June 10, 2008

Mr. Charles D. Naslund
Senior Vice President and
Chief Nuclear Officer
Union Electric Company
Post Office Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 – REQUEST FOR ADDITIONAL INFORMATION RELATED TO RELIEF REQUEST 13R-10 TO USE PLASTIC PIPE INSTEAD OF STEEL PIPE, AND LICENSE AMENDMENT REQUEST FOR ONE-TIME EXTENSION OF COMPLETION TIME FOR INOPERABLE ESSENTIAL SERVICE WATER SYSTEM (TAC NOS. MD6792 AND MD7252)

Dear Mr. Naslund:

By applications dated August 30 and October 31, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML072550488 and ML073100488, respectively), as supplemented by letters dated February 21, March 7, April 17, and May 6, 2008 (ADAMS Accession Nos. ML080640636, ML080780484, ML081190648, and ML081340561, respectively), Union Electric Company (the licensee) requested the U.S. Nuclear Regulatory Commission (NRC) staff approval of the use of plastic pipe in lieu of carbon steel pipe and a one-time change to the Technical Specifications (TS), respectively, for Callaway Plant, Unit 1, in support of a proposed replacement of essential service water (ESW) pipe with a plastic pipe.

The proposed relief would permit the use of plastic piping in the ESW system and references American Society of Mechanical Engineers Code Case N-755 (not approved by NRC); and the license amendment would revise the TS to extend the completion time (CT, or allowed outage time) associated with an inoperable Essential Cooling Water train from 72 hours to 14 days, applicable once per train, and to be implemented prior to December 31, 2008. The licensee also proposed to permanently remove the second CT applicable to TS 3.8.1, Condition B.

The NRC staff has reviewed the information provided in your submittals and determined that additional information is required in order to complete its review in five technical areas as stated in Request for Additional Information (RAI) Enclosures 1, 2, 3, and 4. These RAIs were discussed with your staff on June 5, 2008. In addition, Enclosure 5 discusses inadequacies with your responses to previous risk-related RAIs on the license amendment request. The staff has determined that additional RAIs to solicit adequate and complete responses are not appropriate. However, if you decide to supplement your previous RAI responses, the staff will consider the supplemental information before reaching a final safety decision.

The NRC staff considers that timely responses to RAIs help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. Please provide responses to the RAIs and any supplemental information by July 10, 2008. In accordance with Section 2.108 of Title 10 of the *Code of Federal Regulations*, failure

to provide the requested information by July 10, 2008, may result in denial of the license amendment application and the relief request.

If you have any questions, please contact me at (301) 415-1476 or via e-mail at mohan.thadani@nrc.gov.

Sincerely,

/RA/

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures:
As stated

cc w/encl: See next page

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If you have any questions, please contact me at (301) 415-1476 or via e-mail at mohan.thadani@nrc.gov.

Sincerely,

/RA/

Mohan C. Thadani, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures:
As stated

cc w/encl: See next page

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ADAMS Accession No. ML081580011 (*) Input dated

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DATE	6/10/08	6/10/08	6/2/08	6/5/08
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OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO ESSENTIAL SERVICE WATER

UNION ELECTRIC COMPANY

CALLAWAY PLANT

DOCKET NO. 50-483

The Division of Component Integrity staff has reviewed the licensee's response to the Nuclear Regulatory Commission (NRC) staff's first round of request for additional information (RAI). Based on that review, the NRC staff has a need for additional information. Accordingly, a second round of RAI was sent to the licensee via email on June 2, 2008, and is being formally documented here for response.

As stated above, the NRC staff requests a response to the following second round of RAI.

1. Title 10 of the *Code of Federal Regulations* (10 CFR) Appendix B, Criterion XVII, Quality Assurance Records, states that, "Records shall be identifiable and retrievable." The Standard Fusion Procedure Specification (FSP) in QF-221 implies that the supporting records exist in the Plastic Pipe Institute (PPI), report TR-33/2001. The data used in TR-33/2001 is based on limited tests and equipment manufacturer recommendations. The information supplied in Callaway's request does not provide record traceability and record retrievability that support the FSP qualification tests. Provide a discussion on the accessibility of records supporting the procedure, equipment, and personnel qualifications that will be used for installation and examination of high density polyethylene (HDPE) pipe.

