UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of NEXTERA ENERGY SEABROOK, LLC (Seabrook Station, Unit 1)	Docket No. 50-443-LA-2 ASLBP No. 17-953-02-LA-BD01

Hearing Exhibit

Exhibit Number: NRC041

Exhibit Title: Letter from Richard Plasse, NRC, to Kevin Walsh, NextEra, "Aging Management Program Audit Report Regarding the Seabrook Station License Renewal Application (TAC No. ME4028)," (Dec. 23, 2013)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 23, 2013

Mr. Kevin Walsh
Site Vice President
NextEra Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

SUBJECT: AGING MANAGEMENT PROGRAM AUDIT REPORT REGARDING THE SEABROOK STATION LICENSE RENEWAL APPLICATION (TAC NO. ME4028)

Dear Mr. Walsh:

By letter dated May 25, 2010, NextEra Energy Seabrook, LLC (NextEra or the applicant), submitted an application to renew the operating license for Seabrook Station, Unit 1 (Seabrook). By letter dated May 16, 2012, the applicant submitted a revision to the license renewal application to include a plant-specific Structures Monitoring Program Supplement – Alkali-Silica Reaction (ASR) Monitoring Program. In addition, by letter dated September 13, 2013, the applicant submitted revisions to the program description and program elements "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience." However, the applicant did not revise the "scope of program," "preventive actions," "corrective actions," "quality assurance," and "confirmation process" elements contained in the May 16, 2012 submittal. The staff reviewed each ASR Monitoring program element in accordance with the criteria in "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Appendix A.1, for review of plant-specific aging management programs.

On November 20, 2013, the staff of the U.S. Nuclear Regulatory Commission completed the on-site audit of documents used to develop the ASR aging management programs. The audit report is enclosed.

If you have any questions, please contact me by telephone at 301-415-1427 or by e-mail at Richard.Plasse@nrc.gov.

Sincerely,

Richard Plasse, Project Manager
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
As stated

cc w/encl: Listserv

If you have any questions, please contact me by telephone at 301-415-1427 or by e-mail at Richard.Plasse@nrc.gov.

Sincerely,

/RA Juan Uribe for/

Richard Plasse, Project Manager
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
As stated

cc w/encl: Listserv

DISTRIBUTION: See following pages

ADAMS Accession No.: ML13354B785 **concurred via email ***

OFFICE	LA:DLR*	PM:RPB1:DLR*	BC:RASB:DLR	PM:RPB1:DLR	BC:RPB1:DLR
NAME	IKing	RPlasse	MMarshall	RPlasse ***SCJ for***	YDiaz-Sanabria ***Juan for***
DATE	12/23/13	12/20/13	12/23/13	12/23/13	12/23/13

OFFICIAL RECORD COPY

Letter to Kevin Walsh from Richard Plasse dated December 23, 2013

SUBJECT: AGING MANAGEMENT PROGRAM AUDIT REPORT REGARDING THE SEABROOK STATION LICENSE RENEWAL APPLICATION (TAC NO. ME4028)

DISTRIBUTION:

HARD COPY:
DLR RF

E-MAIL:
PUBLIC
RidsNrrDlr Resource
RidsNrrDlrRpb1 Resource
RidsNrrDlrRpb2 Resource
RidsNrrDlrRarb Resource
RidsNrrDlrRasb Resource
RidsNrrDlrRerb Resource
RidsNrrDraApla Resource
Listserv

Lois.James@nrc.gov
Richard.Plasse@nrc.gov
Brian.Wittick@nrc.gov
Yoira.Diaz-Sanabria@nrc.gov
John.Lamb@nrc.gov
David.McIntyre@nrc.gov
Eugene.Dacus@nrc.gov
Brian.Harris@nrc.gov
Glenn.Dental@nrc.gov
Paul.Cataldo@nrc.gov
Chris.Newport@nrc.gov
Jasmine.Gilliam@nrc.gov
Nancy.McNamara@nrc.gov
Doug.Tiff@nrc.gov
Neil.Sheehan@nrc.gov
Diane.Screnci@nrc.gov

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION, DIVISION OF LICENSE RENEWAL

Docket No:	50-443
License No:	NPF-86
Licensee:	NextEra Energy Seabrook, LLC
Facility:	Seabrook Station
Location:	626 Lafayette Rd. Seabrook, NH 03874
Dates:	November 18-20, 2013
Reviewers:	R. Plasse, Project Manager, Division of License Renewal (DLR) Y. Diaz-Sanabria, Branch Chief, Projects Branch 2, DLR A. Erickson, Structural Engineer, DLR A. Buford, Structural Engineer, DLR

