NEXTera ENERGY SEABROOK

February 23, 2016
SBK-L-16022
Docket 50-443

United States Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Request for Voluntary Response to 2.206 Petition Regarding Methods for Identification of Concrete Affected by Alkali-Silica Reaction

References: 1) Letter from J. G. Lamb (U.S. Nuclear Regulatory Commission) to D. Curtland (NextEra Energy Seabrook, LLC) Request For Voluntary Response to Petition from C-10 Research and Education Foundation Regarding Alkali Silica Reaction in Concrete Structures and Requiring Immediate Implementation and Enforcement of American Concrete Institute 349.3R and American Society for Testing and Materials C856-11 Code Standards, dated January 27, 2016 (ADAMS Accession No. ML16014A164)

2) Enforcement Petition under 10 CFR 2.206 from Sandra Gavutis, Executive Director C-10 Research & Education Foundation, dated December 22, 2015 (ADAMS Accession No. ML16006A002)

In Reference 1, the Nuclear Regulatory Commission invited NextEra Energy Seabrook, LLC ("NextEra") to comment on a petition filed by the C-10 Research and Education Foundation under 10 C.F.R. § 2.206 (Reference 2). NextEra hereby submits the following brief comments on the petition.

We appreciate the NRC's consideration of these comments.

Sincerely,
NextEra Energy Seabrook, LLC

Dean Curtland
Site Vice President

cc: D. Dorman, NRC Region I Administrator
J. Lamb, NRC Project Manager, Project Directorate I-2
P. Cataldo, NRC Senior Resident Inspector

Attachment (1)

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NextEra Energy Seabrook, LLC Response Regarding C-10 2.206 Petition

The C-10 Research and Education Foundation ("C-10") petition asks the Nuclear Regulatory Commission ("NRC") to require NextEra Energy Seabrook, LLC ("NextEra") to adopt ACI Standard 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures" (Reference 1), and ASTM C856-11 "Standard Practice for Petrographic Examination of Hardened Concrete" (Reference 2), for Alkali-Silica Reaction ("ASR") concrete degradation at Seabrook Station.

The petition is based on a number of mistaken assumptions. First, and most fundamentally, the petition assumes that without petrographic confirmation of ASR, NextEra ignores concrete structures and does nothing to manage it. This is incorrect. Because the coarse aggregates used in the construction of concrete structures at Seabrook Station come from sources that produced reactive aggregates, all of the concrete structures at Seabrook Station are susceptible to ASR. For this reason, NextEra's ASR Monitoring Program assumes that every structure has ASR, regardless of whether it has actually been identified and confirmed. As a result, NextEra performs visual ASR examinations of all concrete structures, as though those sites have confirmed ASR.

Further, the petition reflects the belief that new identification techniques are needed to address ASR. However, while both ACI 349.3R and ASTM C 856-11 are useful standards, neither provides any new or improved means to identify, monitor or assess ASR-impacted structures. In general, the petition fails to differentiate between identification of ASR, monitoring its progression, and evaluating its structural implications. The petition is also based on the mistaken assumption that requiring NextEra to follow ACI 349.3R and ASTM C856-11 will necessarily result in a requirement that NextEra must perform petrographic examinations. That is not the case.

Finally, the petition assumes that NextEra has not used either ACI 349.3R or ASTM 856-11 in its ongoing efforts to monitor ASR at Seabrook Station. But NextEra has utilized both of these standards in its investigation and monitoring of ASR conditions. In fact, NextEra relied upon ACI 349.3R, with other guidance, in the development of its Structural Monitoring Program and the ASR Monitoring Program. In addition, all of the petrographic examinations performed to date for Seabrook Station followed ASTM C856 examination standard.

ACI 349.3R and ASTM C856-11 do not Require Petrographic Examination

ACI 349.3R provides limited guidance relative to ASR identification and evaluation. Methods of identification from ACI 349.3R walk downs generally consist of visual inspection of observable crack surfaces. ACI 349.3R does reference ASTM C856, but does not require core boring or petrographic examination. Instead, visual inspection remains the primary method for concrete inspection under ACI 349.3R, supplemented by non-destructive examination, and invasive examination and testing if deemed necessary by qualified engineers. These methods are consistent with current structures monitoring practice at Seabrook.

Contrary to C-10's characterization, there are no new or improved methods of ASR detection provided in ACI 349.3R. It does provide a tiered response criteria based on observable crack sizes, but does not include specific evaluation methods for concrete meeting the tiered response criteria. NextEra has relied upon this tiered response criteria in developing its own tiered ASR monitoring program. In any event,

ACI 349.3R is not a code or standard as C-10 implies. It is a guidance document, written in non-mandatory language.