2. 10 CFR 50 Appendix B, Criterion III, Design Control, states "Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions." The two procedure qualification methods in Code Case N-755 must demonstrate that they are capable of making acceptable fused joints. The demonstrations must cover pipe sizes and essential variable extremes for the equipment (manufacturer model) that is being used for fusing joints. The reference to PPI report TR-33/2001 does not provide sufficient test data for equipment and procedure-specific qualifications for the essential variable extremes. The performance demonstration should use representative pipe material and pipe sizes (diameter and wall thickness), and the performance demonstration should make sufficient repetitions of fused joints to statistically evaluated equipment and fusion process reliability. Provide a discussion describing the performance demonstrations that will be used for equipment and procedure qualifications, and describe the testing that will be used to validate internal soundness supporting equipment and procedure qualifications. Provide the

same discussion for each process (butt fusion, electro fusion, etc.) if more than one process is used for fusing joints.

(a) QF-223(a) provides one pipe diameter and wall thickness for equipment and procedure qualification testing. The use of a one-size (diameter and wall thickness) pipe to represent all pipe sizes ignores the effect that pipe diameter and wall thickness have on fused joint integrity. The PPI TR-33/2001 report does not provide information to support that a one size pipe is representative of all pipe sizes. Discuss the demonstration data that supports the representativeness of one pipe size for all pipe size combinations or that supports the range of pipe sizes that will be used. Provide the criteria to be applied to demonstrate fused joint soundness for the range of pipe sizes that will be used.

(b) QF-104.1(a) defines essential variables as conditions under which fusing must be performed, and QF-222(a) lists essential variables for procedure and equipment qualifications. The standard fusion procedure specification (QF-221) does not contain all of the essential variables listed in (QF-222) for procedure qualification. Discuss the application of the essential variables listed in QF-222(a) that will be used in the equipment and procedure qualification.

(c) In the submittal, Paragraph 3041 provides criteria for minimum design temperature which may inadvertently be applied to procedure qualifications. The Code Case does not address the effects of lower temperatures on the effectiveness of the fusion process. In response to RAI question 1(b), the licensee stated that the minimum ambient temperature for joint fabrication is 50 °F (degrees Fahrenheit) and will apply an environmental enclosure as necessary for temperature control. Since the fusion process is a temperature-dependent process and ambient temperature affects the heater removal to pipe fusion dwell time, the minimum ambient temperature is a variable. Provide the minimum ambient temperature that was used during the performance demonstration for equipment and procedure qualification.

3. The response to RAI question 3(a) did not address the question of performance-based VT (visual examination) personnel qualifications. Performance-based qualifications is in keeping with NUREG/BR-0303 and NRC's presentation, "NRC Perspective on NDE Performance Demonstration," given July 24, 2006, at the EPRI Performance Demonstration Workshop, Myrtle Beach, SC. The VT examination of HDPE-fused joints is substantially different than VT examinations of metal pipe. Therefore, criteria supplementing the current VT qualification are necessary to measure and verify personnel skill in VT examination of HDPE-fused joints. Please supplement the response to RAI question 3(a) that includes criteria for performance-based personnel qualifications.

(a) In response to RAI questions 3(b) pertaining to inside-surface VT examination, 3(c) pertaining to voids at pipe ends, 3(d) pertaining to voids near the joint, and 4.0 pertaining to in-process testing, the licensee proposed using ultrasonic testing (UT) examinations to verify internal soundness of each fused joint and the adjacent pipe material with the exception of fittings. Currently, there are no UT

performance-based criteria that are specific to an HDPE pipe. Provide the performance demonstration criteria for detection of flaws (internal unsoundness), and provide an acceptance criterion statistically establishing detection reliability (an example is the ASME Code, Section XI, Appendix VIII).

(b) The response to RAI question 2(a) defined accessibility to the inside pipe surface as being within direct VT examination from an open pipe end or fitting end. The definition is ignoring industry experience with remote control VT examination equipment. Remote VT equipment is being used for diameters as small as steam generator tubes. Joints not conducive to UT examinations, such as fittings, will still have to be VT examined from both the inside and outside surfaces. Provide the criteria for VT examinations performed from the inside surfaces regardless of the distance from the pipe end or provide another means for ensuring internal soundness for fused joints that can not be UT examined.

