September 2, 2014

ULNRC-06137

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

10 CFR 50.90

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT
UNION ELECTRIC CO.
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING APPLICATION FOR AMENDMENT TO FACILITY OPERATING LICENSE NPF-30
(TAC NO. MF3202, LDCN 13-0016)
REVISION TO FSAR STANDARD PLANT SECTION 3.6 FOR HDPE CRACK EXCLUSION

References:

1. ULNRC-06043 dated December 6, 2013, "Revision to FSAR Standard Plant Section 3.6 for HDPE Crack Exclusion (LDCN 13-0016)"
2. NRC Request for Additional Information, Carl F. Lyon (NRC) to Fadi Diya (Union Electric Company) dated July 1, 2014

In Reference 1 above, Ameren Missouri (Union Electric Company) submitted an application for amendment to Facility Operating License Number NPF-30 for the Callaway Plant. The proposed amendment would add a new pipe crack exclusion allowance to FSAR Standard Plant Section 3.6.2.1.2.4, "ASME Section III and Non-Nuclear Piping – Moderate-Energy," and FSAR Standard Plant Table 3.6-2, "Design Comparison to Regulatory Positions of Regulatory Guide 1.46, Revision 0, dated May 1973, titled 'Protection Against Pipe Whip Inside Containment,'" in particular regard to the high density polyethylene (HDPE) piping installed in ASME Class 3 line segments of the essential service water (ESW) system. The amendment was submitted per the requirements of 10 CFR 50.59(c)(2)(viii).

In Reference 2 above, the NRC requested additional information to complete their review. The attachments to this letter provide the requested information. No commitments are contained in this letter.

If you have any questions on this amendment application, please contact me at (573) 676-8719 or Mr. Tom Elwood at (314) 225-1905.

I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

Executed on: 9/2/2014

Scott Maglio
Manager, Regulatory Affairs

GGY/RAK

Attachments:
1 – RAI Response
2 – Reference Drawings and Calculations

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ATTACHMENT 1

RAI RESPONSE

NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)
LICENSE AMENDMENT REQUEST TO REVISE FSAR-SP 3.6
UNION ELECTRIC COMPANY
CALLAWAY PLANT, UNIT 1
DOCKET NO. 50-483
LDCN 13-0016 (TAC NO. MF3202)

By application dated December 6, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13340A775), to the U.S. Nuclear Regulatory Commission (NRC), Union Electric Company (dba Ameren Missouri, the licensee) submitted a license amendment request (LAR) to revise the Final Safety Analysis Report-Standard Plant (FSAR-SP) Section 3.6.2.1.2.4, "ASME [American Society of Mechanical Engineers] Section Ill and Non-Nuclear Piping - Moderate-Energy," to include a new pipe crack exclusion allowance at Callaway Plant, Unit 1.

The NRC staff has determined that the additional information requested below is needed to complete its review.

Question 1:

In Section 2.2, subsection on 'Need for License Amendment' (Enclosure page 4 of 11) of the LAR, the licensee referred to the supply and return headers for the Essential Service Water (ESW) system. Please provide the following additional information:

(a) A simple layout sketch of the supply and return pipelines in the yard as well as in the control building penetration room, Ultimate Heat Sink (UHS) Cooling Tower penetration room, and yard vault. Please indicate on the sketch the line numbers, supply or return, train A or B, safety classification, yard portions, vault portions, and penetration room portions of piping along with the corresponding stress analysis calculation number. Also, indicate on the sketch the interface between the steel pipe and High Density Polyethylene (HDPE) pipe.

Response:

FSAR SA Figure 3.8-4, Sheet 2, (see Attachment 2) includes a simple layout drawing. Drawings M-UC0321, M-UC0211, and M-23EF01 include additional layout details and depict the interface between the HDPE and stainless steel piping. The line numbers are included in FSAR SA Figure 3.8-4, Sheet 2, as well as the additional drawings provided in Attachment 2. Per the piping identification convention provided in FSAR Standard Plant Figure 1.1-1, Sheet 2, line numbers that contain AZC (i.e., EF-003-AZC-36") are ASME Class 3 HDPE. Line numbers that contain HCC are ASME Class 3 stainless steel (i.e., EF-003-HCC-30"). All piping on this figure is safety-related, Class 3. The associated stress calculations are listed in the response to questions 4d and 8.

