NEXTera ENERGY SEABROOK

June 30, 2015
10 CFR 54

SBK-L-15107
Docket No. 50-443

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

Seabrook Station

Response to Requests for Additional Information for the Review of the Seabrook Station, License Renewal Application- SET 23 (TAC NO. ME4028) Relating to the Alkali-Silica Reaction (ASR) Monitoring Program

References:

1. NextEra Energy Seabrook, LLC letter SBK-L-10077, "Seabrook Station Application for Renewed Operating License," May 25, 2010. (Accession Number ML101590099)
2. NRC Letter, Requests For Additional Information for the Review of the Seabrook Station, License Renewal Application- Set 23 (TAC NO. ME4028), November 25,2014 (Accession Number ML14301A316)
3. NextEra Energy Seabrook, LLC letter SBK-L-15024, "Response to Requests for Additional Information for the Review of the Seabrook Station, License Renewal Application- SET 23 (TAC NO. ME4028) Relating to the Alkali-Silica Reaction (ASR) Monitoring Program," February 23, 2015. (Accession Number ML15062A042)

In Reference 1, NextEra Energy Seabrook, LLC (NextEra) submitted an application for a renewed facility operating license for Seabrook Station Unit 1 in accordance with the Code of Federal Regulations, Title 10, Parts 50, 51, and 54.

In Reference 3 NextEra provided responses to the information requested in Reference 2 for RAIs B.2.1.31A-2(a) and B.2.1.31A-7.

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NRR

Enclosure 1 contains NextEra responses to the information requested in Reference 2 for RAIs B.2.1.31A-5(a) and B.2.1.31A-6(a). Within these responses, changes to LRA Appendix A – Updated UFSAR Supplement, and Appendix B – Aging Management Programs associated with the Alkali-Silica Reaction Monitoring Program are provided. The changes are explained, and where appropriate to facilitate understanding, portions of the LRA are repeated with the change highlighted by strikethroughs for deleted text and bolded italics for inserted text. In some instances the entire text of a section has been replaced or added. In these cases a note is included in the introduction indicating the replacement of the entire text of the section.

Enclosure 2 provides the revised LRA Appendix A - Updated Final Safety Analysis Report Supplement Table A.3, License Renewal Commitment List. This letter contains one revised commitment (83) and one new commitment (91). Commitment 52 status has been changed to "Complete" as the ongoing dewatering activities have been incorporated into the station's preventative maintenance program to maintain the exterior surface of the Containment Structure, from elevation -30 feet to +20 feet, in a dewatered state . In addition, based on staff review, twelve commitments (24, 44, 55, 56, 57, 60, 61, 64, 65, 71, 72, and 73) were changed to incorporate consistent terminology of "...prior to the period of extended operation..."

Enclosures 3/4 are provided to support the review of this RAI response. Enclosure 3 is provided as non-proprietary version of the referenced report. Enclosure 4 provides the proprietary version as described below.

Enclosure 4 to this letter, MPR-4153, Revision 1: Seabrook Station- Approach for Determining Through-Thickness Expansion from Alkali-Silica Reaction, MPR Associates, Inc., Alexandria, VA, June 2015 (Proprietary), contains NextEra Energy Seabrook proprietary information. This letter is supported by an affidavit signed by NextEra Energy Seabrook, setting forth the basis on which the information may be withheld from public disclosure by the Commission and addressing the considerations listed in 10 CFR 2.390(b)(4). Accordingly, it is respectfully requested that the information which is proprietary be withheld from public disclosure in accordance 10 CFR 2.390.

If there are any questions or additional information is needed, please contact Mr. Edward J. Carley, Engineering Supervisor - License Renewal, at (603) 773-7957.

If you have any questions regarding this correspondence, please contact Mr. Michael Ossing Licensing Manager, at (603) 773-7512.

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

Executed on June 30, 2015

Sincerely,

Dean Curtland
Site Vice President
NextEra Energy Seabrook, LLC

Enclosure 1 - Seabrook Station License Renewal Application, Response to Requests for Additional Information - Set 23, RAIs Relating to the Alkali-Silica Reaction (ASR) Monitoring Program for the Seabrook Station License Renewal Application

Enclosure 2 - LRA Appendix A - Final Safety Analysis Report Supplement Table A.3, License Renewal Commitment List Updated to Reflect Changes to Date

Enclosure 3 - MPR-4153, Seabrook Station- Approach for Estimating Through-Thickness Expansion from Alkali-Silica Reaction, MPR Associates, Inc., Alexandria, VA, 2015. (Non-Proprietary)

Enclosure 4 - MPR-4153, Revision 1: Seabrook Station- Approach for Determining Through-Thickness Expansion from Alkali-Silica Reaction, MPR Associates, Inc., Alexandria, VA, June 2015. (Proprietary)

Enclosure 5 Affidavit in Support of Application for Withholding Proprietary Information from Public Disclosure

cc:	D. H. Dorman	NRC Region I Administrator
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<u>Enclosure 1 to SBK-L- 15107</u>

Seabrook Station License Renewal Application
Requests for Additional Information - Set 23

Response to RAIs Relating to the Alkali-Silica Reaction (ASR) Monitoring Program
for the
Seabrook Station License Renewal Application

RAI B.2.1.31A-5(a)

Background

In its response to RAI B.2.1.31A-4, dated May 15, 2014, the applicant clarified that the large-scale testing program does not have a role in establishing the technical basis for the ASR Monitoring Program, and with respect to the monitoring parameters, the large-scale testing program is "confirmatory in nature." However, the testing is referenced in and appears to be relied upon to address the staff's concerns regarding the "parameters monitored or inspected" "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements.

In response to RAI B.2.1.31A-5, dated May 15, 2014, part (1) regarding the adequacy of the crack indexing methodology to monitor volumetric expansion, the applicant indicated that the magnitude of expansion in the reinforced direction (the in-plane, or "x-y", direction which is the direction being monitored on the concrete surface onsite) will be smaller than in a non-reinforced direction (the "through-wall" or "transverse" direction not currently being monitored). The applicant also stated that:-2- [b]ased upon a preliminary review of large-scale testing results to date, the test specimens appear to confirm CCI as an appropriate parameter for monitoring ASR progression.... However, expansion in the test specimens in x and y plane appears to level off over time and is smaller in magnitude than the transverse direction. The applicant further stated that "the test specimens continue to generate information for other parameters including transverse direction expansion, material property changes (e.g., modulus) and the results will be used to confirm and adjust monitoring parameters...." In response to RAI B.2.1.31A-5, part (2) regarding a proposed method or technique to monitor expansion in the transverse direction, the applicant committed (Commitment No. 83) to install instrumentation in "representative sample areas" to monitor expansion in the transverse direction. The applicant stated that "expansion data from deep pins installed in test specimens will be used to correlate with transverse expansion measurements from instruments to be installed in plant structures," and that if determined necessary, "the instrument and pin expansion data will be used to establish acceptance criteria and monitoring frequencies for monitoring transverse expansion.

Nuclear Regulatory Commission (NRC) guidance as stated in Standard Review Plan for License Renewal (SRP-LR), Section A.1.2.3.3, states that the "parameters monitored or inspected" program element should provide a link between the parameters that will be monitored and how monitoring these parameters will ensure adequate aging management.

Issue

The staff has identified the following concerns:

1. The applicant stated, in its response dated May 15, 2014, to part (1) of RAI B.2.1.31A-5, that a larger number of smaller cracks would be anticipated in the restrained direction relative to a smaller number of larger width cracks in an unrestrained direction for the same amount of ASR progression. However, the applicant did not provide any information regarding the structural implications of this phenomenon.

2. It is not clear to the staff how measuring Combined Cracking Index (CCI) and crack width as parameters will correlate the aging effect of cracking due to expansion from reaction with

aggregates to the degradation of ASR-affected structures in order to evaluate whether there is an impact on the structure's intended function. Also, confinement due to reinforcement detailing may affect the CCI measurement between structures. The staff is not clear how it can be confirmed that the same CCI value measured on different structures represents the same degree of ASR degradation.

3. In its response dated May 15, 2014, to part 2 of RAI B.2.1.31A-5, the applicant refers to "representative sample areas" that it plans to monitor expansion due to ASR in the out-of-plane direction. However, the response did not provide any further information as to how the sample will be determined. SRP-LR Section A.1.2.3.4 states that when sampling is used to represent a larger population size, the basis for the sample size should be provided, and should be biased toward locations most susceptible to the specific aging effect. The staff does not have sufficient information to determine whether the sample will be adequate to ensure that the areas instrumented for through-wall expansion data will be bounding of the ASR-related degradation at the plant.