4. The NRC staff has not found Code Case N-755 to be acceptable. The reference of Code Case N-755 in the proposed alternative can not be approved at this time. However, a proposed alternative for a site and application-specific request using the applicable parts and modifications provided in the RAI responses may be reviewable. Provide a revised proposed alternative that is specific to Callaway's essential service water system repair that does not reference Code Case N-755.

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO ESSENTIAL SERVICE WATER

UNION ELECTRIC COMPANY

CALLAWAY PLANT

DOCKET NO. 50-483

The NRC's Division of Engineering staff has reviewed the licensee's analysis provided in response to its request for additional information (RAI), and has determined that additional RAIs are required based on its review. Please provide a response to the following RAIs to facilitate the continuation of the review by the NRC staff.

In its application dated August 30, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072550488), Union Electric Company (AmerenUE) submitted Relief Request (RR) I3R-10 for the replacement of Class 3 buried steel piping in the safety-related essential service water (ESW) system with polyethylene (PE) piping at the Callaway Plant, Unit 1 (Callaway). AmerenUE stated that the construction code of record for buried Class 3 piping is the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Division 1, subsection ND, 1974 Edition through Summer 1975 Addenda. As the construction code and later editions and addenda do not provide rules for the design, fabrication, installation, examination, and testing of piping constructed using PE material, AmerenUE requests the approval of RR I3R-10 for the use of PE piping. AmerenUE proposed to use the provisions of the ASME Code Case N-755 for the ESW piping replacement effort. Since the relief request did not contain detailed technical documentation, the NRC staff requested detailed technical information that was captured in six questions in its initial RAI on February 29, 2008. AmerenUE responded to the NRC RAIs by ULNRC-05490 dated April 17, 2008 (ADAMS Accession No. ML081190648), which included three enclosures (Reference 1).

Based on our review of the information in Reference 1, the following additional information is requested. Callaway is the first licensee that requested to utilize PE 4710 material piping in a safety-related ASME Class 3 application, and is the first to use temperatures higher than 100 °F (degrees Fahrenheit), pressures higher than 115 psig (pounds per square inch gauge), and diameters larger than 12.75 inches.

1. AmerenUE is requested to supplement the relief request to address specific aspects that prompted the NRC staff to not endorse ASME Code Case N-755. NRC's review of the methodology utilized in the relief request is specific for the Callaway application only. The industry is engaged in an extensive ongoing testing program to establish the full range of properties, fatigue data, stress intensification factors, long-term creep rupture data, and slow crack-growth characteristics for the specific grade of PE material (PE 4710) to be utilized in the requested Callaway application. The current test data that

support a fatigue-allowable of 1100 pounds per square inch (psi) for PE 3408 material data is very limited and does not meet the provisions in Section III of the ASME Code for establishing fatigue curves (Electric Power Research Institute (EPRI) Report 1013549). More investigations are needed to confirm the short-duration (30 days) stress allowables, and applicable design factors. Furthermore, techniques to ensure the structural integrity of fusion joints are still evolving. Finally, there is currently no domestic performance or operating experience history regarding PE piping's use in nuclear safety-related applications.

In light of these considerations and in conjunction with this request for alternative, AmerenUE should include whether it will formally commit to:

(a) Prior to submitting Callaway's fourth 10-year interval in-service inspection plan, Callaway will submit information obtained from the above referenced industry testing program to the NRC. If the information supports operation using PE 4710 for the remainder of plant life, this information will be submitted to the NRC for information only.

(b) If the information does not support operation using PE 4710 for the remainder of plant life, this information will be submitted to the NRC as part of a subsequent request for alternative for the fourth 10-year interval.

2. In Enclosure 1 (page 18 of 20), Attachment 2, Design Paragraph 3016, and in Enclosure 3 (page 4 of 152), Section 4.2.2 of Reference 1, AmerenUE states that the Miner's Rule in accordance with ISO 13760 will be used to account for operation for 30 days at (plant) post-accident conditions and normal operating conditions for the balance of the 40-year design life. However, there was no such evaluation included in Enclosure 3, Preliminary Stress Calculation 2007-16760. Provide the evaluation based on the Miner's Rule.