Information on each line is contained below:

- EF-003-AZC-36" – A Train Supply from Yard Vault to Control Building Basement
- EF-003-HCC-30" – A Train Supply portions in Pumphouse, Buried in Yard prior to Yard Vault, in Yard Vault, and in Control Building Basement
- EF-007-AZC-36" – B Train Supply from Yard Vault to Control Building Basement
- EF-007-HCC-30" – B Train Supply portions in Pumphouse, Buried in
- Yard prior to Yard Vault, in Yard Vault, and in Control Building Basement
- EF-083-AZC-36" – A Train Return from Control Building Basement to UHS Penetration Room
- EF-083-HCC-30" – A Train Return portions in Control Building Basement and UHS Penetration Room
- EF-140-AZC-36" – B Train Return from Control Building Basement to UHS Penetration Room
- EF-140-HCC-30" – B Train Return portions in Control Building Basement and UHS Penetration Room

(b) A copy of the FSAR Site Addendum Figure 3.8-4.

Response:

FSAR SA Figure 3.8-4 is enclosed. Note that there are two sheets in Figure 3.8-4. Sheet 1 shows lines that were abandoned in place. The amendment application cited only Sheet 2 which also has the civil drawing number C-U206 in the figure title block.

Question 2:

In Section 2.2, subsection on 'Need for License Amendment' (Enclosure, page 4 of 11) of the LAR, the licensee stated that evaluations performed in support of modification package (MP) 07-0066 failed to include an internal flooding analysis for the HDPE piping installed in the basement of control building room 3101, UHS cooling tower penetration rooms, and the ESW supply line yard vaults. Please provide the following additional information:

(a) Please explain if the internal flooding analysis is required to be performed if moderate energy HDPE piping is exempted from crack postulation based on stress levels. If yes, please clarify if the analysis was subsequently performed. If the flooding analysis was subsequently performed, provide a simple summary of the results.

Response:

No internal flooding analysis for the HDPE piping is required if the HDPE piping is exempted from crack postulation based on stress levels. Therefore, no associated flooding analysis has been performed and no further clarification is required for this response.

(b) A summary list of safety-related components in the basement of control building room 3101, UHS cooling tower penetration rooms and the ESW supply line yard vaults.

Response:

A list of safety-related components in the Control Building Basement (Room 3101) is included in Attachment 2. The UHS Cooling Tower penetration rooms do not contain any additional equipment beyond the HDPE pipe and interfacing stainless steel piping. The ESW supply yard vaults contain the HDPE piping, interfacing stainless steel piping, and a vent with a manual isolation valve. There are no safety-related components that would be susceptible to a moderate energy line break hazard in the UHS Cooling Tower penetration rooms and the ESW Supply yard vaults.

Question 3:

In Section 2.2, subsection on 'Need for License Amendment' (Enclosure page 5 of 11) of the LAR, the licensee stated that a review for consequences of pipe crack in the ESW supply line yard vaults was performed. Please provide a summary of the review results.

Response:

There are no safety-related components in the yard vaults that would be susceptible to a moderate energy line break hazard (i.e., there is no instrumentation or electrical components) as stated in the response to Question 2b. In addition, the yard vaults are located away from both the ESW Pumphouse and the Control Building basement. In the event of a pipe crack in the yard vault, Callaway Plant would be able to achieve cold shutdown using the opposite train in accordance with licensing requirements in FSAR SP Section 3.6.

Per FSAR SP Section 3.6.1.1.d, each break is considered separately as a single postulated initial event occurring during normal plant conditions. Thus, if a break were to occur on the 'A' train, no other breaks would have to be assumed to occur and no other accident or hazard is assumed to occur.

In addition, when the postulated piping failure occurs and results in damage to one of two redundant or diverse safety trains, a single failure of components in other trains (and associated supporting trains) is not assumed per FSAR SP Sections 3.1.2 and 3.6.1.1.g.

Therefore, if a break is postulated in the 'A' train, a single failure is not required to be postulated in the 'B' train. The 'B' train would be available for use and would be used to achieve cold shutdown. Therefore, unlike the exception requested in the amendment application with regard to a postulated break in the control building basement (where both trains could be affected), an exclusion for the postulation of a moderate energy crack for the HDPE piping in the yard vault is not required.

