April 22, 2004

Mr. Garry L. Randolph
Vice President and Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 - CORRECTION LETTER RE: ISSUANCE OF AMENDMENT NO. 161 ON SECONDARY SHIELD WALL OPENING MODIFICATION (TAC NO. MB9879)

Dear Mr. Randolph:

By letter dated April 12, 2004, the Commission issued the Amendment No. 161 to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1. The amendment approved the application of leak-before-break (LBB) for the accumulator and residual heat removal (RHR) lines, and installation of an opening in the secondary shield wall in terms of the effects of the opening on occupational exposure. The amendment was in response to your application dated June 27, 2003 (ULNRC-04868).

It has been determined that the safety evaluation (SE) for the amendment incorrectly stated (1) WCAP-160190-P instead of the correct designation of WCAP-16019-P on page 6, (2) the critical flaw size, leakage flaw size, and margin for node 3510 in WCAP-15983-P on page 14, and (3) the abbreviation for primary water stress corrosion cracking, PWSCC, on page 15. Enclosed are the corrected pages with the corrections identified by vertical lines on the right hand side of the pages. They should replace the pages in the SE issued in the letter dated April 12, 2004. The errors do not change the conclusions in the SE. We regret any inconvenience caused by these errors.

Sincerely,

/RA/

Jack Donohew, Senior Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure: Corrected Pages to Safety Evaluation

cc w/encl: See next page

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SUBJECT: CALLAWAY PLANT, UNIT 1 - CORRECTION LETTER RE: ISSUANCE OF AMENDMENT NO. 161 ON SECONDARY SHIELD WALL OPENING MODIFICATION (TAC NO. MB9879)

Dear Mr. Randolph:

By letter dated April 12, 2004, the Commission has issued the Amendment No. 154 to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1. The amendment approved the application of leak-before-break (LBB) for the accumulator and residual heat removal (RHR) lines, and installation of an opening in the secondary shield wall in terms of the effects of the opening on occupational exposure. The amendment was in response to your application dated June 27, 2003 (ULNRC-04868).

It has been determined that the safety evaluation for the amendment incorrectly stated (1) WCAP-160190-P instead of the correct designation of WCAP-16019-P on page 6, (2) the critical flaw size, leakage flaw size, and margin for node 3510 in WCAP-15983-P on page 14, and (3) the abbreviation for primary water stress corrosion cracking, PWSCC, on page 15. Enclosed are the corrected pages with the corrections identified by vertical lines on the right hand side of the pages. They should replace the pages in the safety evaluation issued in the letter dated April 12, 2004. The errors do not change the conclusions in the safety evaluation. We regret any inconvenience caused by these errors.

Sincerely,
/RA/
Jack Donohew, Senior Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures: Corrected Pages to Safety Evaluation

cc w/encl: See next page

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3.1.4 Design Modification Conclusion

Based on the discussion above and its review of the proposed modification, the NRC staff concludes that the proposed change to the plant's radiation shielding design (1) will not impact the licensee's ability to access vital areas to mitigate the consequences of a design basis accident in accordance with NUREG 0737, Action Item II.B.2, (2) will not impair the licensee's ability to maintain the radiation doses to individuals within the limits in 10 CFR 20.1201, and (3) will allow the licensee to maintain radiation exposures ALARA for occupational exposure in accordance with 10 CFR 20.1003. Based on this, the NRC staff further concludes that the design modification of the secondary shield wall is acceptable.

3.2 LBB Methodology

As stated in GDC 4:

> [h]owever, 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.

For the purpose of this demonstration, the licensee submitted a LBB analysis prepared by Westinghouse for the 14-inch pressurizer surge line, 10-inch accumulator lines, and 12-inch RHR lines. LBB evaluations developed using the methodology contained in NUREG-1061, Volume 3, have been previously approved by the NRC as the demonstration of an extremely low probability of piping system rupture.

3.2.1 Identification of Analyzed Piping and Piping Material Properties

The following discussion contains information supplied by the licensee on its LBB analysis in its application and the attachments to the application. These attachments included the following proprietary reports prepared by Westinghouse for the Callaway plant: WCAP-15983-P, Revision 0; WCAP-16019-P, Revision 0; and WCAP-16020-P, Revision 0.

The licensee analyzed the following sections of piping for LBB behavior verification:

- The pressurizer surge line from its connection to the RCS hot leg to the pressurizer as shown in Figure 3-1 of WCAP-15983-P.
- The 10-inch accumulator lines from its connection to the RCS cold legs to the accumulator as shown in Figures 3-1 through 3-4 of WCAP-16019-P.
- The 12-inch RHR lines layout from its connections to the RCS hot leg line loops 1 and 4 as shown in Figures 3-1 and 3-2 of WCAP-16020-P.

The following information on the above pressurizer surge line, accumulator lines, and RHR lines was provided by the licensee in its application and responses to the NRC's request for additional information (RAI) on the application of LBB for these lines.

