity brought in by the containment purge.

CONTAINMENT PURGE MONITORS - The containment purge monitors function the same as the containment air particulate and gaseous radioactivity monitors, except that the purge monitors sample from the containment purge exhaust line.

CONTAINMENT COOLER CONDENSATE MONITORING SYSTEM - The condensate flow rate is a function of containment humidity, essential service water temperature leaving the coolers, and containment purge rate. The water vapor dispersed by a 1 gpm leak is much greater than the water vapor brought in with the outside air. Air brought in from the outside is heated to 50°F before it enters the containment.

After the air enters the containment, it is heated to 100-120°F so that the relative humidity drops. The water vapor brought in with the outside air does not build up in the containment since it is continually purged. The most important factor in condensing the water vapor is the temperature of the essential service water which is provided to the

Insert A

The containment atmosphere gaseous radioactivity monitor is less sensitive than the containment air particulate monitor but provides a positive indication of leakage in the event that reactor coolant gaseous activity exists as a result of fuel-cladding defects.

Insert B

Analyses have shown that the pre-existing containment radioactive gaseous background levels for which reliable detection is possible is dependent upon the reactor power level, percent failed fuel, and natural radioactivity brought in by the containment purge. With primary coolant concentrations less than equilibrium levels, such as during reactor startup and operation with no fuel defects, the increase in detector count rate due to leakage will be partially masked by the statistical variation of the minimum detector background count rate, rendering reliable detection of a 1 gpm leak uncertain.

Operating experience has shown gaseous background radiation levels in containment that would partially mask the detection of a 1 gpm leak. However, the monitor is capable of detecting an RCS to containment atmosphere leak if elevated reactor coolant gaseous activity is present.

Insert C

This method is limited by the fact that large uncertainties are possible when determining the associated leak rate by calculation. Therefore, in the event of an alarm or increasing trend on these monitors, a water inventory balance is normally performed to determine the equivalent RCS leak rate.

TABLE 5.2-6 (Sheet 2)

Regulatory Guide 1.45 Position	Union Electric
3. At least three separate detection methods should be employed and two of these methods should be (1) sump level and flow monitoring and (2) airborne particulate radioactivity monitoring. The third method may be selected from the following: a. monitoring of condensate flow rate from air coolers, b. monitoring of airborne gaseous radioactivity. Humidity, temperature, or pressure monitoring of the containment atmosphere should be considered as alarms or indirect indication of leakage to the containment.	3. Complies. The methods provided are sump-level and flow (level versus time) monitoring, airborne particulate radioactivity monitoring, airborne gaseous radioactivity monitoring, and containment cooler condensate monitoring. Containment atmosphere humidity monitoring is also available as an indirect indication of leakage to the containment. As such, periodic testing of the sensitivity of the humidity monitoring system is not required.
4. Provisions should be made to monitor systems connected to the RCPB for signs of intersystem leakage. Methods should include radioactivity monitoring and indicators to show abnormal water levels or flow in the affected area.	4. Complies. Refer to Sections 5.2.5.2.1, 9.3.3, and 11.5
5. The sensitivity and response time of each leakage detection system in regulatory position 3. above employed for unidentified leakage should be adequate to detect a leakage rate, or its equivalent, of one gpm in less than one hour.	5. Complies, as described in Section 5.2.5.2.3 and as shown on Figure 5.2-2.

LIST OF COMMITMENTS

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

COMMITMENT	Due Date/Event
The proposed changes to the Technical Specification Bases and FSAR will be implemented within 90 days of NRC approval.	Within 90 days of NRC approval