3. In response to the staff's RAI question 6 (Enclosure 1, page 13 of 20, Reference 1), you stated that any sections with flaws exceeding 10 percent of wall thickness in 4-inch piping or flaws exceeding 7 percent of wall thickness in 36-inch piping shall be cut out and replaced. The response further stated that flaws below the above-stated limits will be left as-is or smoothly blended. Some degree of conservatism needs to be maintained in order to account for the uncertainties in the PE material properties. The ESW supply, return, and backwash lines, when replaced with PE material, will be subjected to relatively high temperatures (175 °F) and/or pressures (for a 36-inch supply line, 95 °F/190 psig; for a 36-inch return line, 175 °F/45 psig; and for a 4-inch backwash line, 95 °F/180 psig). In the minimum required wall thickness (tmin) calculations, the fabricated thickness (tactual) without accounting for the reduced wall thickness due to flaws was utilized and the margins left are practically insignificant as shown in Section 8.1.1 of Enclosure 3, page 141 of 152 of Reference 1 (for a supply line,

tmin = 3.82 inches versus tactual = 3.85 inches; for a backwash line, tmin = 0.46 inches versus tactual = 0.5 inches).

(a) The NRC requests your reassessment of the minimum required wall thickness accounting for flaw depth in actual thickness. Please confirm that the remaining thickness (93 percent thickness (%t) for 36-inch pipes and 90 %t for 4-inch pipes in Section 7.1 Pressure Design of HDPE Pipes of Enclosure 3, Reference 1) exceeds the minimum required ASME Code thickness.

(b) The NRC also requests you to confirm that the remaining wall thickness (93 %t for 36-inch pipes and 90 %t for 4-inch pipes) was used, rather than the fabricated wall thickness, in all of the structural integrity calculations (Reference 1, Section 7.3, Soil and Surcharge Analysis; Section 7.5, Longitudinal Stress Analysis; Section 7.6, Thermal Expansion Stress Calculations; Section 7.7, Seismic Stress Calculations; and Section 7.8, Pipe Systems Finite Element Analysis) to establish the acceptability.

4. For Combined Seismic Induced Stresses [Seismic Wave Passage (equivalent thermal) and Building Seismic Anchor Motion], Enclosure 3, Reference 1: Section 7.7.2 (page 64 of 152, Return Lines); Section 7.7.3 (pages 70 of 152 and 74 of 152), the evaluations were based on a stress intensification factor, i=1.0, for a straight pipe only. There is no sketch of the pipe layout provided to show the locations of mitered elbows, flange connections, interfaces with steel pipe, and buildings, and important joint numbers.

(a) Provide a simple schematic of piping layout showing at least the major details. Include orientation of N-S, E-W, and vertical directions along with Global X, Y, and Z coordinate axes.

(b) Include a stress evaluation at a miter-bend location with a stress intensification factor, i=2.0.

(c) In the stress evaluations, the resultant moment was computed using two moment components (about vertical and transverse axes) only. Piping design rules specify the use of all three moment components including torsional moment in resultant moment computation. Please explain the rationale for your deviation.

5. For Pipe Systems Finite Element Analyses, Enclosure 3, Reference 1, Section 7.8.1 (pages 104 of 152 and 105 of 152, SAP2000 Output, Return Lines), the evaluations were based on a stress intensification factor, i=2.0, for a critical miter-bend location.

(a) Secondary or Thermal expansion stress evaluation should be based on range of all thermal modes or load cases. Based on page 75 of 152:

Load Case 1: Twater – Tground = 175-70 = +105 °F; and Load Case 2: Twater – Tground = 32-55 = -23 °F and not +60 °F as was used in the evaluation. Since Load Case 2 has a negative temperature difference, the moment range between Load Case 1 and Load Case 2 will be higher than due to Load Case 1 or Load Case 2 alone. Given that your evaluation does not account

for thermal expansion stress based on maximum range of moments, you are requested to explain the rationale for your thermal analysis or provide a re-evaluation consistent with maximum bounding thermal moment range. Typical piping stress analysis programs compute moment ranges for load cases, apply the appropriate stress intensification, and automatically compute intensified stresses at every node point in accordance with applicable ASME Section III Code edition. Are you doing stress computations manually using moments from SAP2000, because the SAP2000 program version V7.40 utilized for PE piping analysis does not have these features built-in?

