SeabrookLANPEm Resource

From: Poole, Justin
Sent: Tuesday, February 27, 2018 9:18 AM
To: Bower, Fred; Cataldo, Paul; Floyd, Niklas; Gettys, Evelyn
Cc: Wittick, Brian; Lehman, Bryce; Buford, Angela; Thomas, George; SeabrookLAHearingFile Resource
Subject: FW: Site Visit Plan for the Week of March 19th
Attachments: Seabrook ASR LAR Site Visit Plan - March 2018 - Final.pdf

The LAR/LR site audit plan was sent to the licensee this morning.

Justin C. Poole
Project Manager
NRR/DORL/LPL I
U.S. Nuclear Regulatory Commission
(301)415-2048

From: Poole, Justin
Sent: Tuesday, February 27, 2018 9:14 AM
To: Browne, Kenneth
Subject: Site Visit Plan for the Week of March 19th

Ken,

Attached is the staff's site visit plan for our audit the week of March 19th. If you have any need for clarification in preparing for our visit, please let me know. Thanks.

Justin C. Poole
Project Manager
NRR/DORL/LPL I
U.S. Nuclear Regulatory Commission
(301)415-2048

Hearing Identifier: Seabrook_LA_NonPublic
Email Number: 1405

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From: Poole, Justin

Created By: Justin.Poole@nrc.gov

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Plan for Site Visit to Seabrook Regarding Alkali-Silica Reaction (ASR) LAR and License Renewal ASR Aging Management Program (AMP) Review

Dates: March 19 to March 23, 2018

NRC Participants: A. Buford, Structural Engineer
B. Lehman, Structural Engineer
G. Thomas, Sr. Structural Engineer
R. Morante, Consultant Engineer, BNL
J. Braverman, Consultant Engineer, BNL
J. Poole, Project Manager
B. Wittick, Chief
E. Benner, Director

Background

By letter dated May 25, 2010, NextEra Energy Seabrook (NextEra or the applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC or the staff) its application for renewal of its operating license for Seabrook Station, Unit 1 (Seabrook). The applicant requested renewal of the operating license for an additional 20 years beyond the current 40-year license, which expires on March 15, 2030. In its letter dated November 3, 2017, the applicant supplemented its application to provide a revision to its plant-specific Alkali-Silica Reaction (ASR) aging management program (AMP) to manage the effects of aging due to ASR. This revision included a revised LRA Appendix B Section B.2.1.31A, Alkali-Silica Reaction (ASR) Monitoring Program and LRA Section B.2.1.31B, Building Deformation Program. These programs were submitted for the staff's review related to Open Item OI 3.0.3.2.18-1 in the safety evaluation report (SER) with Open Items (ADAMS Accession No. ML12160A374).

By letter dated August 1, 2016, and supplemented by letters dated September 30, 2016, October 3 and December 11, 2017, NextEra submitted a license amendment request (LAR) to revise the current licensing basis for Seabrook to adopt a methodology for the analysis of seismic category I structures with concrete affected by alkali-silica reaction (ASR). The proposed amendment would revise the Seabrook Updated Final Safety Analysis Report (UFSAR) to include new methods for analyzing seismic category I structures affected by ASR.

In a November 17, 2017, public meeting between NextEra and the NRC, NextEra stated that it credits a "methodology document" as technical basis for the Building Deformation Program, both for its current license and aging management through the period of extended operation. The applicant stated that this document provides the procedural basis for applicable elements of its plant-specific program. On December 11, 2017, the applicant, as part of its ASR-related license amendment request, submitted the "methodology document" in Enclosure 4, titled "Methodology for the Analysis of Seismic Category I Structures with Concrete Affected by Alkali-Silica Reaction for Seabrook Station."

Staff from the Office of Nuclear Reactor Regulation will conduct a regulatory audit to review examples of implementation of the methodology document to verify that the methodology can be consistently applied to Seabrook structures and that the Building Deformation AMP will adequately manage the effects of ASR on concrete structures through the period of extended operation.

Regulatory Audit Basis

Title 10 of the Code of Federal Regulations (10 CFR), Part 50 (10 CFR 50), "Domestic Licensing of Production and Utilization Facilities," includes the requirements for nuclear reactor licensees. 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," requires license amendments be filed with the Commission as specified in 10 CFR 50.4. 10 CFR 50.71, "Maintenance of Records, Making of Reports," requires that records connected to licensed activities be maintained by the licensee.

License renewal requirements are specified in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." 10 CFR 54.17, "Filing of Application," requires applicants for renewed licenses to send written correspondence to the NRC. 10 CFR 54.37, "Additional Records and Record Keeping Requirements," requires that license renewal applicants maintain documents demonstrating compliance with the requirements of 10 CFR Part 54 in auditable and retrievable form. License renewal staff guidance is provided in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010, and in NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010.

