

October 27, 2004

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

ULNRC-05072

Ladies and Gentlemen:



**DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
RESPONSE TO NRC GENERIC LETTER 2004-01:
REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS**

Enclosed is the Callaway Plant 60-day response to NRC Generic Letter 2004-01: "Requirements for Steam Generator Tube Inspections," dated August 30, 2004. NRC Generic Letter 2004-01 requested information related to steam generator tube inspection methods, assessment of compliance with the SG tube inspection requirements, and a tube structural and leakage integrity safety assessment.

This letter does not contain new commitments.

If you have any questions regarding this submittal, please contact me at (573) 676-8659 or Mr. Dave Shafer, Superintendent – Licensing at (314) 554-3104.

Sincerely,

A handwritten signature in cursive script that reads "Keith D. Young".

Keith D. Young
Manager - Regulatory Affairs

Attachments: I – Affidavit
II - RAI Responses

AIL5

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STATE OF MISSOURI)
)
COUNTY OF CALLAWAY) S S

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 27 day of OCTOBER, 2004.

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

Lori L. Twillman
LORI L. TWILLMAN

RESPONSE TO NRC GENERIC LETTER 2004-01:
REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS

Below is the Callaway response to Nuclear Regulatory Commission (NRC) Generic Letter 2004-01: "Requirements for Steam Generator Tube Inspections," dated August 30, 2004. The Generic Letter "Required Information" is shown in bold.

Requested Information

Within 60 days of the date of this generic letter, addressees are requested to provide the following information to the NRC:

- 1. Addressees should provide a description of the SG tube inspections performed at their plant during the last inspection. In addition, if they are not using SG tube inspection methods whose capabilities are consistent with the NRC's position, addressees should provide an assessment of how the tube inspections performed at their plant meet the inspection requirements of the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B, and corrective action taken in accordance with Appendix B, Criterion XVI. This assessment should also address whether the tube inspection practices are capable of detecting flaws of any type that may potentially be present along the length of the tube required to be inspected and that may exceed the applicable tube repair criteria.**

AmerenUE Response

Callaway Plant has four Westinghouse Model F steam generators. The tubing material in each of the steam generators is a combination of Inconel 600 mill-annealed and Inconel 600 thermally-treated (first 10 rows). The tubes were hydraulically expanded full-length into the tubesheet during fabrication. Tube support plates are stainless steel with quatrefoil tube holes.

Prior to each inspection, a degradation assessment, which includes operating experience, is performed to identify degradation mechanisms that may be present, and a technique validation assessment is performed to verify that the eddy current techniques are capable of detecting the targeted degradation.

Callaway's last steam generator inspection was performed in April-May 2004, during the plant's 13th refueling outage. The scope of the examination was as follows:

- 100% Full Length Bobbin Exams in All Four SGs
- 100% Hot Leg Top-of-Tubesheet in All Four SGs w/+Point RPC Probe.¹
- 100% Rows 1 and 2 U-bend in SG A w/+Point RPC Probe
- 100% Row 11 U-bends in All Four SGs w/Array Probe
- 50% Row 12 U-bends (100% in SGs A and D) w/Array Probe
- 50% Rows 17-21 U-bends (100% in SGs A and D) w/Array Probe

- 100% Electrosleeves (26) in SG C w/UT Probe
- 100% Laser Welded Sleeves (43) in SG A w/+Point RPC Probe
- 20% Dents / Dings > 2 Volts in All Four SGs w/+Point RPC Probe
- 100% Dents / Dings > 5 Volts in All Four SGs w/+Point RPC Probe
- Special Interest Exams (for Bobbin "I" Codes Signals That Cannot be Qualified) w/+Point Probe, as Required

¹For the hot leg tubesheet examinations, the length of inspection was "+2 / - X" relative to the secondary surface of the tubesheet, where X (5, 7, or 9 inches) differs depending on the location (Zone) of the tube in the bundle. The required distance X is based on leakage and structural integrity analysis contained in WCAP-15932-P. This WCAP is discussed more later.