Question 4:

The licensee indicated in page 4, Section 5.0, Attachment# 4 of the LAR, that the initial design, analyzed in calculation 2007-16760, was revised to eliminate the anchors, which were never installed. The revised design without anchors was not reanalyzed but justified in section B2.4 of newly added Appendix-B which was not included in the LAR. Please provide the following additional information:

(a) A copy of the newly added Appendix-B.

Response:

Attachment 2 provides a copy of Appendix B to Calculation 2007-16760. The entire calculation is 244 pages, whereas Appendix B is 13 pages. In the interest of a concise response, only the requested Appendix B is provided with specific emphasis directed to Section B2.4, "Removal of Boundary Anchors."

(b) The number of anchors in the original design which were deleted or not installed.

Response:

A total of eight anchors were included in the initial pipe layout, but they were removed from the design in the intermediate stages of the modification development process.

There are four anchors that were not installed in the Control Building basement (Room 3101). Those anchors were preliminarily named EF01A001/321, EF01A002/321, EF01A003/321, and EF01A004/321. They were to be located 14" from the flanges that mate the stainless steel piping with the HDPE Supply and Return piping for both trains entering the building and are labeled as A001, A002, A003, and A004 on the Attachment 2 modification drawing labeled MP07-0066-M-25EF01-012-001. Note that this drawing was revised in a field change notice (FCN) and was never issued. It is enclosed for the purpose of depicting the anchor locations.

There are two anchors that were not installed in the UHS Cooling Tower Penetration Rooms. Those anchors are EF11A001/021 and EF11A002/021. They were to be located 2'5" from the flanges that mate the stainless steel piping with the HDPE Return piping for both trains entering the penetration rooms and are labeled as EF11-A001/021 and

EF11-A002/021 on the Attachment 2 modification drawing labeled MP07-0066-M-U50211-003-000. Note that this drawing was revised in a field change notice (FCN) and was never issued. It is enclosed for the purpose of depicting the anchor locations.

There is one anchor in each of the yard vaults, which accounts for the final two anchors that were not installed. These anchors are shown on the modification drawing for M-U50111 (MP 07-0066-M-U50111-003-000) and were labeled as A003 and A004 on the drawing. The effects of the differences in piping configuration are evaluated in Calculation 2007-16760, Appendix B, Section B2.1, while the effect of removing the anchors is justified in Appendix B, Section B2.4 for the HDPE piping. The effect on the metallic piping is evaluated in Calculations 2007-18080, 2007-18081, 2007-18082, and 2007-18083 and is further discussed in the response to Question 4d. The changes in piping configuration are shown on modification drawings MP 07-0066-C-U206-N/A-001 and MP 07-0066-C-U206-N/A-002, which are provided in Attachment 2.

(c) A sketch showing the location of these anchors that were not installed.

Response:

Attachment 2 provides copies of modification drawings based on the initial piping layout design. The drawings of the initial design cited in the response to Question 4.b above are MP 07-0066 M-25EF01-012-001, MP 07-0066 M-U50211-003-000, and MP 07-0066 M-U50111-003-000. The final layout can be seen on drawings MP 07-0066 M-25EF01-012-002, MP 07-0066 M-U50211-003-001, and MP 07-0066 M-U50321-N/A-000.

(d) Since the anchors were not installed, please clarify if the termination boundaries of the stress analysis of the piping models on either side of these deleted anchors are extended to include additional piping beyond the deleted anchors. Provide a description or sketches for the revised analysis boundaries for Calculations 2007-18080; 2007-18081, 2007-18082, 2007-18083, 2007-16601, and 2007-16760.

Response:

The pipe stress boundaries occur at the HDPE to stainless steel flanges for all eight boundaries. Drawings M-25EF01, M-U50211, and M-U50321 are included to show the locations of the stress problem boundaries.

The HDPE piping is analyzed in Calculation 2007-16760. Appendix B evaluates the stress changes due to the removal of the eight anchors and shows that the stresses on the HDPE piping will be lower due to the elimination of the anchors. Thus, additional piping beyond the deleted anchors was not included.