(b) In the stress evaluations, the resultant moment was computed using two moment components (about vertical and transverse axes) only. NRC requests a re-evaluation using all three moment components including torsional moment in resultant moment computation (similar to item 4(c) above of this RAI).

6. For Pipe Systems Finite Element Analyses, Enclosure 3, Reference 1, Section 7.8.2 (pages 139 of 152 and 140 of 152, SAP2000 Output, Backwash Lines), the evaluations were based on a stress intensification factor, i=2.0, for a miter-bend location.

(a) Secondary or Thermal expansion stress evaluation should be based on a range of all thermal modes or load cases. Based on page 100 of 152, Load Case 1: Twater – Tground = 95-70 = +25 °F; Load Case 2: Twater – Tground = 32-55 = -23 °F and not +20 °F as was used in the evaluation. Since, Load Case 2 has a negative temperature difference, the moment range between Load Case 1 and Load Case 2 will be higher than due to Load Case 1 or Load Case 2 alone. An explanation for this discrepancy is requested or a re-evaluation of thermal expansion stress based on maximum range of moments is required.

(b) In the stress evaluations, the resultant moment was computed using two moment components (about vertical & transverse axes) only. NRC requests a re-evaluation using all three moment components including torsional moment in resultant moment computation.

7. For SAP2000 Input/Output, Enclosure 3, Reference 1 (page 10 of 24 of Attachment 10.4; page 10 of 19 of Attachment 10.5; page 13 of 37 of Attachment 10.6; and page 13 of 37 of Attachment 10.7), the value of 8.980E-05 kips per cubic inch used for weight per unit volume for PE material under material property data does not agree with the value of 0.959 grams per cubic centimeter (which corresponds to 3.465E-05 kips per cubic inch) given on page 7 of 152. Explain the discrepancy in the weight per unit volume for PE material and evaluate the impact, if any, on the results.

8. For Allowable Stress for Circumferential Compressive Stress in the sidewalls (Section 7.3, page 33 of 152 and Section 6.2.1, page 15 of 152), the NRC finds inappropriate the use of a constant allowable of 1000 psi (without any temperature dependence) for compression of sidewalls in PE piping. A re-evaluation is required using an allowable stress corresponding to the temperature to which the piping is subjected. For supply and backwash lines, it should be 695 psi at 95 °F, and for return lines it should be 340 psi at 175 °F in lieu of a constant 1000 psi.

9. For Flotation Analysis (Section 7.4, page 44 of 152), the weight of water (W_w) displaced by the pipe, the per unit length (upward buoyant force) should be based on the outside diameter of the pipe. The calculations in Section 7.4 were based on the inside diameter of the pipe. Please re-evaluate the calculations based on outside diameter of supply, return, and backwash lines.

10. For Longitudinal Stress Analysis (pages 46 of 152 through 52 of 152 in Sections 7.5.1, 7.5.2, and 7.5.3, Reference 1), the evaluations were based on primary stress indices of $B_1 = 0.5$ and $B_2 = 1.0$ for a straight pipe only. For mitered elbows with a diameter ratio of DR = 9, $B_1 = 0.69$ and $B_2 = 1.64$; and with a diameter ratio of DR = 9.35, $B_1 = 0.69$ and $B_2 = 1.69$.

    (a) Include stress evaluation at a critical miter-bend location also with applicable primary stress indices.

    (b) In the stress evaluations, the resultant moment was computed using two moment components (about vertical and transverse axes) only. NRC requires a re-evaluation using all three moment components including torsional moment in resultant moment computation.

11. (a) For Stress Allowable at 176 °F (Enclosure 3, Attachment 10.3, page 2 of 2, Reference 1), is 340 psi considered as the allowable with DF = 0.5 for 2.5 years of continuous operation or for 30 days of continuous operation? Please provide clarification. Also, note that DF>0.5 which corresponds to a factor of safety of less than 2 is not acceptable to the NRC.

    (b) Are the additional loads from the buried piping side included in the design of interface anchors at the control building, UHS Control Tower, ESW pump house, ESW Yard Vaults, and others, if any? Please provide a summary of anchor loads.

    (c) For Ring Deflection Equation (page 15 of 152, Enclosure 3, Reference 1), clarify that Ω, Ωmax are non-dimensional ring deflections, that is a ratio of ring deflection to diameter and not ring deflection values. Since the units for vertical soil pressure due to earth load (PE) and pressure due to surcharge load (PL) seismic anchor motion (SAM) are in psf (pounds per square foot) and the units for E_{pipe} and E' are in psi, a 1/144 factor is required.