The inspection description and tube integrity assessment results were provided in ULNRC-05048, dated September 30, 2004.

Steam generator tube inspections performed at Callaway are consistent with the NRC's position, except as follows:

Tubesheet inspections at Callaway are performed in accordance with WCAP-15932-P, Improved Justification of Partial-Length RPC Inspection of Tube Joints of Model F Steam Generators of AmerenUE Callaway Plant, Rev. 1, dated May 2003. [Rev. 0 of the WCAP was submitted to the NRC via ULNRC-04745, dated October 3, 2002. Rev. 1 incorporated changes based on discussion with the staff.] Callaway Plant has applied the WCAP technical basis to limit the rotating coil inspection extent depending on the location of the tube in the bundle. The rotating coil is capable of detecting flaws of any type that may potentially be present along the examined length of tube, and any degradation detected by the rotating coil has been repaired in accordance with plant Technical Specifications. Potential degradation that may be present below the examined length of tube is not necessarily capable of being detected by the bobbin coil, but it does not contribute to burst or significant leakage according to the analysis provided in the WCAP.

2. **If addressees conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, they should discuss their proposed corrective actions (e.g., changing inspection practices consistent with the NRC's position or submitting a TS amendment request with the associated safety basis for limiting the inspections) to achieve full compliance. If addressees choose to change their TS, the staff has included in the attachment suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the staff in cases where the tubes are expanded for the full depth of the tubesheet and where the extent of the inspection in the tubesheet region is limited.**

AmerenUE Response

As stated above, Callaway's method of inspecting the hot leg tubesheet region is not consistent with the staff's position outlined in the Generic Letter. As stress corrosion cracking is an active damage mechanism in this region, Callaway inspects for this mechanism using advanced rotating probe technology that is capable of identifying defects of this type. WCAP-15932-P provides a depth, for each tube, beyond which any defects would not constitute a structural or leak integrity issue. Callaway does not inspect the entire length of the tubesheet with a rotating probe.

The finding that Callaway's inspection methodology for hot leg tubesheet examinations is not consistent with the staff's position as provided in Generic Letter 2004-01 will be entered into the plant's corrective action program. Callaway will replace the steam generators at the next refueling outage. No other corrective action is required.

3. For plants where SG tube inspections have not been or are not being performed consistent with the NRC's position on the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, the licensee should submit a safety assessment (i.e., a justification for continued operation based on maintaining tube structural and leakage integrity) that addresses any differences between the licensee's inspection practices and those called for by the NRC's position. Safety assessments should be submitted for all areas of the tube required to be inspected by the TS where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used, and should include the basis for not employing such inspection techniques. The assessment should include an evaluation of (1) whether the inspection practices rely on an acceptance standard (e.g., cracks located at least a minimum distance of x below the top of the tube sheet, even if these cracks cause complete severance of the tube) which is different from the TS acceptance standards (i.e., the tube plugging limits or repair criteria), and (2) whether the safety assessment constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the joint. If the safety assessment constitutes a change to the method of evaluation under 10 CFR 50.59, the licensee should determine whether a license amendment is necessary pursuant to that regulation.

AmerenUE Response

Provided below is a safety assessment that addresses any differences between Callaway Plant's inspection practices and those required by the NRC's position.

**SAFETY ASSESSMENT FOR CALLAWAY PLANT
RESPONSE TO NRC GENERIC LETTER 2004-01,
REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS**

1.0 General Information

Callaway Plant has four Westinghouse Model F steam generators (SG). The tubing material in each of the steam generators is a combination of Inconel 600 mill-annealed and Inconel 600 thermally-treated (first 10 rows). The tubes were hydraulically expanded full-length into the tubesheet during fabrication. Tube support plates are stainless steel with quatrefoil tube holes.

