From: Robert Kuntz
Sent: Thursday, May 25, 2023 1:07 PM
To: Taken, Jason C.:(Exelon Nuclear)
Subject: RAI RE: LaSalle Downcomer analysis amendment request (EPID L-2023-LLA-0008)

Mr. Taken,

By letter dated January 12, 2023, Constellation Energy Generation, LLC, (Constellation) proposed to revise the design basis for lower downcomer braces at LaSalle County Station, Units 1 and 2. The Nuclear Regulatory Commission (NRC) staff has determined that additional information is required to complete its review. The NRC staff's request for additional information (RAI) is included. During a clarification discussion on May 22, 2023 a 60 day response was requested. The staff therefore expects a response to this RAI by July 24, 2023. The NRC staff notes that a 60-day response could result in a challenge to complete the review as requested in the amendment request.

The staff has revised items b), c), and d) in the draft RAI to clarify the request based on the discussion held May 22, 2023. The draft RAI stated the following for these items which have been revised in the enclosed RAI:

b) Confirm whether the steel gusset plates, as plate-elements, can be modeled as integral part of downcomer piping using the PIPSYS program. Is there a three-dimensional element in PIPSYS program that can characterize the gusset-plates in a mathematical model?

c) Justify applicability of using plastic section property(ies) in analytical analyses to qualify seismic Category I SSCs.

d) Calculate the elastic and plastic section properties of gusset plate in orthogonal directions.

If you have any questions contact me.

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Request for Additional Information

LaSalle County Station, Units 1 and 2

License Amendment Request:

Revise Design Basis to Allow Use of Plastic Section Properties in

Lower Downcomer Braces Analysis

RAI-1

Requirements:

- 10 CFR 50.55a, “Codes and Standards,” requires that SSCs be designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed.

- 10 CFR 50, Appendix A, General Design Criterion (GDC) 1, “Quality standards and records,” with respect to ensuring that the structures important to safety other than containment are designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the safety function to be performed.

- 10 CFR Part 50, Appendix A, GDC 2, “Design bases for protection against natural phenomena,” as it relates to the design of seismic Category I structures, systems, and components (SSCs), requires, in part, that the SSCs important to safety shall be designed to withstand the effects of natural phenomena such as tornadoes and hurricanes without loss of capability to perform their safety functions.

- 10 CFR 50, Appendix A, GDC 16, "Containment Design," requires that reactor containment and associated systems shall be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

- 10 CFR 50, Appendix A, GDC 50, “Containment Design Basis," requires that the reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any loss-of-coolant accident. This margin shall reflect consideration of (1) the effects of potential energy sources which have not been included in the determination of the peak conditions, such as energy in steam generators and as required by § 50.44 energy from metal-water and other chemical reactions that may result from degradation but not total failure of emergency core cooling functioning, (2) the limited experience and experimental data available for defining accident phenomena and containment responses, and (3) the conservatism of the calculational model and input parameters.

- In Subsection, 1.2.2.4.1, “Primary Containment,” of LSCS Updated Final Safety Analysis Report (UFSAR), Revision 13, the last paragraph on Page 1.2-15, states “The drywell and wetwell are separated by reinforced concrete floor which is penetrated by 98 stainless steel downcomers.”

Background:

The license amendment request dated January 12, 2023, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23013A076), states:

a) In Section 2.0, “Design Input,” on Page 4 of Attachment 3, “Based on discussion with Exelon on 5/18/2020, the reduction in thickness for an operating life of 40 years is to be used herein” and that red_{corr} = 1 mil/year. In Section 3.0, “Assumptions & Engineering Considerations,” on Page 9 of Attachment 3, “There are no unverified assumptions used in the preparation of this analysis.”

b) In Section 6.1, “Methodology,” on Page 12 of Attachment 3, “The loads on the downcomer vents ... are put into the PIPSYS model to determine the moments and axial loads at a joint.”

c) In Section 6.2, “Acceptance Criteria,” on Page 25 of Attachment 3, “However, for the lower downcomer braces and gusset plate section, Licensing Action LI-21-0215 allows the use of plastic section properties.”

d) In Section 2.0, “Design Input,” on Page 8, in Item 3, “Lower Downcomer Brace Plate,” of Attachment 3, “Elastic section modulus of effective gusset section (S_{gp}),” and “Plastic section modulus of effective gusset section” were calculated to be 184 in^3 and 29.54 in^3, respectively.

e) Based on the review of the calculations in Attachment 3, the staff did not find any calculations qualifying the welds at the connection of lower downcomer bracing members.