    (d) For Flotation (page 16 of 152, Enclosure 3, Reference 1), since the units for PE are in psf, and the units for D are in inches, a 1/12 factor for the term (P_E.D) is required.

    (e) Concerning Enclosure 2 of Reference 1, please provide clarification for the terms CRS and HBD (or HDB?).

12. Enclosure 3, page 11 of 152, Reference 1, states that preliminary finite element analyses studies indicated that lower soil spring stiffness gave higher thermal stresses in buried HDPE piping and the inverse for the combined seismic wave passage and SAM controlled by SAM. Provide a simple summary table of the study runs, including a discussion of the spacing utilized for the soil springs.

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO ESSENTIAL SERVICE WATER

UNION ELECTRIC COMPANY

CALLAWAY PLANT

DOCKET NO. 50-483

The NRC's Division of Safety Systems staff has reviewed the information provided in your submittal and determined that additional information is required in order to complete its review. Please provide a response to the following request for additional information (RAI) questions by July 10, 2008, to facilitate the continuation of the review by the NRC staff.

1. Attachment 1, page 5 of 22, "Need for Change"

   The licensee states: "Performing the connection of the new PE [polyethylene] ESW [essential service water] piping with the rest of the ESW system during Refuel 16 could be contrary to safety since proper management and project coordination are more difficult during an outage setting…… If this work is performed outside the outage, as requested by way of this one-time Completion Time extension, it can be done with the full emphasis of the plant staff brought to bear on the modification and with the full complement of heat removal systems available during normal power operation."

   Explain how performing the connection as stated above during Refuel 16 could be contrary to safety since proper management and project coordination are more difficult during an outage setting.

2. Attachment 1, page 6 of 22, "Evaluation of Safety Margins"

   The licensee states: "…however, the proposed design will result in improved ESW system performance and enhanced system reliability, and will satisfy the criteria of 10 CFR 50.55a (a)(3)(i)…"

   Describe the improved ESW system performance resulting from the replacement of existing steel ESW piping during the one-time completion time extension.

ENCLOSURE 3

3. Attachment 1, page 7 of 22, “Defense in Depth,” Bullet 1

   The licensee states: “Preserving the operability of one ESW train and serving the inoperable ESW train’s loads from the normal service water system during this portion of the 14-day Completion Time will maintain the balance among the prevention of core damage, prevention of containment failure, and consequence mitigation.”

   With the emphasis on consequence mitigation, briefly explain how the balance as stated above is maintained for the ESW one-time completion time extension.

4. Attachment 1, page 7 of 22, “Defense in Depth,” Bullet 2

   The licensee states: “The proposed extension of the Completion Time (11 day increase to 14 days per ESW train vs. the current 3-day Completion Time) results in a corresponding increase in the amount of time that the redundancy that is normally afforded by the other (inoperable) ESW train will not be available, thereby increasing the amount of time that safety systems are vulnerable to single failures. However, as discussed above, the normal service water (EA) system will be cross-connected to supply the inoperable ESW train loads during a portion of the extended Completion Times for each train, although the pumped flow from the normal service water system would be unavailable if a loss of offsite power were to occur during this 14-day Completion Time. Steps will be taken to minimize the likelihood of losing offsite power during the use of this one-time Completion Time extension.”

   Given that “a loss of offsite power is the most relevant concern for this amendment request” (Attachment 1, page 13 of 22), state the diverse types of steps that will be taken to minimize the likelihood of losing offsite power during the use of this ESW one-time completion time extension.

   The licensee also states: “Compensatory measures discussed under Tier 2 in Section 4.0 of this Evaluation include programmatic activities. However, because this is a one-time change of limited duration, some use of programmatic activities can be credited for minimizing the risks involved and for maintaining defense-in-depth.”

   Describe the programmatic activities that can be credited for minimizing the risks involved and for maintaining defense-in-depth for the ESW one-time completion time extension.

5. Attachment 1, page 8 of 22, “Defense in Depth,” Bullet 4

   The licensee states: “As discussed in the previous bullet, compensatory measures will be established to assure the availability and capability of redundant, independent, and diverse means of accomplishing critical safety functions during the one-time proposed completion time extension.”