4. Commitment No. 83 states that instrumentation to monitor expansion due to ASR in the out-of-plane direction will be installed "to determine whether there is a need to enhance the program to monitor expansion in the out-of-plane direction." Commitment 83 also states that this evaluation will take place "prior to the period of extended operation;" however, the implementation schedule did not contain sufficient detail for the staff to review and evaluate. The staff is concerned that depending on when this activity is performed, if it is determined that it is necessary to monitor out-of-plane expansion; there may not be sufficient time to acquire enough information to determine whether the expansion could impact structural function. The RAI response did not provide any information regarding schedule and duration of activities, and associated technical bases, in order for the staff to determine whether the time of implementation provides for adequate monitoring and trending during the Period of Extended Operation (PEO).

5. The applicant's RAI response states "expansion data from deep pins installed in test specimens will be used to correlate with out-of-plane expansion measurements from instruments to be installed in plant structures." It also states that "[i]f an additional monitoring parameter in the out-of-plane direction is determined to be necessary as part of the [ASR] Monitoring Program, NextEra will enhance the [program]...to establish acceptance criteria and monitoring frequencies for monitoring out of plane expansion." It is not clear how the expansion data from deep pins in test specimens will be correlated to data from instrumentation installed in plant structures because there is no expansion data measured to date for onsite structures, and it is not clear how the test specimens simulate the boundary conditions of the structural components (e.g., walls) of the onsite structures.

6. Since the majority of the walls of the ASR-affected structures at Seabrook are not restrained in the transverse direction, expansion in the transverse direction could lead to laminar cracking which could propagate with time. It is not clear whether the program accounts for the potential for laminar cracking and its implication with regard to structural and anchor bolt capacity or if there is a technical basis for not considering the potential for delamination.

7. During a February 21, 2013, public meeting with the applicant, the staff expressed its concern regarding the ability to correlate CCI to loss of strength, a parameter not monitored as part of the ASR Monitoring Program. As documented in the meeting summary (Agency wide Documents Access and Management System (ADAMS) Accession No. ML13066A488), the applicant responded to that concern stating that the selection of specific acceptance criteria was based on its review of industry experience. The large-scale testing, which it is currently pursuing, will provide results that will be used for its structural evaluation to determine operability and for assessing and evaluating plant structures impacted by ASR. The staff is concerned that there is no aspect of the ASR Monitoring Program, either periodic or one-time, that would validate the assumed changes in material properties being established through the large-scale testing program. It is unclear to the staff whether the applicant will have enough information to perform an adequate structural evaluation if warranted.

   At this time, it appears that multiple elements of the program have yet to be fully established and may need to be amended; therefore, the staff does not have sufficient information to make a determination that the effects of cracking due to expansion from reaction with aggregates will be adequately managed during the period of extended operation.

<u>Request</u>

Considering the staff concerns identified in the "Issue" section, provide information with technical basis to: (1) demonstrate the adequacy of the parameters proposed to be monitored or inspected by the program to manage the effects of aging due to ASR; and (2) clearly establish the link between the parameters that will be monitored and how monitoring these parameters will ensure adequate aging management such that intended function will be maintained during the period of extended operation.

<u>NextEra Energy Seabrook Response to RAI B.2.1.31A-5(a)</u>

NextEra's monitoring plan for ASR has two objectives. First, the degree and rate of progression of ASR over time is monitored and trended to prevent the loss of intended function. Second, the monitored parameters are used to correlate the structural test data obtained from large scale testing program at the University of Texas at Austin, Ferguson Structural Engineering Laboratory (FSEL) to Seabrook Station structures. Expansion (strain) is the primary monitoring parameter, because the potential for impact on structural performance from ASR is a result of the internal expansion that leads to concrete cracking [References: 1, 2 &3]. Seabrook Station's approach to monitoring expansion is to use a combined crack index (CCI) for in-plane (x-y direction) expansion and extensometers for out-of-plane (through-the-thickness or z direction) expansion.

The large scale testing program at the FSEL validated the use of expansion to monitor the level and rate of ASR progression. Preferential ASR expansion is expected in the unrestrained or less restrained direction. Consistent with this expectation, observation of the large scale test specimens has confirmed expansion to be significantly more pronounced in the out-of-plane direction. The FSEL tests include the direct measurement and monitoring of strain in both in-plane and out-of-plane directions via cast in place metal pins. Expansion in the in-plane direction has been observed to plateau (i.e., minimal change over time) at some point while ASR expansion in the out-of-plane direction continues to progress. [Reference: 6].

NextEra has been using a Combined Cracking Index (CCI) method to monitor expansion in the in-plane directions for approximately two years. CCI is monitored in the same manner for the plant as it is for the test specimens. CCI correlates well with strain in the in-plane directions and the ability to visually detect cracking in exposed surfaces makes it an effective initial detection parameter. CCI's limitation for heavily reinforced structures is that in-plane expansion, and therefore CCI, has been observed to plateau at a relatively low level of accumulated strain. While CCI remains useful for the detection and monitoring of ASR at the initial stages, an additional monitoring parameter in the out-of-plane direction is required to monitor more advanced ASR progression. No structural impacts from ASR have been seen at these plateau levels in the large scale testing program at FSEL. In fact, no adverse structural impacts have been identified at any level of tested ASR expansion to date.

In addition to the three tier approach for monitoring the CCI for the in-plane direction, ASR expansion in the out-of-plane direction will be monitored by borehole extensometers installed in drilled core bore holes. Expansion is proven to be the most effective parameter for long term monitoring [Reference: 6]. Out-of-plane expansion is also the best parameter for correlating the degree of ASR progression in the test specimens to the in-situ plant structures. The ASR aging management program will be enhanced to include measurement of out-of-plane expansion. A representative sample of out-of-plane monitoring areas will be chosen to bound different environmental conditions and levels of ASR. The locations in plant structures that will be selected for the installation of the extensometers to monitor out-of-plane expansion are representative of various plant exposure conditions, levels of ASR progression, and structural details. Extensometers will also be installed in selected control locations not impacted by ASR for comparison of instrument data. The selected locations for monitoring out-of-plane expansion consider the following criteria.

- Exposure; Ambient weather exposure and below grade ground water exposure
- Level of ASR progression based on CCI; Tier 3, Tier 2, Tier 1 (control instruments)
- Thickness of concrete element; 1.5 foot, 2 foot, 2.5 foot, 3 foot, 3.5 foot, 4 foot, 6 foot
- Type of concrete element; walls and slabs
- Design compressive strength of the concrete; 3 ksi and 4 ksi

The large scale testing program at FSEL determines the actual structural performance at various levels of ASR expansion. The acceptance criteria for structural performance will be determined from the test results by correlating the degree of monitored ASR expansion at the plant to the plot of tested structural performance of the test specimens versus ASR expansion [Reference: 6]. The instruments to measure out-of-plane expansion were not installed during original construction. This means that an estimate of accumulated strain to date is required to be added to any monitoring of strain going forward. A correlation curve for out-of-plane expansion and percent reduction in tested modulus was developed for Seabrook Station [Reference: 6]. The test data used for this correlation were obtained from full scale test specimens that were designed to be representative of the concrete and reinforcement details at Seabrook Station. Furthermore, the correlation compares well with trends noted in the literature of other published studies of free expansion [Reference: 6]. Using this correlation to determine through-thickness expansion to date, the structural impact of ASR for any level of out-of-plane expansion can be determined. The uncertainties associated with this correlation will be included in the evaluation of structural implications for a given level of ASR expansion. When installing the extensometers at the plant, the removed cores will be tested for modulus. Total out-of-plane expansion is determined as the sum of the pre-instrument expansion (determined from modulus loss correlation) and measured expansion from the extensometers. Levels of ASR expansion are within the acceptance criteria for structural performance when the monitored quantitative value of ASR expansion is less than the ASR expansion level successfully tested in structural specimens at FSEL.