During review of a licensing action, there may be supporting information retained as records that, although may not necessarily be required to be submitted as part of the application, provide additional information and technical bases for the submitted information, and therefore the staff may determine an audit is necessary. Regulatory audits may focus on specific documents or may be performed by sampling analyses and information in support of the regulatory action. This audit will be performed in accordance with staff guidance in NRC Office of Nuclear Reactor Regulation, Office Instruction LIC-111, "Regulatory Audits," in order for the staff to gain a better understanding of detailed calculations and analyses underlying the formal application and confirm the staff's understanding of the application.

Regulatory Audit Scope and Methodology - LAR

The NRC participants plan to discuss the methodology document with NextEra staff and to review a sample of calculations that have been completed in accordance with the updated methodology document. This will allow the staff to gain a better understanding of the unique, first-of-a-kind methodology and ensure the methodology is being applied as described in the LAR and supporting submittals.

During review of the LAR, the staff has developed a list of topics to focus on during the audit. These topics, along with a list of completed calculations the staff would like to review, have been included as an attachment to this audit plan. Note that while addressing these topics new issues and need for additional information may be identified by the staff. Based on the results of the audit, the staff will determine what, if any, information needs to be submitted on the docket subsequent to the audit and if additional requests for information (RAIs) will be necessary.

Regulatory Audit Scope and Methodology - LRA

The scope of this audit is to examine the applicant's supporting documentation for LRA AMP B.2.1.31B. This plant-specific AMP will be evaluated for the 10 program elements in accordance with the guidance provided in SRP-LR Appendix A.1 "Aging Management Review Branch Technical Position RLSB-1". The SRP-LR states that an applicant can choose to

establish one or more plant-specific AMPs. It is incumbent on the applicant to ensure that the plant program contains adequate descriptions and depth of bases for all 10 elements of the AMP.

The staff will review the applicant's program basis documents, review supporting calculations and evaluations, conduct related walkdowns as needed, and interview applicant representatives to obtain additional clarification related to the AMP. Specifically, the staff will review completed analyses that follow the procedural methodology, including applicable finite element analysis input and results (stage 1, stage 2 and stage 3) and result in inputs to the parameters monitored or inspected, detection of aging effects, monitoring and trending, and acceptance criteria AMP program elements. Based on the results of the audit, the staff will determine what, if any, information would need to be submitted on the docket subsequent to the audit. The staff will also assess whether it needs to request docketing of additional information.

Logistics

NextEra will make relevant information available and will provide rooms and space as necessary. The NRC staff plans to perform the entrance meeting on the morning of Monday March 19, 2018. At the end of each day, a brief meeting will be held to go over current status and upcoming activities. On Thursday March 22, 2018, an exit meeting will be held to lay out what items have been accomplished and any new issues that have been identified.

Proposed Schedule

March 19th:	Entrance meeting Review topics in Attachments 1 and 2 with NRC Staff and licensee
March 20th:	NRC Staff reviews provided calculations
March 21st:	AM – Discussion with licensee based on review of calculations. PM – Discussion with licensee on license renewal
March 22nd:	Continued discussion between NRC and licensee Exit Meeting
March 23rd:	Additional document review, if necessary

The staff will issue a summary of the site visit within 90 days of the completion of the trip.

Licensee Contact: Licensing Manager: Kenneth Browne (603) 773-7932
Engineering Supervisor - License Renewal: Ed Carley (603) 773-7957

Attachment 1: Discussion Topics and Calculations to be Reviewed

Calculations to be Reviewed:

Note: Please provide hard copy and load electronic copy on to electronic reading room (ERR) by March 5, 2018.

- Updated Containment Enclosure Building (CEB)
- Fuel Storage Building
- Containment (on ERR currently - FP101113_000_3.pdf)
- Main Steam East Pipe Chase
- RHR Equipment Vault (on ERR currently – FP101179 160268-CA-06.pdf)
- Electrical Cable Tunnel (on ERR currently – 170443-CA-01 Rev. 0 (UNSEC).pdf)
- Condensate Storage Tank Enclosure (on ERR currently - FP101104_000.pdf)

Discussion Topics:

- Questions to be developed on the reviewed calculations
- Methodology Document
    - Non-ASR Demands: "…non-ASR demands may be recalculated using methods that are generally consistent with the original design methodology…" What is meant by "generally consistent"? (Sections 4.2.2, 4.3.2. 4.4.2)
    - Estimating the effects of ASR expansion in the concrete backfill (Sections 3.1.2, 4.2.3.2, 4.3.3.2 and 4.4.3)
    - Calculation and use of cracked section properties (Sections 4.2.3.3, 4.3.3.3, 4.4.5, RAI-D2 – Supplement 4, and Appendix A)
        - See Attachment 2 for detailed questions on Appendix A
    - How the steel reinforcement is modeled in the concrete (Sections 4.3.3.1 and 4.4.3.1)
    - How development of cracked section properties in methodology document accounts for the large-scale test program results which indicate an increase in stiffness as ASR progresses
- A summary discussion of the first assessment of the corroboration that ASR behavior in Seabrook structures is similar to the test specimens