The examination of steam generator tubing at Callaway Plant is performed in accordance with Technical Specification (TS) 5.5.9, Steam Generator (SG) Tube Surveillance Program. Historically, Callaway Plant has met the surveillance requirements of the TS using the bobbin coil probe, which was the standard industry technique at the time the plant began operation.

The bobbin coil was used exclusively in the pre-service inspection ("performed after the field hydrostatic test and prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections," according to the TS) and initial inservice examinations.

However, it was recognized early in plant life that stress-corrosion cracking (SCC), which is not generally detectable using the bobbin coil, would eventually occur in the hot leg top-of-tubesheet region. Callaway Plant took early and aggressive action to screen for SCC using supplemental inspection techniques (rotating pancake coil - RPC) that had the capability to detect the damage mechanism. SCC tube degradation was first identified at Callaway in 1995.

In every refueling outage since 1995, 100% of the hot leg top-of-tubesheet transitions have been inspected in all four steam generators using the latest RPC technology. In addition, RPC and advanced array-probe techniques have been used to screen tube regions that have the greatest potential for SCC initiation. To date, SCC has not been identified in any other region of the Callaway steam generator tubing.

Although TS do not prescribe the specific nondestructive test methods used to inspect steam generator tubing, Callaway has considered the bobbin coil (used for the pre-service inspection) the TS-required technique. The RPC examinations at the top-of-tubesheet were performed to supplement the TS surveillance in order to provide assurance of tube integrity. Due to the high cost (in expense and schedule) of these supplemental examinations, they have been limited in scope to those areas where SCC presents a tube integrity concern. Because there are no structural or significant leakage

concerns with SCC deep within the tubesheet, Callaway (and industry) practice has been to limit RPC inspections based on a technical evaluation.

2.0 Safety Assessment

AmerenUE's inspection methodology for the hot leg tubesheet is not consistent with the position of the staff as outlined in Generic Letter 2004-01. Callaway does not inspect the entire length of the hot leg tubesheet with advanced techniques capable of detecting circumferential cracks. Instead, tubesheet inspections at Callaway are performed in accordance with WCAP-15932-P, Improved Justification of Partial-Length RPC Inspection of Tube Joints of Model F Steam Generators of AmerenUE Callaway Plant, Rev. 1, dated May 2003. [This WCAP was previously submitted to the NRC via ULNRC-04745, dated October 3, 2002]. WCAP-15932-P provides a depth, for each tube, beyond which any defects would not constitute a structural or leak integrity issue based on statistical analysis of as-found conditions.

The Westinghouse analysis found that, based on plant observance of a certain maximum primary-to-secondary side leakage value during normal operation, primary water stress corrosion cracking (PWSCC) below a certain depth into the tubesheet, from the secondary surface of the tubesheet, will pose neither structural issues such as tube severance and pullout nor excessive leakage during the limiting accident condition.

As stated in the Generic Letter, NRC raised the issue of tubesheet inspections at a number of plants in early 2002. The staff initially required plants to address the issue via exigent TS changes prior to restart. As Callaway had a fall outage scheduled, AmerenUE attempted to resolve the issue prior to that inspection.

In October 2002, AmerenUE submitted (ULNRC-04745, dated October 3, 2002) a proposed revision to Technical Specification 5.5.9 (per the guidance of Administrative Letter 98-10) describing the methodology being used at the hot leg top-of-tubesheet and requesting a license amendment "to clearly delineate the scope of the steam generator tube inspection required in the tubesheet region," in order to incorporate the methodology into plant TS.

During the review period, NRC modified their position on whether a TS change was required to restart subsequent to an outage in which the tubesheet inspection was limited (an affected plant was requested to withdraw their submittal pending an industry response – restart was not affected). Subsequent to that occurrence, while responding to RAI's associated with the submittal, AmerenUE proposed (ULNRC-04861, dated June 5, 2003) that "... since the treatment of tube inspections in plant technical specifications has become a generic industry issue we propose that this amendment request be held until generic technical specification language has been developed and accepted. We will provide a follow-up submittal to update the Callaway Technical Specification at that time."