The observed strains due to ASR are very small in magnitude and adequately monitored by CCI and extensometers for the purpose of observing rate of progression and for correlating the structural strength impacts from the large scale testing program. However recent operating experience at NextEra Seabrook has shown that over large distances, and with the right building geometry, discernable dimension changes in a structure can result due to ASR. While this is not a structural capacity concern, it can result in relative displacement between structures. Additional monitoring of this relative displacement potential and its impact to plant systems and components will be included in the ASR Monitoring program. Specifically, this will include additional monitoring focused on identifying signs of relative building deformation (e.g., fire seal displacement, seismic gap width changes, pipe/conduit misalignments at penetrations or between adjacent structures, bent or displaced pipe/conduit and supports, doorway misalignments). Critical building geometry locations where the potential for deformation is likely will be monitored for displacement via laser targets and gap measurements to validate that design margin remains acceptable. If a monitoring location is found outside of its original design the location will be restored to be within the original design or reanalyzed for continued operability.

NextEra Energy Response to Issue No. 1

There are no direct structural implications resulting from this phenomenon. The ASR structural implications are best correlated to expansion or strain. Strain in a given direction is approximated by the summation of crack widths over distance. For a given strain, more reinforcement will generally result in a relatively larger number of narrower cracks than for the same strain with lesser reinforcement. The large scale test specimens at FSEL include reinforcement details with #9 and #11 bars at different spacing. This is representative of the reinforcement detailing for walls at Seabrook Station. No discernable difference in in-plane crack width or crack pattern was seen between these types of reinforcement differences. CCI was found to correlate with strain in both the x and y in-plane directions. In the out-of-plane direction there is no reinforcement (also the case for limiting structures at the plant). In this case a significant difference in individual crack width was noted, with essentially one or a few wide cracks perpendicular to the direction of expansion. The structural testing is being correlated to the out-of-plane expansion and therefore, implicitly includes any structural impact of preferential expansion in this direction.

CCI is used as a surrogate for accumulated strain from ASR expansion in the in-plane directions. Cracking in the in-plane direction as a monitoring parameter for the plant was originally based on industry recommendations [Reference: 1 and 3]. A second factor in the selection of CCI is a means to provide an estimate of cumulative expansion to date, whereas other methods for monitoring in-plane expansion such as imbedded pins only provide information of expansion that occurs after the pins are installed.

NextEra Energy Response to Issue No. 2

The large scale test program at FSEL includes direct measurement of in-plane strain in the specimens to validate the correlations of CCI to internal expansion. CCI was confirmed to correlate well with respect to in-plane strain. The CCI values measured on the test specimens are applicable to CCI values measured at Seabrook Station based on the following considerations: (1) the specimens are designed to be representative of structures at Seabrook Station; (2) reinforcement detailing, which is the primary means of confinement, is representative of structures at Seabrook Station; and (3) the CCI procedure used at the laboratory is the same as that used at Seabrook Station.

CCI has not been observed to be impacted by nominal differences in reinforcement detailing between the longitudinal and perpendicular directions of a given specimen (No. 9 bar versus No. 11 bar), or by differences in the longitudinal reinforcement ratio for the shear test specimens versus the reinforcement anchorage test specimens. The reinforcement bars used in the test specimens duplicate the plant details and are much larger than is typical outside the nuclear industry. The measured in-plane strain was much lower in magnitude than the strain perpendicular to the reinforcement and was shown to level off over time. Additionally, the out-of-plane expansion was of significantly greater magnitude than the in-plane expansion. Therefore, the long-term ASR monitoring at the site will include out-of-plane expansion in addition to in-plane expansion. Out-of-plane expansion will be the principal parameter for correlating the beam test structural results to the plant. CCI will be used in the initial assessment of ASR and will provide correlation for the anchor bolt program, since out-of-plane expansion is not as influential as in-plane expansion (cracking) for anchor bolt performance.

NextEra Energy Response to Issue No. 3

Not all ASR affected areas will be directly monitored for out-of-plane expansion. The monitored locations will be selected to bound the most advanced ASR areas and environmental conditions, as well as include locations with lower levels of ASR and control locations (no ASR). ASR in the out-of-plane direction will be monitored by at least thirty-four (34) Geokon model A-4, single snap ring anchor, rod-type borehole extensometers installed in bore holes. The instrument type and installation is based on work done at the FSEL in the instrument beam portion of the testing. The locations in plant structures that were selected for the installation of the extensometers to monitor out-of-plane expansion are representative of various plant exposure conditions, levels of ASR distress, and structural details. Extensometers will also be installed in selected control locations not impacted by ASR for comparison of instrument data. The selected locations bound the following criteria.

- Exposure; Ambient weather exposure and below grade ground water exposure
- Level of ASR progression based on CCI; Tier 3, Tier 2, Tier 1 (control instruments)
- Thickness of concrete element; 1.5 foot, 2 foot, 2.5 foot, 3 foot, 3.5 foot, 4 foot, 6 foot
- Type of concrete element; walls and slabs
- Design compressive strength of the concrete; 3 ksi and 4 ksi

Below is a breakdown of number of instruments to be installed in each of the above criteria, totaling 34 locations.

Exposure	Quantity of Instruments
Ambient weather Conditions	18
Below-Grade Groundwater Exposure	10
Below-Grade No Water Control	6
TOTAL	**34**

Thickness of Concrete Element	Quantity of Instruments
1 ½ ft	1
2 ft	17
2 ½ ft	4
3 ft	2
3 ½ ft	1
4 ft	7
6 ft	2
TOTAL	**34**

Level of ASR	Quantity of Instruments
Tier 1 (control)	15
Tier 2	10
Tier 3	9
TOTAL	**34**

Design Compressive Strength of Concrete	Quantity of Instruments
3 ksi	24
4 ksi	10
TOTAL	**34**

Type of Concrete Element	Quantity of Instruments
Wall	31
Slab	3
TOTAL	**34**

Using the Operating Experience Element of the ASR Monitoring Program, the sample size will be increased if necessary.

NextEra Energy Response to Issue No. 4

It has been concluded that monitoring of out-of-plane expansion is required prior to entering the period of extended operation and continuing through the period of extended operation. The instrumentation type and installation details have already been developed and these instruments will be installed in thirty-four (34) sample locations in 2016. . Data collection will commence upon installation in accordance with the ASR Monitoring Program and will continue through the period of extended operation. Collection of data starting in 2016 through the start of extended operations in 2030 provides sufficient time for monitoring and trending of ASR progression.

NextEra Energy Response to Request No. 5

The deep pins that will be installed are extensometers installed in bore holes in the affected walls. The instrument type and mounting is based on mockups developed at FSEL for this program. These instruments provide the best correlation to direct measurements of out-of-plane expansion. Because the instruments to measure out-of-plane expansion were not installed during original construction, an estimate of accumulated strain to date is required. A correlation curve for out-of-plane expansion and percent reduction in tested modulus was developed for Seabrook Station [Reference: 6]. The test data used for this correlation were obtained from full scale test specimens that were designed to be as close as practical to the concrete and reinforcement details at Seabrook Station. Furthermore, the correlation compares well with trends noted in the literature of other published studies of free expansion [Reference: 6]. Based on this correlation, the structural impact of ASR for any level of out-of-plane expansion can be determined. The uncertainties associated with this correlation will be included in the evaluation of structural implications for a given level of ASR expansion. When installing the extensometers at the plant site, the removed cores will be tested for modulus. Total out-of-plane expansion is determined as the sum of the pre-instrument expansion (determined from modulus loss correlation) and measured expansion from the extensometers.

NextEra Energy Response to Issue No. 6

As stated previously, the expansion in the unreinforced out-of-plane direction has been seen to be much greater than in the reinforced in-plane direction. In the test specimens this has resulted in the formation of one or a few relatively large surface cracks perpendicular to the expansion. All investigated cracks have been shown to be mostly a surface phenomenon by direct sectioning of affected specimens and not leading to delamination [Reference: 7]. Cracks in this orientation are not observable by inspection of the interior surface and/or exterior surface of in-situ walls at the plant. Additionally, core bores removed to install the out-of-plane instruments will be thoroughly inspected to rule out the laminar cracking phenomenon if it's present in the plant. Thirty-four (34) concrete cores have been removed to date from ASR impacted concrete and visually examined. No evidence of laminar cracking in any of the concrete cores has been identified to date.

NextEra Energy Response to Issue No. 7

Monitoring the potential loss of structural strength in ASR affected structures is the primary goal of the monitoring program. However this parameter cannot be monitored directly. Expansion due to ASR (in the through-the-thickness direction) will be monitored and correlated to the structural impacts quantified in the large scale testing program.