All calculations for the interfacing sections of metallic piping were reanalyzed after the removal of the eight anchors. The interfacing calculations are:

- EF-119 (A Train Supply Line in Control Building Basement)
- 2007-18082 (A Train Return Line in Control Building Basement)
- EF-120 (B Train Supply Line in Control Building Basement)
- 2007-18083 (B Train Return Line in Control Building Basement)
- 2007-16601 (A and B Train Return Lines in UHS Cooling Tower)
- 2008-12413 (A and B Train Supply Lines in Yard Vault)

All of these interfacing calculations include the HDPE piping in the model for its effect on the metallic piping. Thus, additional piping beyond the anchors was included for the metallic side piping calculations. The ESW piping analyzed in Calculations 2007-18080 and 2007-18081 has been reanalyzed in Calculations EF-119 and EF-120, respectively. The boundary locations remain the same. Note that Calculation 2008-12413 is mentioned only for information purposes, but it is not a design input since a moderate energy crack exclusion is not requested for the yard vault locations.

Question 5:

The licensee indicated in page 4, Section 5.0, Attachment 4 of the LAR, that Section B2.4 of Appendix-B uses the peak axial forces and resultant moments from interfacing calculations (2007-18080; 2007-18081, 2007-18082, 2007-18083, 2007-16601) from metallic piping side. These axial forces and moments were subsequently used for moderate energy crack postulation. Please explain and confirm that the axial forces and moments from the other (HDPE piping) side in Calculation 2007-16760 (when the anchors were deleted) are smaller than those from the metallic piping side (when the anchors were deleted).

Response:

Calculation 2007-16760 Rev. 2 evaluates the effects on the HDPE piping due to the eight anchors that were not installed. In the UHS Cooling Tower penetration rooms and in the ESW supply line yard vaults, guide supports were installed in the location where the anchors were to be installed in order to minimize lateral and vertical load transfer from the stainless steel piping to the HDPE piping. In the Control Building, new supports were added and existing supports were modified to minimize lateral and vertical load transfer from the stainless steel piping to the HDPE piping. At all locations, the transition between the stainless steel and the HDPE is unrestrained in the axial direction to allow thermal expansion and contraction. Since lateral and vertical supports are still provided for the stainless steel piping, the modeling of anchors in Calculation 2007-16760 is conservative as the analyzed axial loads at the transitions between the stainless steel and HDPE piping are greatly reduced by allowing the piping to move [Ref. Calculation 2007-16760 App. B2.4]. Additional evaluation is contained in Appendix B, Section B2.4, which is provided in Attachment 2.

Question 6:

The licensee indicated in page 4, Section 5.0, Attachment# 4 of the LAR, that check valves were installed on the service water supply piping near the tie-ins to ESW. It was also mentioned that Calculations EF-119 and EF-120 were created to reanalyze the ESW and service water supply piping, which were previously analyzed in Calculations 2007-18080 and 2007-18081. Please provide the following additional information:

(a) A sketch showing the location of the added check valves in the piping models for EF-119 and EF-120. Please clarify if the added check valves are located close to the deleted anchor locations.

Response:

The added check valves are part of the non-safety related Service Water system, not the safety-related Essential Service Water system, and are labeled EAV0184 and EAV0185. They are located near where the non-safety related service water piping becomes buried piping and can be seen on drawing M-25EA01, which is provided in Attachment 2. The deleted anchors can be seen on the Attachment 2 modification drawing for M-25EF01 (MP07-0066-M-25EF01-012-001) as described in the response to Question 4b. The deleted anchors are located over 60 feet away from the check valves. There are multiple valves and supports in between as seen on the enclosed drawings. In addition, Calculations EF-119 and EF-120 model the HDPE piping for its effect on the metallic piping. The effect on the HDPE piping is addressed in the response to Question 6c.
(b) Please clarify if the Calculations EF-119 and EF-120 replace the Calculations 2007-18080 and 2007-18081, and account for the effects of deleted anchors as well as added check valves.

Response:

EF-119, Rev. 0, reanalyzes the same portion of piping in Calculation 2007-18080, Rev. 2, with the exception of the new 4" drain line that was installed under MP 10-0066. The 4" drain line was decoupled from the header piping and analyzed separately in Calculation 2007-18080, Rev. 2. The analysis for the 4" drain line remains valid, while the remainder of Calculation 2007-18080 is superseded; therefore, Calculation 2007-18080 is partially superseded by EF-119.