Approved By:

Division of License Renewal
Michael Marshall, Chief
Aging Management of Structures, Electrical,
and Systems Branch
Division of License Renewal

ENCLOSURE

1 INTRODUCTION AND BACKGROUND

1.1 Introduction

By letter dated September 13, 2013, NextEra Energy Seabrook, LLC (NextEra), submitted to the U.S. Nuclear Regulatory Commission (NRC), a supplement to the license renewal application (LRA) regarding the plant-specific Alkali-Silica Reaction (ASR) Monitoring program. In support of the staff's safety review of the LRA, NRC staff from the Division of License Renewal, Aging Management of Structures, Electrical, and Plant Systems Branch, audited and reviewed the ASR Monitoring program and relevant documents used to develop this plant-specific aging management program (AMP).

The NRC staff performed its work in accordance with the requirements of Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), Requirements for Renewal of Operating Licenses for Nuclear Power Plants; the guidance provided in Revision 2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR); and the guidance provided in Revision 2 of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

The NRC staff conducted a three-day onsite audit on November 18 - 20, 2013. During its audit, the NRC staff examined the applicant's ASR Monitoring Program and program bases documents, interviewed various applicant representatives, and conducted walkdowns of selected structures affected by ASR. This audit report documents the results of the staff's activities during the audit.

1.2 Background

By letter dated May 25, 2010, NextEra submitted, to the NRC, its application for a renewed facility operating license for Seabrook Station, Unit 1 (Seabrook). Following correspondence between the NRC staff and the applicant regarding the aging management of structures affected by ASR, NextEra supplemented its application by letter dated May 16, 2012, with a plant-specific ASR Monitoring Program to augment the Structures Monitoring AMP. On February 21, 2013, a public meeting was held at the NRC Headquarters in Rockville, MD, between NRC staff and NextEra, during which the NRC staff verbally communicated its concerns regarding elements of the ASR Monitoring Program that needed additional information and further technical basis to support the continued review of this plant-specific AMP. By letter dated September 13, 2013, NextEra supplemented the LRA to incorporate additional information.

2 AUDIT SCOPE

The purpose of the audit was to review the applicant's plant-specific ASR Monitoring Program against the requirements of 10 CFR Part 54, the guidance provided in Appendix A.1, "Aging Management Review – Generic," of the SRP-LR, and the GALL Report to verify that the applicant's AMP will adequately manage the effects of aging for structures affected by ASR, so that their intended functions will be maintained consistent with the Seabrook current licensing basis (CLB) for the period of extended operation.

LRA AMP B.2.1.31A, PLANT-SPECIFIC ASR MONITORING PROGRAM

Summary of Information in the Application. The LRA states that, to manage the effects of cracking due to expansion and reaction with aggregates (e.g., ASR) in concrete structures, the existing Structures Monitoring AMP, B.2.1.31, has been augmented by this plant-specific ASR Monitoring program, B.2.1.31A. According to LRA Section B.2.1.31A, ASR developed at Seabrook because the concrete mix designs utilized an aggregate that was susceptible to ASR, which was not known at the time. Although testing was conducted in accordance with ASTM C289, "Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)," this standard was subsequently identified as being limited in its ability to predict late or slow reactivity in concrete. This program proposes performing visual inspections of concrete for indications of ASR, and monitoring the combined cracking index (CCI) and individual crack widths for locations that meet the criteria prescribed by the program. The AMP further states that a CCI of less than the 1.0 mm/m and individual crack width of less than 1.0 mm can be deemed to be "Acceptable with Deficiencies," and areas with deficiencies determined to be acceptable with further review are trended for evidence of further degradation. CCI and individual crack widths that exceed those values require a structural evaluation.

During its audit of this plant-specific AMP, the staff reviewed the basis documents and references used in developing each element of the applicant's program against criteria described in SRP-LR, Appendix A.1, which provides the staff's technical position and guidance for evaluating the demonstration of aging management through plant-specific programs. Issues identified but not resolved in this report will be addressed in the safety evaluation report.