NRC responded (letter dated September 15, 2003) that "In discussing with your staff the merits of (1) the staff placing this LAR on hold until you resubmit a new LAR versus (2) you withdrawing the LAR and then re-submitting a new LAR, it was concluded that it would be better to have the current LAR application dated October 3, 2002, withdrawn. Later, you can re-submit a new TS 5.5.9 LAR, or a different SG tube surveillance LAR, once the 'generic technical specification language' has been worked out. . . Based on this, we are terminating our review of your application dated October 3, 2002, and closing out the subject TAC."

Prior to startup, from the last refueling outage, Callaway performed an operational assessment (OA) to justify operation through the current operating cycle. This assessment considered the degradation found during the inservice inspection and the expected degradation of the steam generators for the current operating cycle, including the presence of SCC in the uninspected zones of the tubesheet. The OA analysis concluded a full cycle of operation was justified. Therefore, AmerenUE's approach to inspection of the tubesheet region ensures tube integrity is maintained and continued operation for the current operating cycle is justified.

Question 3 of the Generic Letter also requests licensees to consider whether the safety assessment, performed for those conditions where tube inspections within the tubesheet are not being performed consistent with the NRC's position, constitutes a change to the "method of evaluation" (as defined in 10CFR50.59) for establishing the structural and leakage integrity of the tube and/or tubesheet joint. In assessing this question, the Generic Letter inquires as to whether the safety assessment is redefining the ASME Section III pressure boundary and is using a different method of evaluation to demonstrate the structural and leakage integrity of the revised pressure boundary. AmerenUE has reviewed the NRC's position and has concluded that the analysis approach does not redefine the ASME pressure boundary and is not a change in the method of evaluation per 10CFR50.59 based on the following:

1. AmerenUE does not consider the assessment approach, or the described inspection program scope, as redefining the ASME Section III pressure boundary. The selection of NDE techniques or extent of inspection does not, by itself, define the limits of the ASME pressure boundary. For example, the Generic Letter indicates that current technical specifications include language that excludes sections of cold leg tubing from inspection extent. The Generic Letter also states that the selection of NDE techniques is not specified in the Technical Specifications, but is governed by the provisions of 10CFR Part 50 Appendix B, and as such, are not used to define pressure boundary limits. From an integrity assessment perspective, neither past NRC approval of Alternate Repair Criteria (ARCs) nor the suggested changes to the Technical Specification provided in Generic Letter 2004-01 address or indicate that the basis for approval is a redefinition of the pressure boundary.

2. The NRC endorsed guidance for 10CFR 50.59 evaluations (NEI 96-07) defines "method of evaluation" and the associated 10CFR50.59 screening protocol. Section 4.3.8 of NEI 96-07 states that methods of evaluation that are not described, outlined or summarized in the UFSAR are excluded from departure consideration. The tube integrity assessments employed by AmerenUE consider the entire length of pressure boundary tubing. Undetected flaws and their impact on tube integrity are addressed. The assessments are consistent with industry standards. The analyses and analysis parameters are not described, outlined or summarized in ASME Section III, ASME Section XI or in the Callaway's FSAR, and therefore would not constitute a change/departure in the method of evaluation per 10CFR 50.59.
3. Tube integrity assessments were performed in accordance with the provisions of the EPRI Steam Generator Integrity Assessment Guidelines and the structural and accident leakage integrity performance criteria specified in NEI 97-06 and NUREG 1022. This ensures margins of safety consistent with the ASME Section III Code and Regulatory Guide 1.121 and that any potential accident leakage is within safety analysis limits.

Despite the conclusion that the assessment does not constitute a change to the method of evaluation as described in 10CFR50.59, AmerenUE has concluded that the steam generator inspections within the tubesheet region are not consistent with the Generic Letter 2004-01 position and will address the issue as indicated in response to Question 2.