   Briefly discuss the sufficiency of the redundant, independent, and diverse means that will be maintained by established compensatory measures in accomplishing critical safety functions during the ESW one-time proposed completion time extension.

The licensee also states: "As such, appropriate measures will be taken to preserve defenses against potential common cause failures and no new common cause failure mechanisms will be introduced."

Briefly explain how compensatory measures will be taken to preserve defenses against potential common cause failures and to not introduce new failure mechanisms during the ESW one-time completion time extension.

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION

RELATED TO ESSENTIAL SERVICE WATER

UNION ELECTRIC COMPANY

CALLAWAY PLANT

DOCKET NO. 50-483

The NRC's Division of Inspection and Regional Support staff has reviewed the information provided in your submittal and determined that additional information is required in order to complete its review. Please provide a response to the following request for additional information question by July 10, 2008, to facilitate the continuation of the review by the NRC staff:

1. In the licensee's request for a one-time TS change to extend the allowed outage time from 72 hours to 14 days, the "note" added should make it clear that the second limiting condition for operation in the TS will not apply for the planned plastic pipe installation only, and that the change does not constitute permanent removal of the second completion time.

ENCLOSURE 4

OFFICE OF NUCLEAR REACTOR REGULATION

INFORMATION INADEQUACIES IN PREVIOUS RAI RESPONSES

RELATED TO ESSENTIAL SERVICE WATER

UNION ELECTRIC COMPANY

CALLAWAY PLANT

DOCKET NO. 50-483

The NRC's Division of Risk Assessment staff has reviewed the licensee's responses to the NRC staff's request for additional information (RAI) regarding consideration of incremental risk. In RAIs dated March 31, 2008 (ADAMS Accession No. ML080880012), the staff requested additional information regarding a qualitative or quantitative analysis of the risk of internal floods and fires during the extended emergency service water (ESW) outage sufficient to demonstrate that the risk (i.e., core damage frequency and large early relief frequency) from these initiators, omitted from the quantitative risk results, is not significant. In your response dated May 6, 2008 (ADAMS Accession No. ML081340561), the licensee stated that the conditional core damage probability for floods and fires during the ESW outage could approach 1.0.

Based on this information, the staff cannot conclude that the plant risk due to floods and fires is not significant for this application. The information provided would indicate that the risk from fires and internal floods may in fact be dominant compared to the internal events risk. In order to resolve this issue, the licensee would need to demonstrate, through a rigorous quantitative analysis of flood and fire risk, that the total risk during the extended ESW outage (i.e., combined with the internal events risk) is not significant.

Further, the safety analysis of internal floods and fires appears to rely substantially on the availability of the normal charging pump and turbine-driven auxiliary feedwater pump, and possibly on the normal alignment of normal service water (NSW) to the operating ESW header. Because internal floods and fires are apparently not included in the configuration risk management program, unplanned unavailability of these components would not be quantitatively assessed, and could result in a high-risk configuration. This safety issue would need to be addressed through appropriate companion controls for turbine-driven auxiliary feedwater pump and for normal charging pump and NSW supply alignment to the operable ESW to assure the availability of these functions during the extended ESW outage. (The licensee has previously committed (in response to RAI) to have the turbine-driven feedwater pump operable, and NSW to ESW alignment available during the proposed extended ESW outage time.)

Finally, the staff requested the licensee to identify uncertainty impacts of critical assumptions supporting its analyses. One specific assumption was a 50 percent reduction in the loss of offsite power (LOOP) frequency during the ESW outage, due to restrictions on switchyard access and favorable weather over the 14-day period based on monitoring the long-range

forecasts. The licensee's uncertainty analysis demonstrated that the risk results are sensitive to these assumptions and, therefore, a more rigorous assessment of the LOOP frequency reduction is warranted. In addition, the staff does not believe it to be appropriate to reduce weather-related LOOP frequency based on long-range forecasts.

The staff also notes that the licensee has not updated its risk analyses to account for the new commitments regarding the NSW alignment to ESW, and the availability of backup diesel generators. Given that the risk impact from internal events is already above the Regulatory Guide 1.177 guidance, the staff would have expected revised calculations which show the lower risk impacts.