EF-120, Rev. 0, reanalyzes the same portion of piping in Calculation 2007-18081, Rev. 1, with the exception of the new 4" drain line that was installed under MP 10-0066. The 4" drain line was decoupled from the header piping and analyzed separately in Calculation 2007-18081, Rev. 1. The analysis for the 4" drain line remains valid, while the remainder of Calculation 2007-18080 is superseded; therefore, Calculation 2007-18081 is partially superseded by EF-120.

Calculations EF-119 and EF-120 model the HDPE piping for its effect on the metallic piping to account for the effects from the deleted anchors. The new check valves (EAV1084 and EAV0185) are included in the models as well.

(c) Please explain if Calculation 2007-16760 is affected by the addition of check valves.

Response:

The impact of adding check valves EAV0184 and EAV0185 is discussed in Calculation 2007-16760, Revision 2, Addendum 3 which is provided in Attachment 2.

(d) Please explain why the peak axial forces and moments used in Appendix-B and subsequently used to compute the stress levels (to demonstrate whether moderate energy crack needs to be postulated or not) were from Calculations 2007-18080 and 2007-18081, but not from EF-119 and EF-120.

Response:

The peak axial forces for the supply lines for both 'A' train and 'B' train were from Calculations EF-119 and EF-120, not Calculations 2007-18080 and 2007-18081 as suggested in Question 6d. This is stated in Calculation 2007-16760, Revision 2, Addendum 2 on pages 4 and 5 (included in the 12/6/2013 amendment application as Attachment 4).

Question 7:

For the moderate energy crack postulations discussed in page 5, Section 5.0, Attachment 4 of the LAR, of the two axial force numbers being added, please identify the contributions to the axial force from the Operating Basis Earthquake (OBE) and seismic anchor motion (SAM) for the supply piping in Control Building room 3101. Also identify the breakdown of the contribution from X, Y and Z SAM cases.

Response:

The contribution from the OBE is the first term in each of the equations below. The contribution from SAM is the second term in each equation below. The breakdown of the contributions from the X, Y, and Z SAM cases is included in that order.

$$F_{aATrain} = 1466 + \sqrt{245^2 + 28^2 + 1091^2} = 2585lb$$

$$F_{aBTrain} = 1204 + \sqrt{66^2 + 29^2 + 1243^2} = 2449lb$$

Question 8:

Please provide a summary table pertaining to moderate energy crack postulation with the following information, referred in pages 14 and 15, Section 5.0, Attachment # 4 of the LAR.

Please include line number, description (e.g., supply, return), location (e.g., control building room 3101, yard vault, UHS cooling tower penetration room) design pressure, design temperature, maximum pressure, thermal modes analyzed (e.g., temperatures), computed stress (sum of equations 9 and 10 stresses), crack postulation threshold stress limit, margin, and conclusion about moderate energy crack postulation.

Response

See Table 1 on the following page. Calculation 2007-16760 Section 4.3 contains design pressures and temperatures, which are also included in the table.

Description	Location	Design Pressure (psig)	Maximum Pressure (psig)	Design Temperature (°F)	Thermal Mode Analyzed (°F)	Computed Stress (psi)	Crack Postulation Threshold limit (psi)	Margin (psi)
A Train Supply	Control Building Basement	190	190	95	95	673.26	773.6	100.34
B Train Supply	Control Building Basement	190	190	95	95	717.48	773.6	56.12
A Train Return	Control Building Basement	45	45	175	175	300.58	734.2	433.62
B Train Return	Control Building Basement	45	45	175	175	441.04	734.2	293.16
A Train Return	UHS Penetration Room	45	45	175	175	236.06	734.2	498.14
B Train Return	UHS Penetration Room	45	45	175	175	236.06	734.2	498.14
Conclusion: The sum of the Service Level B Longitudinal Stress and the Alternative Thermal Expansion or Contraction Stress (Computed Stress column) is less than the Crack Postulation Threshold for all locations. The Crack Postulation Threshold is equivalent to the moderate energy pipe break stress limit for ASME Section III design equations listed in NRC MEB 3-1 Section B.2.b and Callaway FSAR Section 3.6.2.1.2.4.								

Table 1 – Summary Table Pertaining to Moderate Energy Crack Postulation