- Clarification on UFSAR Table 3.8-16 footnote 6 associated with ASR Loads
    - Does the reduction apply to ASR loads in severity zones in that structure or just the zones exceeding severity zone 1?
    - Can a structure have different ASR load factors in the same load combination?
- Several docketed documents (LAR Section 3.2.1, Section 6.3.1 of MPR-3727, Supplement 2 of Section 5.6 of the Methodology Document, “Additional Comment on Compression,” in Appendix A of Enclosure 1 of RAI response dated October 3, 2017) appear to have conflicting statements regarding the compression limit state. Clarification of technical position on ASR effect on load capacity for compression limit state for structures subject to axial compression or compression and flexure.
- RAI-D2
    - Supplement 3 – Why is ACI 318-83 Section 11.7 not being used in its entirety?
    - Supplement 4 – When will Eqn. 9-4 be used?
- RAI-D8
    - QA concern (documents include footnotes stating “preliminary results, may change during checking and approval” and “calculation pending final review”
    - Necessity of evaluation for inelastic behavior under service conditions if structures reach ASR severity zone 4

Attachment 2: Questions on Appendix A of Methodology Document

- For Step 4, the approach for stiffness reduction for flexural rigidity, axial rigidity, and shear rigidity are based on normal reinforced concrete. Explain how the expansion effects of ASR are considered in determining the stiffness reduction equations being used. If the ASR effects are not considered, provide the technical basis for not considering it.

- For Step 4, the first sub-bullet for Flexural Rigidity provides an equation for the effective moment of inertia based on ACI 318-71, Equation 9-4. The staff notes that ACI 318-71 also states that the effective moment of inertia calculated using Equation 9-4 shall not be greater than the gross moment of inertia. Explain why this limitation is not included in Step 4, in addition to Equation 9-4.

- For Step 4, second sub-bullet for Axial Rigidity, address the following:

    - This section states: "Knowing the axial/membrane strain, ε, calculate the axial stress, σ, using either the procedure recommended by ACI Committee 224 [A3], or the Steven's equation that accounts for tension stiffening [A4] by using an exponential decay function." The ACI Committee 224.2R-92 report presents several methods for estimating the axial stiffness of cracked reinforced concrete methods. Clarify which method(s) in ACI 224.2R-92 is (are) being referenced. Provide a basis for selecting the appropriate method, between ACI and the Steven's equation. Also, the summary in ACI 224.2R-92 indicates that the "approaches appear to be acceptable for the analysis of one-dimensional members." In view of this statement, explain why it is acceptable to use these methods for finite element analysis with multi-directional loading of concrete members. If one or more of these methods will be used, how do these methods compare to one another and to the ASCE 4-16 guidance, which is not to use stiffness reduction for axial rigidity?

    - The value of f_t is obtained "using the following equation which is within the value range recommended by Nilson et al. [A5]: $f_t = 5\sqrt{f'_c}$." According to Nilson (Eighth edition), for lightweight concrete f_t ranges from 4 to 5 $\sqrt{f'_c}$ while for sand and gravel concretes f_t ranges from 6 to 7 $\sqrt{f'_c}$. Therefore, $f_t = 5\sqrt{f'_c}$, corresponding to lightweight concrete, is being used for the evaluation of Seabrook structures. The Steven's equation referenced above (Reference A4 in Appendix A) indicates that $f_t = .33\sqrt{f'_c}$ in MPa. This is equivalent to $3.97\sqrt{f'_c}$ in psi. Also, ASR can reduce the tensile strength of concrete members. Consequently, the value of the tensile strength can vary, depending on the reference being used and whether the region in the concrete structure is affected by ASR. In view of these uncertainties, explain the sensitivity of the axial tensile strength on the overall response of concrete structures at Seabrook, and if significant, how is that addressed.

- Step 4, third sub-bullet for shear stiffness reduction, uses the shear stiffness reduction based on Reference A6 of Appendix A. A comparison of the equation in Appendix A with Reference 6 shows that the parameter c_3 is omitted. This parameter corresponds to

a user-defined scaling factor, which in Appendix A apparently is assumed to be 1.0. This implies that the full shear reduction estimated by the equation is used. Also, the equation in Appendix A has a negative sign in front of the equation, which is not consistent with Reference A6. In addition, the shear stiffness of concrete may be affected by ASR. In view of these uncertainties, explain the sensitivity of the shear stiffness reduction on the overall response of concrete structures at Seabrook, and if significant, how is that addressed.

- Step 6 states: "Note that if the analysis stops before obtaining convergence, the results would be conservative, i.e. bending moment, shear and/or tensile force would be greater than the expected values. Therefore, one might use such conservative results for evaluation." Clarify that "if the analysis stops before obtaining convergence" is properly interpreted to mean that the iterative process is stopped before satisfying the "completed" criterion. Also, the staff notes that this appears to be not conservative with respect to displacements. For situations that are displacement-critical, explain why it is acceptable to stop the analysis prior to convergence.