Similarly, ASTM C856-11 "Standard Practice for Petrographic Examination of Hardened Concrete," does not require petrographic examinations. Instead, it is an examination standard that provides the techniques and procedures to be followed once a petrographic examination of hardened concrete has been deemed necessary. It does not specify when, where, or at what frequency core boring or subsequent petrographic examination should be performed. A qualified engineer must make those determinations based on an evaluation of the condition, configuration, material, environment, and history of the structure in question. However, if core boring and petrographic examinations are deemed appropriate based upon the observed conditions, it naturally follows that ASTM C856-11 would be considered as a standard for performing the petrographic examinations.

NextEra's Alkali-Silica Monitoring Program

NextEra has a thorough and extensive program to identify and monitor ASR at Seabrook. The additional petrography sought by C-10 is not necessary because NextEra's program is adequate to provide reasonable assurance that areas affected by alkali-silica reaction will be identified and evaluated. In a 2012 inspection report (Reference 3), the NRC documented its determination that NextEra's methods for assessing operability of ASR-affected reinforced concrete structures were reasonable and generally comprehensive.

In Information Notice 2010-14 "Containment Concrete Surface Conditions Examination Frequency and Acceptance Criteria" (Reference 4), the NRC noted that "[t]he primary inspection method specified in Subsection IWL for concrete surface examination is visual examination" and recommended that that licensees follow the guidance in ACI 349.3R regarding frequency and acceptance of visual inspections of concrete. In response to IN 2010-14, the Seabrook Inservice Inspection Procedure Primary Containment Section XI IWL Program was revised to include the guidance of ACI 201.1R and ACI 349.3R for identifying degradation during general visual examinations.

NextEra agrees that petrography is one method of obtaining a definitive confirmation of ASR. In fact, petrography is identified in NextEra's ASR Aging Management Program as a method of confirming a diagnosis of ASR and NextEra has initiated non-destructive examinations, as well as invasive measures (such as core boring and physical testing of cores or petrographic analysis), when deemed necessary and appropriate by plant engineers. However, as the NRC explained in a December 2013 letter (Reference 5) "[v]isual examination is recognized in the concrete industry as an effective means to detect ASR." That being said, it is important to reiterate that NextEra does not rule out ASR in structures, so petrographic confirmation is not necessary in order to ensure that the structure is monitored in accordance with NextEra's program. In any case, other techniques, including chemical analysis of the ASR gels can provide similar confirmation. Further, petrography alone does not provide any way to quantify structural degradation due to ASR. Material property results from cores removed from a reinforced concrete structure do not properly represent the actual structural performance because the structural context is lost. The decision to core bore a concrete member and perform additional examinations should be evaluated on a case-by-case basis, and should only be performed when and where a qualified engineer has determined that it is appropriate.

Moreover, as part of its license renewal application, NextEra has committed to perform a number of core bores. For instance, NextEra recently completed a shallow core bore in an area that was continuously wetted from borated water to examine for signs of concrete degradation. As committed by NextEra, petrography was performed on this sample in accordance with ASTM Standard Practice C856.

Other Issues Raised in the C-10 Petition

Containment

The Petition is specifically concerned with the structural integrity of the containment building. But the Seabrook Station containment building is triaxially reinforced. While ASR generally reduces the stiffness of unreinforced concrete, reinforced concrete structures affected by ASR behave differently from unreinforced cores due to confinement of the concrete by the reinforcing bars. ASR has been shown to significantly increase the post-elastic stiffness of reinforced concrete components, at least for concrete structures that are triaxially confined by reinforcement. In short, in a case where the benefits of triaxial confinement can be established through the presence of a three dimensional reinforcement cage, there does not appear to be any adverse effect on structural response due to ASR.

Nevertheless, NextEra continues to inspect and monitor the containment building for ASR. NextEra has performed a comprehensive visual examination of the containment structure concrete in accordance with Section XI, subsection IWL. Currently, NextEra has identified one location on the containment structure where ASR meets the Tier 3 criteria in its ASR Monitoring Program. As a Tier 3 location, it has been monitored on a 6-month frequency since June 2012. Trending of the Combined Cracking Indices (CCI), crack width measurements, and expansion measurement data collected since 2012 has shown no progression of ASR at this location. NextEra has also identified two locations on the containment structure where ASR meets meet the Tier 2 criteria. The two Tier 2 locations are monitored on a 30-month frequency. Re-inspection and monitoring of these two Tier 2 locations was most recently completed in August 2014. Trending of the CCI, crack width measurements, and expansion measurement data from these locations has shown no progression of ASR. Because of the shear reinforcement, NextEra's qualified engineers have concluded that the impact of the level of ASR present would have a negligible effect on the design and performance of the containment structure.