Although concrete cores will be removed from affected structures and tested, those test results will not be indicative of material strength changes. The expansion (strain) due to ASR and resulting cracking may degrade the tested material properties of the concrete samples removed [References: 1, 2 &3]. The potential for impact on structural performance from ASR is also a result of the internal expansion that leads to concrete cracking. Consequently, the tested material strength properties in removed concrete core samples that typically demonstrate the most significant changes are elastic modulus and tensile strength. Tested compressive strength may also be affected, but less rapidly and less severely. While the progression of ASR results in a reduction in tested material properties of the removed core samples, there is not necessarily a corresponding decrease in the actual in-situ structural performance. As discussed in previous reports on ASR at Seabrook Station [References: 4&5], cores removed from a reinforced ASR affected structure for testing are no longer confined by the reinforcement and therefore, do not represent the structural context of the in-situ condition. Structural context is of particular importance with an ongoing internal expansion mechanism like ASR where the confining reinforcement may function more as pre-stressed or post tensioned reinforcement. Therefore, in ASR affected structures, the material properties obtained from removed cores have limited applicability for directly evaluating the actual structural capacity. These core-based material tests do however, remain indicative of the amount of ASR progression (expansion and cracking) and are useful additional monitoring parameters. Monitoring will include core samples taken when the extensometers are installed and these will be tested for compressive strength and elastic modulus.

Large scale specimens that duplicate the reinforcement detailing of the subject structure retain the structural context during testing. The large scale testing program conducted for Seabrook at FSEL provides direct measurement of the structural performance at various levels of ASR progression with the structural context of the specimen intact. The test specimens were designed with the same concrete strength and reinforcement details as the structures at Seabrook Station. ASR progression was accelerated in the test specimens both by adding additional aggregate reactivity to the original mix design and conditioning at elevated ambient temperature and humidity. The testing methodology is the same as was used in development of the ACI 318 code relationships. Structural testing of the specimens was performed at several ASR levels (based on monitored strains, CCI, material core tests and petrography). The structural performance of the plant at any given level of ASR can then be determined from the test results by correlating the ASR expansion at the plant to the plot of ASR expansion versus tested structural performance of the test specimens [Reference: 6]. This will provide reasonable assurance that the aging effects due to ASR expansion can be adequately managed during the period of extended operation to prevent the loss of the intended function of structural performance. . Furthermore, FSEL testing to date has not shown any negative structural implications due to the advanced progression of ASR in structural components designed to be representative of Seabrook Station.

References:

1. Institution of Structural Engineers, Structural Effects of Alkali-Silica Reaction: Technical Guidance on the Appraisal of Existing Structures, London, UK, 1992.
2. Bayrak, O., "Structural Implications of ASR: State of the Art," July 2014.
3. Fournier, B. et al, FHWA-HIF-09-004, Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction in Transportation Structures, January 2010.
4. MPR-3727, Seabrook Station: Impact of Alkali-Silica Reaction on Concrete Structures and Attachments, Rev. 1, MPR Associates, Inc., Alexandria, VA, 2012.
5. MPR-3848, Seabrook Station - Approach for Shear and Reinforcement Anchorage Testing of Concrete Affected by Alkali-Silica Reaction, April 2013.
6. MPR-4153, Revision 1: Seabrook Station- Approach for Determining Through-Thickness Expansion from Alkali-Silica Reaction, MPR Associates, Inc., Alexandria, VA, June 2015. (Proprietary)
7. Seabrook/MPR ASR Test Programs at FSEL: Destructive Examination of Anchor Test Specimen AN-02, MPR DRN 0326-0058-171, Revision 0, January 22, 2014.

Based on the above clarification, LRA Appendix B and Appendix A have been revised as follows:

a) LRA Appendix B, Section B.2.1.31A, Alkali Silica Reaction (ASR) Monitoring Program, the following new paragraphs have been added to the end of Element 3 (Parameters Monitored/Inspected)

ELEMENT 3 – PARAMETERS MONITORED/INSPECTED

Monitoring Expansion in the Out-Of-Plane Direction

CCI correlates well with strain in the in-plane directions and the ability to visually detect cracking in exposed surfaces makes it an effective initial detection parameter. CCI's limitation for heavily reinforced structures is that it has been observed to plateau at a relatively low level of accumulated strain. No structural impacts from ASR have been seen at these plateau levels in the large scale testing program at the University of Texas at Austin, Ferguson Structural Engineering Laboratory. While CCI remains useful for the detection and monitoring of ASR at the initial stages, an additional monitoring parameter in the out-of-plane direction is required to monitor more advanced ASR progression. ASR expansion in the out-of-plane direction will be monitored by borehole extensometers installed in drilled core bore holes.

Monitoring Building Deformation

The observed strains due to ASR are of very small magnitude and adequately monitored by CCI and extensometers for the purpose of observing rate of progression and for correlating the structural strength impacts from the large scale testing program. However, over large distances, and with the right building geometry, these strains due to ASR can result in discernable dimensional changes in a structure. While this is not a structural capacity concern, it can result in relative displacement between structures. Additional monitoring of this relative displacement potential and its impact to plant systems and components will be included in the ASR Monitoring Program. Specifically, this will include additional monitoring focused on identifying signs of relative displacement or building deformation (e.g., fire seal displacement, seismic gap width changes, pipe/conduit misalignments at penetrations or between adjacent structures, bent or displaced pipe/conduit and supports, doorway misalignments). Critical building geometry locations where the potential for deformation is likely will be monitored for displacement via laser targets and gap measurements.

b) LRA Appendix B, Section B.2.1.31A, Alkali Silica Reaction (ASR) Monitoring Program, the following new paragraphs have been added to the end of Element 5 (Monitoring and Trending)

ELEMENT 5 - MONITORING AND TRENDING

Monitoring Expansion in the Out-Of-Plane Direction

The deep pins that will be installed are extensometers installed in bore holes in the affected walls. The instrument type and mounting is based on mockups developed at FSEL for this program. These instruments provide the best correlation to direct measurements of out-of-plane expansion. Because the instruments to measure out-of-plane expansion were not installed during original construction, an estimate of accumulated strain to date is required. A correlation curve for out-of-plane expansion and percent reduction in tested modulus was developed for Seabrook Station. The test data used for this correlation were obtained from full scale test specimens that were designed to be as close as practical to the concrete and reinforcement details at Seabrook Station. Furthermore, the correlation compares well with trends noted in the literature of other published studies of free expansion [Reference: 6]. Using this correlation to determine through-thickness expansion to date,, the structural impact of ASR for any level of out-of-plane expansion can be determined. The uncertainties associated with this correlation will be included in the evaluation of structural implications for a given level of ASR expansion. When installing the extensometers at the plant site, the removed cores will be tested for modulus. Total out-of-plane expansion is determined as the sum of the pre-instrument expansion (determined from modulus loss correlation) and measured expansion from the extensometers.

Monitoring Building Deformation

Monitoring of relative displacement potential and its impact to plant systems and components will include additional monitoring focused on identifying signs of relative building deformation (e.g., fire seal displacement, seismic gap width changes, pipe/conduit misalignments at penetrations or between adjacent structures, bent or displaced pipe/conduit and supports, doorway misalignments). Critical building geometry locations where ***the potential for deformation is likely will be monitored for displacement via laser targets and gap measurements to validate that the established design margin remains acceptable.***

c) LRA Appendix B, Section B.2.1.31A, Alkali Silica Reaction (ASR) Monitoring Program, the following new paragraph has been added to the end of Element 6 (Acceptance Criteria).

ELEMENT 6 – ACCEPTANCE CRITERIA

Monitoring Expansion in the Out-Of-Plane Direction

Total out-of-plane expansion is determined as the sum of the pre-instrument expansion (determined from modulus loss correlation) and measured expansion from the extensometers. Levels of ASR expansion are within the acceptance criteria for structural performance when the monitored quantitative value of ASR expansion is less than the ASR expansion level successfully tested in structural specimens at FSEL.