f) In Section 6.2 “Acceptance Criteria,” on Page 25 of Attachment 3,

> As previously discussed, LC #7 controls for the bracing members based on the existing analyses and is considered in this evaluation. The allowable stresses for this LC (abnormal extreme environmental) are defined per Table 4.3-2 of the LaSalle DAR (Ref. 1c) and are provided below:
>
> S_7 = 1.6*AISC allowable not to exceed 0.95Fy
>
> Consistent with the existing evaluations, the maximum allowable stress of $0.95F_y$ is applicable to axial tension and bending, as well as axial compression. Section 1.7 of Cale. 187 (Ref. 3a) states that an allowable stress of $0.95F_y$ is acceptable for axial compression loads since the loads are dynamic in nature and last only a short time.

g) In Section 6.2 “Acceptance Criteria,” on Page 25 of Attachment 3, “Additionally, per SRP Section 3.6.2 (Ref. 8b), Subsection III.2.a, a 10% increase of the minimum specified design yield strength may be used in the analysis to account

for strain rate effects under dynamic loading. This increase is considered for the axial and bending allowables only."

Issues:

a) It is not clear why the corrosion reduction in thicknesses of the structural members were limited to 40 years, and how the annual corrosion reduction is assured to be to be a linear value of 1 mil/year for the duration of the operations where the lower downcomer bracing members are in stagnant and unrefreshed water environment.

b) It is not clear whether the steel gusset plates, as plate-elements, can be modeled as integral parts of downcomer piping using the PIPSYS program. Is there a three-dimensional element in PIPSYS program that can characterize the gusset-plates in mathematical models?

c) It is not clear how the American Institute of Steel Construction (AISC) code can be implemented to determine plastic section property(ies) to qualify the structural integrity of seismic Category I SSCs.

d) The values of elastic and plastic section modulus of effective gusset plate section are calculated in one of the orthogonal directions only. However, based on the configuration in Figure 2.1-2, "Lower Downcomer Gusset Plate Dimensions," the section properties of gusset plate configuration are different and shall be calculated in both orthogonal directions.

e) It is not clear whether the stresses of welds at the connections of lower downcomer bracing members are within the weld acceptance criteria since no weld calculations are provided in the application.

f) It is not clear why the calculated shear stresses were not compared against the acceptance criterion for shear stresses ($0.95 \times F_y / (3)^{1/2} = 0.548 \times F_y$) as it was provided in Table 3.8-9 in Revision 13 of the LSCS UFSAR.

g) Standard Review Plan (SRP) Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," (ADAMS Accession No. ML16088A041) specifically provides information concerning break and crack location criteria and methods of analysis for evaluating the dynamic effects associated with postulated breaks and cracks in high-and moderate-energy fluid system piping, including "field run" piping inside and outside of containment. Then a 10 percent increase of minimum specified design yield strength (S_y) to account for strain rate effects may not be applicable for the structural members of the supports. Therefore, it is not clear whether any other industrial and/or regulatory requirement(s) allows the use of a 10 percent increase of minimum specified design yield strength (S_y) in the analyses to account for strain rate effects for the structural members of seismic Category I supports.

Requests:

a) Justify why the corrosion reduction in thicknesses of the structural members were limited to 40 years, and how the annual corrosion reduction is assured to be to be a linear value of 1 mil/year for the duration of the operations.

b) Confirm whether the steel gusset plates, as plate-elements, can be modeled as an integral part of downcomer piping using the PIPSYS program. Is there a three-dimensional element in the PIPSYS program that can characterize the gusset-plates in a mathematical model? If not, justify whether the closed pipe element behavior is representative of open-sections, like gusset-plates, in analytical mathematical models under external loading conditions.

c) Justify the use of plastic section properties under the AISC code to qualify the structural integrity of seismic Category I components.

d) Does the calculations of the elastic and plastic section properties of gusset plate provided in support of the amendment request consider forces in each orthogonal direction including combination of forces? If the provided analysis does not consider forces in each orthogonal direction justify the analysis or provide revised analyses as needed to support the amendment request.

e) Provide assurance that the as-built weld joint configuration at the connections of critical locations of the lower downcomer bracing members meets the acceptance criteria.

f) Justify why the calculated shear stresses, in the steel gusset plates, were not compared against the shear acceptance criterion as provided in Table 3.8-9 in Revision 13 of the LSCS UFSAR.

g) Indicate the engineering requirement, industry standard, or code provision that allows the use of a 10 percent increase of minimum specified design yield strength (S_y) in the analyses to account for strain rate effects for the structural members of seismic Category I supports.

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