NextEra's comprehensive examination did not detect any other locations on the containment structure impacted by ASR. The ASME IWL examination of the Containment concrete will be performed again soon. This will provide an opportunity to re-confirm the limited area of the containment concrete visually affected by ASR and that the majority of the concrete area is not affected by ASR, or alternatively, identify new areas of ASR to monitor under NextEra's program.

For the reasons stated above, and based on the recommendations of its qualified engineers, NextEra has elected not to perform core boring into the containment structure for the purpose of performing petrographic examination and mechanical property testing on the extracted core. In any event, NextEra has already "screened in" these locations for continued monitoring based on their visual indications of ASR – petrographic confirmation is therefore not necessary to ensure continued monitoring.

Other Concrete Structures

Trending of the data from the 6-month monitoring of all of the ASR Tier 3 locations in the plant since 2012 has identified no progression of ASR. There has been some limited progression of expansion at some other locations in the plant. This limited progression remains bounded by the Interim Structural Assessment and the Open Prompt Operability Determinations, thus the classifications remain the same - i.e. fully qualified or qualified but degraded. The structural capacity of the impacted structures can adequately meet the loading conditions and ultimately the demand on the structures.

Radiation Induced Degradation

The C-10 Petition also argues that ASR may couple with radiation-induced effects to accelerate deterioration of the containment building walls. The NRC addressed this issue in NUREG/CR-7171 (Reference 6), which explained that there may be a coupling effect between radiation and ASR that can potentially accelerate ASR activity or cause ASR to occur with aggregates that are not normally reactive. NUREG/CR-7171 agrees that the primary method for detection of ASR is visual examination and that removal of samples and petrographic evaluation can be used to confirm the presence of ASR.

ACI 349.3R explains that the most likely locations of irradiation degradation is in areas *within* the primary containment, that are in close proximity to the reactor core and near reactor coolant piping nozzles or reactor support structures. Other areas are likely to be subjected to lower levels of irradiation. NUREG/CR-7171 similarly states that concrete used as biological shields or as support for the reactor pressure vessel are particularly susceptible to irradiation. As a result, this is less likely to impact the containment building. In any event, NUREG/CR-7171 concludes that the "techniques associated with identification of concrete that has experienced or is experiencing elevated temperatures, ASR, or carbonation may also provide indications that the concrete has been affected by radiation."

Applicable 10 CFR 2.206 Review Criteria

Management Directive 8.11, "Review Process for 10 CFR 2.206 Petitions" (Reference 7), provides criteria for considering petitions under 10 CFR 2.206. One criterion is that a request should not address deficiencies with existing NRC rules, which should be handled as rulemaking petitions. Here, C-10 has already filed a substantially similar rulemaking petition (Reference 8), which also sought the imposition of ACI 349.3R and ASTM C856. Because, C-10 has already acknowledged that NRC does not currently require licensees to follow ACI 349.3R, ASTM C856, or perform petrography, it is apparent that enforcement action under 10 CFR 2.206 against NextEra is inappropriate and action should be taken, if at all, through the NRC's well-established rulemaking process.

References

1. ACI Standard 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," (June 17, 2002).

2. ASTM C856-11 "Standard Practice for Petrographic Examination of Hardened Concrete."

3. Letter from C.G. Miller, (U.S. Nuclear Regulatory Commission) to K. Walsh (NextEra Energy Seabrook, LLC), "Seabrook Station, Unit No. 1 – Confirmatory Action Letter Follow-Up Inspection - NRC Inspection Report 05000443/2012009, dated December 3, 2012 (ML12338A283).

4. Information Notice 2010-14 "Containment Concrete Surface Conditions Examination Frequency and Acceptance Criteria", dated August 4, 2010 (ML101600151).

5. Letter from W. M. Dean, (U.S. Nuclear Regulatory Commission) to D. Wright (Union of Concerned Scientists), dated December 6, 2013 (ML13340A405).

6. NUREG/CR-7171, A Review of the Effects of Radiation on Microstructure and Properties of Concretes Used in Nuclear Power Plants," dated November 2013 (ML13325B077).

7. Management Directive 8.11, "Review Process for 10 CFR 2.206 Petitions," dated October 25, 2000 (ML041770328).

8. Letter from S. Gavutis (C-10) to A. Vietti-Cook (U.S. Nuclear Regulatory Commission) "Petition for Rulemaking", dated September 25, 2014 (ML14281A124).