Monitoring Building Deformation

Monitoring of relative displacement potential and its impact to plant systems and components will include additional monitoring focused on identifying signs of relative building deformation (e.g., fire seal displacement, seismic gap width changes, pipe/conduit misalignments at penetrations or between adjacent structures, bent or displaced pipe/conduit and supports, doorway misalignments). Critical building geometry locations where the potential for deformation is likely will be monitored for displacement via laser targets and gap measurements to validate that the established design margin remains acceptable. If a monitoring location is found outside of its original design, the location will be restored to be within the original design or reanalyzed for continued operability.

d) LRA Appendix A, Section A.2.1.31A, Alkali Silica Reaction (ASR) Monitoring Program, the following new paragraphs have been added to the end of the program description as follows:

Program Description

CCI correlates well with strain in the in-plane directions and the ability to visually detect cracking in exposed surfaces making it an effective initial detection parameter. CCI's limitation for heavily reinforced structures is that in-plane expansion, and therefore CCI has been observed to plateau at a relatively low level of accumulated strain. No structural impacts from ASR have been seen at these plateau levels in the large scale testing program at the University of Texas at Austin, Ferguson Structural Engineering Laboratory. While CCI remains useful for the detection and monitoring of ASR at the initial stages, an additional monitoring parameter in the out-of-plane direction is required to monitor more advanced ASR progression. ASR expansion in the out-of-plane direction will be monitored by borehole extensometers installed in drilled core bore holes. Although the observed strains due to ASR are of very small magnitude and adequately monitored by CCI and extensometers, over large distances and with the right building geometry, they can result in

discernable dimension changes in a structure. While this is not a structural capacity concern, it can result in relative displacement between structures. Additional monitoring of this relative displacement potential and its impact to plant systems and components will be included in the ASR Monitoring Program. Specifically, this will include additional monitoring focused on identifying signs of relative displacement or building deformation (e.g., fire seal displacement, seismic gap width changes, pipe/conduit misalignments at penetrations or between adjacent structures, bent or displaced pipe/conduit and supports, doorway misalignments). Critical building geometry locations where the potential for deformation is likely will be monitored for displacement via laser targets and gap measurements.

e) LRA Appendix A, Section A.3, Commitment #83 has been revised and a new commitment #91 has been added as follows:

Note: The entire text of Commitment #83 has been revised.

No.	PROGRAM or TOPIC	COMMITMENT	UFSAR LOCATION	SCHEDULE
83	Alkali-Silica Reaction Monitoring	***Install extensometers in representative sample areas of structures to monitor expansion due to alkali-silica reaction in the out-of-plane direction. Install at least thirty-four (34) extensometers by December 31, 2016. Using the Operating Experience Element of the ASR Monitoring Program, determine if increase in sample size is required.*** ***Monitoring expansion in the out-of-plane direction will commence upon installation of the extensometers in 2016 and continue through the period of extended operation.***	A.2.1.31A	***December 31, 2016***
91	***Alkali-Silica Reaction Monitoring***	***In building geometry locations where the potential for deformation is likely, enhance the program to monitor for building displacement using laser targets and by taking gap measurements.***	***A.2.1.31A***	***Within 10 years prior to the period of extended operation.***

B.2.1.31A-6(a)

Background

In its response to RAI B.2.1.31A-6, dated May 15, 2014, the applicant stated that a separate evaluation for inaccessible areas has not been performed; however, the opportunistic or focused inspections performed every 5 years will establish the baseline for future monitoring and trending. The applicant also stated that the concrete materials used to produce concrete at the site was the same for both accessible and inaccessible areas of structures; therefore, the performance and aging would be the same.

Regarding the evaluation of inaccessible areas, the applicant stated in its response to RAI B.2.1.31-1, dated March 30, 2012, that "it is expected that where there is cracking in the interior exposed walls, the level of ASR-related distress will be similar on the exterior wall surface." The applicant also stated in its response to RAI B.2.1.31-9 dated November 2, 2012, that "since these [accessible] surfaces have the least confinement, the expansion will be most pronounced on the exposed surfaces."

Issue

In the absence of an evaluation for the acceptability of inaccessible areas, where conditions in accessible areas indicate the presence of ASR, the staff cannot verify that the effects in accessible areas would be the same for inaccessible areas. The rate of expansion on the exterior surface of structures, some of which are directly exposed to groundwater, could be greater than the observed planar ("x-y," or "in-plane") expansion on the interior surfaces of structures. Although the ASR Monitoring Program was revised to include inspection of inaccessible areas meeting the criteria described in the program, the staff is concerned that the opportunistic or focused inspections may not be representative of inaccessible areas of accessible concrete exhibiting the highest levels of ASR degradation.

Request

For inaccessible areas of concrete structures, state whether actions will be taken to confirm the validity of the expectation that the magnitude of cracking due to expansion from reaction with aggregates is not greater than that observed on the accessible surfaces. Include a discussion of any planned actions. If not, explain how, absent an evaluation of inaccessible areas, the program will ensure ASR is not more severe in inaccessible areas.

NextEra Energy Seabrook Response to RAI B.2.1.31A-6(a)

Inspection of inaccessible areas of concrete will be performed during opportunistic or focused inspections for buried concrete performed under the Maintenance Rule every 5 years. These inspections will establish the baseline inspection for future monitoring and trending of inaccessible areas of concrete. The concrete materials used to produce the concrete placed in inaccessible areas were the same as the concrete materials used to produce the concrete placed in accessible areas. Thus, the performance and aging of inaccessible concrete would be the same as the performance and aging of accessible concrete.

To date, NextEra has not observed ASR in-accessible areas greater than that observed in accessible areas and does not expect to observe such expansion in the future. In general these areas are not accessible because they are buried and have no accessible interior spaces. The environmental conditions that affect ASR development are those related to alkali transport and silica solubility. Temperature and humidity (in this case ground water) are the most significant. The buried concrete will be subject to ground water on all sides. Most accessible areas have groundwater on one side with an adjacent interior space. This arrangement allows for flow through the concrete with an alternating wet dry surface on one side. This tends to facilitate alkali transfer and higher ASR progression has been seen in these conditions as opposed to fully or constantly wetted conditions.

With respect to ambient temperature, in general the higher the temperature the more soluble the silica and the faster ASR will progress. The below grade accessible areas generally have a heated interior space that means the concrete is warmer than the surrounding backfill material. The inaccessible below grade concrete will essentially be at the constant cool temperature of the surrounding backfill material. The ambient temperature and humidity conditions are no harsher for ASR than the observable concrete and so the rates of ASR progression are bounded.

The same three Tier evaluation process and acceptance criteria specified in the ASR Monitoring Program will be applied during the initial assessment of inaccessible areas of concrete. These areas will also be monitored and trended at the same frequency as the accessible areas as specified in the ASR Monitoring Program. In other words, if a Tier 2 or 3 ASR location is identified during an opportunistic or focused inspection of an inaccessible area, the re-inspection of this ASR location would be every 2.5 years for a Tier 2 location and every 6 months for a Tier 3 location.

Several inaccessible areas have been inspected during the last 30 months and results to date have confirmed instances where ASR is present. However, the levels of ASR observed have been consistent with that observed in accessible areas of the plant. Typical inaccessible areas inspected include underground electrical manholes, GSU transformer foundations, GSU transformer containment structures, underground SW pipe access vault, and below grade backfill concrete.

Based on the information above Element 10 of the ASR AMP is appended as follows:

An opportunistic Structures Monitoring inspection was conducted on the underground Unit 2 Circulating Water Pipe Access Vault on June 3rd, 2015. On opening the vault it was found to have been flooded to approximately 15 foot elevation. Overall the condition of the concrete was found to be in good condition and deemed acceptable. Minor cracking was present (mostly on the top surface concrete) but did not exceed 0.025 inches in width and appeared to be shallow in depth for all notable instances. No visible map cracking, dark staining or gel exudation indicative of ASR was noted.

An opportunistic Structures Monitoring inspection was conducted on concrete structures associated with the Generator Step-up Transformer Units (GSU) on March 19th, 2014 and June 26th, 2014 for "A" and "C", respectively. The inspections encompassed both the GSU foundation and its respective containment structure. Both pit areas that were inspected showed characteristics that are suggestive of ASR (map cracking, and dark staining). The indications were noted on the inside face and top of the oil containment structure only. No indications were noted on the foundations. The nominal width of the pattern cracking appeared to be less than 2 mils (0.002 inches), the minimum measurable crack width that can be reliably and accurately measured. Therefore, the ASR pattern cracking on top of the oil containment walls are classified as ASR Tier 2 -Qualitative and being monitored on a 30-month basis. The top of the south wall at 1-ED-X-1A (GSU) has a modified CCI grid (due to size restrictions) and will be classified as ASR Tier 2- Quantitative and will be re-inspected on a 30-month basis as well. In addition, areas of spalled concrete were found on the GSU foundations and were promptly remediated.