the critical locations in the analyzed piping segments that would generate a leakage rate of 10 gpm (10 times the leakage detection capability of 1 gpm at Callaway). Therefore, a margin of 10 exists between the calculated leak rate from the leakage flaw and the leak detection capability of 1 gpm. The licensee then determined the critical flaw sizes for the critical locations that would be predicted to lead to piping failure under the faulted loading conditions. These critical flaw size calculations were performed using plots of limit moment versus crack lengths. The critical flaw size corresponds to the intersection of this curve and the maximum load line. The last step in the licensee's evaluation process was the calculation of ratios (margins) between the critical flaw size and the leakage flaw size for the critical locations. The relationship between the critical flaw size and leakage flaw size results from the criteria in draft SRP 3.6.3 and NUREG-1061, Volume 3, that specifies that a margin of two should be maintained for an acceptable LBB evaluation. In WCAP-15983-P, for the pressurizer surge line, Westinghouse identified the limiting location to be node 3510, with a critical flaw size of 12.15" and a leakage flaw size of 5.18" and, therefore, a margin of 2.35 for the standard LBB evaluation. Likewise, in WCAP-16019-P for the 10-inch accumulator lines, the limiting location is Node 3295 that has a margin of 2.64, and in WCAP-16020-P for 12-inch RHR piping, the limiting nodal locations are Node 3285 (line loop1) and Node 3020 (line loop 4), with margins of 4.37 and 3.01, respectively. Therefore, the margin on flaw size is acceptable. Based on the aforementioned discussion, all of the LBB recommended margins are satisfied. The NRC staff has determined that a postulated through-wall crack in the analyzed portion of pressurizer surge line, 10-inch accumulator lines and 12-inch RHR piping would remain stable and would not cause a gross failure of the component.

In regard to Criterion 1 in Section 3.2.2.2 of this SE, the LBB approach should not be considered when operating experience has indicated particular susceptibility to failure from the effects of corrosion, water hammer, or fatigue. The NRC staff agrees with the licensee's evaluation that water hammer should not occur in the subject piping because of system design, testing, and operational considerations. The licensee's evaluation of the effects of low and high cycle fatigue including the effects of thermal stratification were acceptable. The licensee addressed concerns regarding the impact of degradation mechanisms on the use of LBB for the subject lines. For the accumulator and RHR lines, stress corrosion cracking is precluded by use of fracture resistant materials (fine grain, solution annealed, controlled fabrication) in the piping system and controls on reactor coolant chemistry. Wall thinning by erosion-corrosion will not occur in the subject piping due to low velocity and use of austenitic stainless steel material.

For the pressurizer surge line, however, the pressurizer nozzle safe end to pipe weld has an Alloy 82/182 weld that is susceptible to PWSCC and, therefore, by Criterion 1, the NRC staff concludes that LBB is not applicable to this weld, and, therefore, not to the line. After discussions with the licensee on this weld, the licensee withdrew its request to apply LBB to this weld in its letter of April 5, 2004. In the letter, the licensee also requested that LBB be applied to the part of the pressurizer surge line that is downstream of the pipe whip restraints needed to hold the line in place for a double ended rupture of the line at this weld.

In its letter of April 5, 2004, the licensee stated that typically LBB is approved by the NRC staff for an entire line and that the analysis documented in WCAP-15983-P is for the entire pressurizer surge line. However, the licensee went on to state that its analysis assumed and evaluated a potential pipe break in the surge line at the Alloy 82/182 weld location and this analysis demonstrates that a break at this location does not cause a consequential failure at any other location along the pressurizer surge line. Additionally, the licensee stated that (1) it will continue

to maintain all required plant equipment and structures, including pipe whip restraints, to address an assumed failure at this weld location, and (2) analyses currently being performed considering the plant configuration after the replacement steam generators are installed, will also consider a postulated break at this weld location.

Although the licensee has presented a technical basis that the pipe whip restraints on the pressurizer surge line that address the rupture of the line at the Alloy 82/182 weld location and the analyses that demonstrate no further rupture of the line if the line ruptures at the weld location, the NRC staff still has concerns about approving LBB on the portion of the line downstream of the pipe whip restraints needed to anchor that part of the line at the Alloy 82/182 weld location. The NRC staff has not approved an application of LBB for a segment of a piping system. To address the NRC staff's concerns, the licensee has been requested to demonstrate that effective mitigative measures are in place, or will be implemented, to counteract PWSCC at the Alloy 82/182 weld. With such measures that are acceptable to the NRC staff, the NRC will then reconsider its concerns about applying LBB to this line.

Based on the above discussion, the NRC staff confirms the licensee's conclusion that the subject piping segments with the exception of the pressurizer surge line, can be shown to exhibit LBB behavior consistent with the criteria given in Section 3.2.2.2 of this SE, and in draft SRP 3.6.3 and NUREG-1061, Volume 3. This conclusion is based on the licensee's margins on leak rate, flaw size and combination of loads for stability of crack. The licensee's RCS leakage detection system is capable of detecting a leakage of 1 gpm in one hour. Based upon this information, the NRC staff concludes that LBB behavior has been demonstrated for the 10-inch accumulator lines and the 12-inch RHR piping.

Conclusions

Based on the materials engineering information and analyses provided by the licensee and discussed in Section 3.2.2.2 above, the NRC staff evaluated the LBB applicability of the analyzed portions of the 10-inch accumulator lines and the 12-inch RHR piping. Based on the above evaluation, the NRC staff concludes that because acceptable margins on leakage and crack size have been demonstrated, these sections of piping meet the LBB criteria in draft SRP 3.6.3 and, therefore, are consistent with the provisions of GDC 4, in that this piping will exhibit LBB behavior.

The pressurizer surge line is not approved for LBB applicability since the pressurizer surge line nozzle safe end to pipe weld contains Alloy 82/182 weld material and is susceptible to PWSCC and, therefore, by Criterion 1 in Section 3.2.2.2 of this SE, the NRC staff concludes that LBB is not applicable to this line at this time without effective mitigation measures. The licensee's revised request for application of LBB to the pressurizer surge line does not change the NRC staff's conclusion. If the licensee can demonstrate that effective mitigation measures acceptable to the NRC staff are in place or will be implemented to counteract PWSCC in the Alloy 82/182 weld, the NRC staff can approve this request at a later time.