<u>Enclosure 2 to SBK-L-15107</u>

LRA Appendix A - Final Safety Report Supplement Table A.3, License Renewal Commitment List Updated to Reflect Changes to Date

A.3 LICENSE RENEWAL COMMITMENT LIST

No.	PROGRAM or TOPIC	COMMITMENT	UFSAR LOCATION	SCHEDULE
1.	PWR Vessel Internals	Provide confirmation and acceptability of the implementation of MRP-227-A by addressing the plant-specific Applicant/Licensee Action Items outlined in section 4.2 of the NRC SER.	A.2.1.7	Complete
2.	Closed-Cycle Cooling Water	Enhance the program to include visual inspection for cracking, loss of material and fouling when the in-scope systems are opened for maintenance.	A.2.1.12	Prior to the period of extended operation.
3.	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Enhance the program to monitor general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system.	A.2.1.13	Prior to the period of extended operation.
4.	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Enhance the program to list additional cranes for monitoring.	A.2.1.13	Prior to the period of extended operation.
5.	Compressed Air Monitoring	Enhance the program to include an annual air quality test requirement for the Diesel Generator compressed air sub system.	A.2.1.14	Prior to the period of extended operation.
6.	Fire Protection	Enhance the program to perform visual inspection of penetration seals by a fire protection qualified inspector.	A.2.1.15	Prior to the period of extended operation.
7.	Fire Protection	Enhance the program to add inspection requirements such as spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates by qualified inspector.	A.2.1.15	Prior to the period of extended operation.
8.	Fire Protection	Enhance the program to include the performance of visual inspection of fire-rated doors by a fire protection qualified inspector.	A.2.1.15	Prior to the period of extended operation.

9.	Fire Water System	Enhance the program to include NFPA 25 (2011 Edition) guidance for "where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing".	A.2.1.16	Prior to the period of extended operation.
10.	Fire Water System	Enhance the program to include the performance of periodic flow testing of the fire water system in accordance with the guidance of NFPA 25 (2011 Edition).	A.2.1.16	Prior to the period of extended operation.
11.	Fire Water System	Enhance the program to include the performance of periodic visual or volumetric inspection of the internal surface of the fire protection system upon each entry to the system for routine or corrective maintenance to evaluate wall thickness and inner diameter of the fire protection piping ensuring that corrosion product buildup will not result in flow blockage due to fouling. Where surface irregularities are detected, follow-up volumetric examinations are performed. These inspections will be documented and trended to determine if a representative number of inspections have been performed prior to the period of extended operation. If a representative number of inspections have not been performed prior to the period of extended operation, focused inspections will be conducted. These inspections will commence during the ten year period prior to the period of extended operation and continue through the period of extended operation.	A.2.1.16	Within ten years prior to the period of extended operation.
12.	Aboveground Steel Tanks	Enhance the program to include 1) In-scope outdoor tanks, except fire water storage tanks, constructed on soil or concrete, 2) Indoor large volume storage tanks (greater than 100,000 gallons) designed to near-atmospheric internal pressures, sit on concrete or soil, and exposed internally to water, 3) Visual, surface, and volumetric examinations of the outside and inside surfaces for managing the aging effects of loss of material and cracking, 4) External visual examinations to monitor degradation of the protective paint or coating, and 5) Inspection of sealant and caulking for degradation by performing visual and tactile examination (manual manipulation) consisting of pressing on the sealant or caulking to detect a reduction in the resiliency and pliability.	A.2.1.17	Within 10 years prior to the period of extended operation.

13.	Fire Water System	Enhance the program to perform exterior inspection of the fire water storage tanks annually for signs of degradation and include an ultrasonic inspection and evaluation of the internal bottom surface of the two Fire Protection Water Storage Tanks per the guidance provided in NFPA 25 (2011 Edition).	A.2.1.16	Within ten years prior to the period of extended operation.
14.	Fuel Oil Chemistry	Enhance program to add requirements to 1) sample and analyze new fuel deliveries for biodiesel prior to offloading to the Auxiliary Boiler fuel oil storage tank and 2) periodically sample stored fuel in the Auxiliary Boiler fuel oil storage tank.	A.2.1.18	Prior to the period of extended operation.
15.	Fuel Oil Chemistry	Enhance the program to add requirements to check for the presence of water in the Auxiliary Boiler fuel oil storage tank at least once per quarter and to remove water as necessary.	A.2.1.18	Prior to the period of extended operation.
16.	Fuel Oil Chemistry	Enhance the program to require draining, cleaning and inspection of the diesel fire pump fuel oil day tanks on a frequency of at least once every ten years.	A.2.1.18	Prior to the period of extended operation.
17.	Fuel Oil Chemistry	Enhance the program to require ultrasonic thickness measurement of the tank bottom during the 10-year draining, cleaning and inspection of the Diesel Generator fuel oil storage tanks, Diesel Generator fuel oil day tanks, diesel fire pump fuel oil day tanks and auxiliary boiler fuel oil storage tank.	A.2.1.18	Prior to the period of extended operation.
18.	Reactor Vessel Surveillance	Enhance the program to specify that all pulled and tested capsules, unless discarded before August 31, 2000, are placed in storage.	A.2.1.19	Prior to the period of extended operation.
19.	Reactor Vessel Surveillance	Enhance the program to specify that if plant operations exceed the limitations or bounds defined by the Reactor Vessel Surveillance Program, such as operating at a lower cold leg temperature or higher fluence, the impact of plant operation changes on the extent of Reactor Vessel embrittlement will be evaluated and the NRC will be notified.	A.2.1.19	Prior to the period of extended operation.

20.	Reactor Vessel Surveillance	Enhance the program as necessary to ensure the appropriate withdrawal schedule for capsules remaining in the vessel such that one capsule will be withdrawn at an outage in which the capsule receives a neutron fluence that meets the schedule requirements of 10 CFR 50 Appendix H and ASTM E185-82 and that bounds the 60-year fluence, and the remaining capsule(s) will be removed from the vessel unless determined to provide meaningful metallurgical data.	A.2.1.19	Prior to the period of extended operation.
21.	Reactor Vessel Surveillance	Enhance the program to ensure that any capsule removed, without the intent to test it, is stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation.	A.2.1.19	Prior to the period of extended operation.
22.	One-Time Inspection	Implement the One Time Inspection Program.	A.2.1.20	Within ten years prior to the period of extended operation.
23.	Selective Leaching of Materials	Implement the Selective Leaching of Materials Program. The program will include a one-time inspection of selected components where selective leaching has not been identified and periodic inspections of selected components where selective leaching has been identified.	A.2.1.21	Within five years prior to the period of extended operation.
24.	Buried Piping And Tanks Inspection	Implement the Buried Piping And Tanks Inspection Program.	A.2.1.22	Within ten years prior to ~~entering~~ the period of extended operation
25.	One-Time Inspection of ASME Code Class 1 Small Bore-Piping	Implement the One-Time Inspection of ASME Code Class 1 Small Bore-Piping Program.	A.2.1.23	Within ten years prior to the period of extended operation.
26.	External Surfaces Monitoring	Enhance the program to specifically address the scope of the program, relevant degradation mechanisms and effects of interest, the refueling outage inspection frequency, the training requirements for inspectors, and the required periodic reviews to determine program effectiveness.	A.2.1.24	Prior to the period of extended operation.

27.	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.	A.2.1.25	Prior to the period of extended operation.
28.	Lubricating Oil Analysis	Enhance the program to add required equipment, lube oil analysis required, sampling frequency, and periodic oil changes.	A.2.1.26	Prior to the period of extended operation.
29.	Lubricating Oil Analysis	Enhance the program to sample the oil for the Reactor Coolant pump oil collection tanks.	A.2.1.26	Prior to the period of extended operation.
30.	Lubricating Oil Analysis	Enhance the program to require the performance of a one-time ultrasonic thickness measurement of the lower portion of the Reactor Coolant pump oil collection tanks prior to the period of extended operation.	A.2.1.26	Prior to the period of extended operation.
31.	ASME Section XI, Subsection IWL	Enhance procedure to include the definition of "Responsible Engineer".	A.2.1.28	Prior to the period of extended operation.
32.	Structures Monitoring Program	Enhance procedure to add the aging effects, additional locations, inspection frequency and ultrasonic test requirements.	A.2.1.31	Prior to the period of extended operation.
33.	Structures Monitoring Program	Enhance procedure to include inspection of opportunity when planning excavation work that would expose inaccessible concrete.	A.2.1.31	Prior to the period of extended operation.

34.	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program.	A.2.1.32	Prior to the period of extended operation.
35.	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program.	A.2.1.33	Prior to the period of extended operation.
36.	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Implement the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program.	A.2.1.34	Prior to the period of extended operation.
37.	Metal Enclosed Bus	Implement the Metal Enclosed Bus program.	A.2.1.35	Prior to the period of extended operation.
38.	Fuse Holders	Implement the Fuse Holders program.	A.2.1.36	Prior to the period of extended operation.

39.	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program.	A.2.1.37	Prior to the period of extended operation.
40.	345 KV SF6 Bus	Implement the 345 KV SF6 Bus program.	A.2.2.1	Prior to the period of extended operation.
41.	Metal Fatigue of Reactor Coolant Pressure Boundary	Enhance the program to include additional transients beyond those defined in the Technical Specifications and UFSAR.	A.2.3.1	Prior to the period of extended operation.
42.	Metal Fatigue of Reactor Coolant Pressure Boundary	Enhance the program to implement a software program, to count transients to monitor cumulative usage on selected components.	A.2.3.1	Prior to the period of extended operation.
43.	Pressure –Temperature Limits, including Low Temperature Overpressure Protection Limits	Seabrook Station will submit updates to the P-T curves and LTOP limits to the NRC at the appropriate time to comply with 10 CFR 50 Appendix G.	A.2.4.1.4	The updated analyses will be submitted at the appropriate time to comply with 10 CFR 50 Appendix G, Fracture Toughness Requirements.

44.	Environmentally-Assisted Fatigue Analyses (TLAA)	NextEra Seabrook will perform a review of design basis ASME Class 1 component fatigue evaluations to determine whether the NUREG/CR-6260-based components that have been evaluated for the effects of the reactor coolant environment on fatigue usage are the limiting components for the Seabrook plant configuration. If more limiting components are identified, the most limiting component will be evaluated for the effects of the reactor coolant environment on fatigue usage. If the limiting location identified consists of nickel alloy, the environmentally-assisted fatigue calculation for nickel alloy will be performed using the rules of NUREG/CR-6909. (1) Consistent with the Metal Fatigue of Reactor Coolant Pressure Boundary Program Seabrook Station will update the fatigue usage calculations using refined fatigue analyses, if necessary, to determine acceptable CUFs (i.e., less than 1.0) when accounting for the effects of the reactor water environment. This includes applying the appropriate Fen factors to valid CUFs determined from an existing fatigue analysis valid for the period of extended operation or from an analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). (2) If acceptable CUFs cannot be demonstrated for all the selected locations, then additional plant-specific locations will be evaluated. For the additional plant-specific locations, if CUF, including environmental effects is greater than 1.0, then Corrective Actions will be initiated, in accordance with the Metal Fatigue of Reactor Coolant Pressure Boundary Program, B.2.3.1. Corrective Actions will include inspection, repair, or replacement of the affected locations before exceeding a CUF of 1.0 or the effects of fatigue will be managed by an inspection program that has been reviewed and approved by the NRC (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC).	A.2.4.2.3	At least two years prior to ~~entering~~ the period of extended operation.

45.	Number Not Used			
46.	Protective Coating Monitoring and Maintenance	Enhance the program by designating and qualifying an Inspector Coordinator and an Inspection Results Evaluator.	A.2.1.38	Prior to the period of extended operation.
47.	Protective Coating Monitoring and Maintenance	Enhance the program by including, "Instruments and Equipment needed for inspection may include, but not be limited to, flashlight, spotlights, marker pen, mirror, measuring tape, magnifier, binoculars, camera with or without wide angle lens, and self sealing polyethylene sample bags."	A.2.1.38	Prior to the period of extended operation.
48.	Protective Coating Monitoring and Maintenance	Enhance the program to include a review of the previous two monitoring reports.	A.2.1.38	Prior to the period of extended operation.
49.	Protective Coating Monitoring and Maintenance	Enhance the program to require that the inspection report is to be evaluated by the responsible evaluation personnel, who is to prepare a summary of findings and recommendations for future surveillance or repair.	A.2.1.38	Prior to the period of extended operation.
50.	ASME Section XI, Subsection IWE	Perform UT of the accessible areas of the containment liner plate in the vicinity of the moisture barrier for loss of material. Perform opportunistic UT of inaccessible areas.	A.2.1.27	Baseline inspections were completed during OR16. Repeat containment liner UT thickness examinations at intervals of no more than five (5) refueling outages.
51.	Number Not Used			
52.	ASME Section XI, Subsection IWL	Implement measures to maintain the exterior surface of the Containment Structure, from elevation -30 feet to +20 feet, in a dewatered state.	A.2.1.28	~~Ongoing~~ *Complete*
53.	Reactor Head Closure Studs	Replace the spare reactor head closure stud(s) manufactured from the bar that has a yield strength > 150 ksi with ones that do not exceed 150 ksi.	A.2.1.3	Prior to the period of extended operation.

54.	Steam Generator Tube Integrity	NextEra will address the potential for cracking of the primary to secondary pressure boundary due to PWSCC of tube-to-tubesheet welds using one of the following two options: 1) Perform a one-time inspection of a representative sample of tube-to-tubesheet welds in all steam generators to determine if PWSCC cracking is present and, if cracking is identified, resolve the condition through engineering evaluation justifying continued operation or repair the condition, as appropriate, and establish an ongoing monitoring program to perform routine tube-to-tubesheet weld inspections for the remaining life of the steam generators, or 2) Perform an analytical evaluation showing that the structural integrity of the steam generator tube-to-tubesheet interface is adequately maintaining the pressure boundary in the presence of tube-to-tubesheet weld cracking, or redefining the pressure boundary in which the tube-to-tubesheet weld is no longer included and, therefore, is not required for reactor coolant pressure boundary function. The redefinition of the reactor coolant pressure boundary must be approved by the NRC as part of a license amendment request.	A.2.1.10	Complete
55.	Steam Generator Tube Integrity	Seabrook will perform an inspection of each steam generator to assess the condition of the divider plate assembly.	A.2.1.10	Within five years prior to ~~entering~~ the period of extended operation.
56.	Closed-Cycle Cooling Water System	Revise the station program documents to reflect the EPRI Guideline operating ranges and Action Level values for hydrazine and sulfates.	A.2.1.12	Prior to ~~entering~~ the period of extended operation.
57.	Closed-Cycle Cooling Water System	Revise the station program documents to reflect the EPRI Guideline operating ranges and Action Level values for Diesel Generator Cooling Water Jacket pH.	A.2.1.12	Prior to ~~entering~~ the period of extended operation.
58.	Fuel Oil Chemistry	Update Technical Requirement Program 5.1, (Diesel Fuel Oil Testing Program) ASTM standards to ASTM D2709-96 and ASTM D4057-95 required by the GALL XI.M30 Rev 1	A.2.1.18	Prior to the period of extended operation.

59.	Nickel Alloy Nozzles and Penetrations	The Nickel Alloy Aging Nozzles and Penetrations program will implement applicable Bulletins, Generic Letters, and staff accepted industry guidelines.	A.2.2.3	Prior to the period of extended operation.
60.	Buried Piping and Tanks Inspection	Implement the design change replacing the buried Auxiliary Boiler supply piping with a pipe-within-pipe configuration with leak detection capability.	A.2.1.22	Prior to ~~entering~~ the period of extended operation.
61.	Compressed Air Monitoring Program	Replace the flexible hoses associated with the Diesel Generator air compressors on a frequency of every 10 years.	A.2.1.14	Within ten years prior to ~~entering~~ the period of extended operation.
62.	Water Chemistry	Enhance the program to include a statement that sampling frequencies are increased when chemistry action levels are exceeded.	A.2.1.2	Prior to the period of extended operation.
63.	Flow Induced Erosion	Ensure that the quarterly CVCS Charging Pump testing is continued during the PEO. Additionally, add a precaution to the test procedure to state that an increase in the CVCS Charging Pump mini flow above the acceptance criteria may be indicative of erosion of the mini flow orifice as described in LER 50-275/94-023.	N/A	Prior to the period of extended operation.
64.	Buried Piping and Tanks Inspection	Soil analysis shall be performed prior to entering the period of extended operation to determine the corrosivity of the soil in the vicinity of non-cathodically protected steel pipe within the scope of this program. If the initial analysis shows the soil to be non-corrosive, this analysis will be re-performed every ten years thereafter.	A.2.1.22	Prior to ~~entering~~ the period of extended operation.
65.	Flux Thimble Tube	Implement measures to ensure that the movable incore detectors are not returned to service during the period of extended operation.	N/A	Prior to ~~entering~~ the period of extended operation.
66.	Number Not Used			

67.	Structures Monitoring Program	Perform one shallow core bore in an area that was continuously wetted from borated water to be examined for concrete degradation and also expose rebar to detect any degradation such as loss of material. The removed core will also be subjected to petrographic examination for concrete degradation due to ASR per ASTM Standard Practice C856.	A.2.1.31	No later than December 31, 2015.
68.	Structures Monitoring Program	Perform sampling at the leakoff collection points for chlorides, sulfates, pH and iron once every three months.	A.2.1.31	Quarterly Preventive Maintenance Activity Implemented
69.	Open-Cycle Cooling Water System	Replace the Diesel Generator Heat Exchanger Plastisol PVC lined Service Water piping with piping fabricated from AL6XN material.	A.2.1.11	Complete.
70.	Closed-Cycle Cooling Water System	Inspect the piping downstream of CC-V-444 and CC-V-446 to determine whether the loss of material due to cavitation induced erosion has been eliminated or whether this remains an issue in the primary component cooling water system.	A.2.1.12	Within ten years prior to the period of extended operation.
71.	Alkali-Silica Reaction (ASR) Monitoring Program	Implement the Alkali-Silica Reaction (ASR) Monitoring Program. Testing will be performed to confirm that parameters being monitored and acceptance criteria used are appropriate to manage the effects of ASR.	A.2.1.31A	Prior to ~~entering~~ the period of extended operation.
72.	Flow-Accelerated Corrosion	Enhance the program to include management of wall thinning caused by mechanisms other than FAC.	A.2.1.8	Prior to ~~entering~~ the period of extended operation.
73.	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Enhance the program to include performance of focused examinations to provide a representative sample of 20%, or a maximum of 25, of each identified material, environment, and aging effect combinations during each 10 year period in the period of extended operation.	A.2.1.25	Prior to ~~entering~~ the period of extended operation.

74.	Fire Water System	Enhance the program to perform sprinkler inspections annually per the guidance provided in NFPA 25 (2011 Edition). Inspection will ensure that sprinklers are free of corrosion, foreign materials, paint, and physical damage and installed in the proper orientation (e.g., upright, pendant, or sidewall). Any sprinkler that is painted, corroded, damaged, loaded, or in the improper orientation, and any glass bulb sprinkler where the bulb has emptied, will be evaluated for replacement.	A.2.1.16	Prior to the period of extended operation.
75.	Fire Water System	Enhance the program to a) conduct an inspection of piping and branch line conditions every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of inspecting for the presence of foreign organic and inorganic material per the guidance provided in NFPA 25 (2011 Edition) and b) If the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material will be removed and its source is determined and corrected. In buildings having multiple wet pipe systems, every other system shall have an internal inspection of piping every 5 years as described in NFPA 25 (2011 Edition), Section 14.2.2.	A.2.1.16	Prior to the period of extended operation.
76.	Fire Water System	Enhance the Program to conduct the following activities annually per the guidance provided in NFPA 25 (2011 Edition). • main drain tests • deluge valve trip tests • fire water storage tank exterior surface inspections	A.2.1.16	Prior to the period of extended operation.

77.	Fire Water System	The Fire Water System Program will be enhanced to include the following requirements related to the main drain testing per the guidance provided in NFPA 25 (2011 Edition). • The requirement that if there is a 10 percent reduction in full flow pressure when compared to the original acceptance tests or previously performed tests, the cause of the reduction shall be identified and corrected if necessary. • Recording the time taken for the supply water pressure to return to the original static (nonflowing) pressure.	A.2.1.16	Prior to the period of extended operation.
78.	External Surfaces Monitoring	Enhance the program to include periodic inspections of in-scope insulated components for possible corrosion under insulation. A sample of outdoor component surfaces that are insulated and a sample of indoor insulated components exposed to condensation (due to the in-scope component being operated below the dew point), will be periodically inspected every 10 years during the period of extended operation.	A.2.1.24	Prior to the period of extended operation.
79.	Open-Cycle Cooling Water System	Enhance the program to include visual inspection of internal coatings/linings for loss of coating integrity.	A.2.1.11	Within 10 years prior to the period of extended operation.
80.	Fire Water System	Enhance the program to include visual inspection of internal coatings/linings for loss of coating integrity.	A.2.1.16	Within 10 years prior to the period of extended operation.
81.	Fuel Oil Chemistry	Enhance the program to include visual inspection of internal coatings/linings for loss of coating integrity.	A.2.1.18	Within 10 years prior to the period of extended operation.
82.	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Enhance the program to include visual inspection of internal coatings/linings for loss of coating integrity.	A.2.1.25	Within 10 years prior to the period of extended operation.

83.	Alkali-Silica Reaction Monitoring	~~Install instrumentation in representative sample areas of structures to monitor expansion due to alkali-silica reaction in the out-of-plane direction. Evaluate instrument and pin expansion data under the Operating Experience Element of the Alkali-Silica Reaction Monitoring Program to determine whether there is a need to enhance the program to monitor expansion in the out-of-plane direction. If the evaluation concludes that out-of-plane monitoring is necessary, establish acceptance criteria and monitoring frequencies for expansion in the out-of-plane direction using the instrument and pin expansion data.~~ ***Install extensometers in representative sample areas of structures to monitor expansion due to alkali-silica reaction in the out-of-plane direction. Install at least thirty-four (34) extensometers by December 31, 2016. Using the Operating Experience Element of the ASR Monitoring Program, determine if increase in sample size is required.*** ***Monitoring expansion in the out-of-plane direction will commence upon installation of the extensometers in 2016 and continue through the period of extended operation.***	A.2.1.31A	~~Prior to the period of extended operation.~~ ***December 31, 2016.***
84.	ASME Section XI, Subsection IWL	Evaluate the acceptability of inaccessible areas for structures within the scope of ASME Section XI, Subsection IWL Program.	A.2.1.28	Prior to the period of extended operation.
85.	Fire Water System	Enhance the program to perform additional tests and inspections on the Fire Water Storage Tanks as specified in Section 9.2.7 of NFPA 25 (2011 Edition) in the event that it is required by Section 9.2.6.4, which states "Steel tanks exhibiting signs of interior pitting, corrosion, or failure of coating shall be tested in accordance with 9.2.7."	A.2.1.16	Prior to the period of extended operation.
86.	Fire Water System	Enhance the program to include disassembly, inspection, and cleaning of the mainline strainers every 5 years.	A.2.1.16	Prior to the period of extended operation.

87.	Fire Water System	Increase the frequency of the Open Head Spray Nozzle Air Flow Test from every 3 years to every refueling outage to be consistent with LR-ISG-2012-02, AMP XI.M27, Table 4a.	A.2.1.16	Prior to the period of extended operation.
88.	Fire Water System	Enhance the program to include verification that a) the drain holes associated with the transformer deluge system are draining to ensure complete drainage of the system after each test, b) the deluge system drains and associated piping are configured to completely drain the piping, and c) normally-dry piping that could have been wetted by inadvertent system actuations or those that occur after a fire are restored to a dry state as part of the suppression system restoration.	A.2.1.16	Within five years prior to the period of extended operation.
89.	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Incorporate Coating Service Level III requirements into the RCP Motor Refurbishment Specification for the internal painting of the motor upper bearing coolers and motor air coolers. All four RCPs will be refurbished and replaced using the Coating Service Level III requirements prior to entering the period of extended operation.	A.2.1.25	Prior to the period of extended operation.
90.	PWR Vessel Internals	Implement the PWR Vessel Internals Program. The program will be implemented in accordance with MRP-227-A (Pressurized Water Reactor Internals Inspection and Evaluation Guidelines) and NEI 03-08 (Guideline for the Management of Materials Issues).	A.2.1.7	Prior to the period of extended operation
91.	***Alkali-Silica Reaction Monitoring***	***In building geometry locations where deformation is likely, enhance the program to monitor for building deformation using laser targets and by taking gap measurements.***	***A.2.1.31A***	***Within 10 years prior to the period of extended operation.***