Audit Activities. During its onsite audit, the staff interviewed the applicant's staff and reviewed supporting documentation for the AMP. In addition, the staff conducted walkdowns of selected locations currently being monitored for cracking due to expansion from reaction with aggregates. Specifically, the staff walked down areas of the Primary Auxiliary Building, Mechanical Penetration Area, and the Containment Enclosure Ventilation Area, which is the annulus area between the Containment Building and Containment Enclosure Building. The staff also conducted an independent review of the applicant's plant-specific operating experience database using keywords: "ASR," "alkali," "pattern cracking," "map cracking," "expansion," and "craze."

The table below lists the documents that were reviewed by the staff and were found relevant to the audit. These documents were provided by the applicant or were identified in the staff's search of the applicant's plant-specific operating experience.

Relevant Documents Reviewed

Document	Title	Revision / Date
1. LRAP-ASR Results Book	Seabrook Station License Renewal Project Aging Management Program Basis Document Alkali-Silica Reaction (ASR) Monitoring Program	Revision 1
2. FHWA-HIF-09-004	Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction in Transportation Systems, U.S. Department of Transportation, Federal Highway Administration	January 2010
3. The Institution of Structural Engineers	Structural Effects of Alkali-Silica Reaction – Technical Guidance on the Appraisal of Existing Structures	July 1992
4. ORNL/NRC/LTR-95/14	In-service Inspection Guidelines for Concrete Structures in Nuclear Power Plants	December 1995
5. MPR-3727	Seabrook Station: Impact of Alkali-Silica Reaction on Concrete Structures and Attachments	Revision 0 April 2012
6. EDS-36180	NextEra Energy Structural Engineering Standard Technical Procedure	Revision 4
7. ES1807.031	Inservice Inspection Procedure Primary Containment Section XI IWL Program	Revision 3
8. AR 01703049	Emergent Work Associated with ASR Evaluation	11/03/2011
9. AR 01771909	Installation of ASR Crack Index Gage Points	05/31/2012
10. AR 01641413	Documented Concrete Inspection Results Containment CEVA Area	04/14/2011
11. AR 01643562	Issue Identified During Containment Surface Walkdown	04/20/2011
12. AR 01664399	Concrete Test Results	06/27/2011
13. AR 01687131	ASR Action Plan – Key Activities & Completion Dates	09/16/2011
14. AR 01749443	Alkali-Silica Reaction Project Activities	03/28/2012
15. AR 01757861	Additional Areas of Concrete Affected by ASR	04/22/2012
16. AR 01877634	ASR Walkdown Assessment of Concrete – Phase 3 Locations	05/28/2013
17. WO 40209732	ASR Crack Mapping Indexing & Expansion Measurements	06/28/2013
18. AR 01862204	Evaluate Concrete Condition at Tihange 2 Nuclear Power Plant	06/20/2013
19. AR 1734230	DRI & ASR Rating – SH&H "Damage Rating Index and Visual Assessment of Alkali-Silica Reactivity in Concrete Core Sections of Three Partial-Depth Cores from the Bravo Electrical Tunnel at NextEra Energy, Seabrook, NH	Revision 1

During the audit, the staff reviewed program elements one through ten against the corresponding guidance for each element described in SRP-LR, Appendix A.1. For each of the plant-specific ASR Monitoring Program elements, the staff made the following observations.

Element 1 - Scope of Program

- Each of the concrete structures listed in the scope of the Structures Monitoring AMP, which is based on the existing Structures Monitoring Program that satisfies the requirements of 10 CFR 50.65, Maintenance Rule, is within the scope of the ASR Monitoring Program.

Element 2 - Preventive Actions

- Program basis documents indicate that mitigative measures have been taken and/or were considered under the current licensing basis; however, the implementation of the ASR Monitoring Program does not rely on preventive actions.

Element 3 - Parameters Monitored or Inspected

- The applicant proposes to identify the presence of ASR through general visual examinations of concrete surfaces which include the following visual characteristics of ASR:
  - pattern cracking on the surface of the concrete
  - secondary deposits at the pattern cracking location
  - dark staining adjacent to the cracks
  - gel exudation in the cracks
- The applicant proposes to monitor expansion of the concrete by measuring CCI and individual crack width as parameters. The applicant's decision to monitor these parameters is based on available literature. The applicant's supporting technical basis are discussed in a plant-specific structural evaluation, titled MPR-3727, "Seabrook Station: Impact of Alkali-Silica Reaction on Concrete Structures and Attachments." This report is used to assess expansion due to ASR and is based on the following references:
  - "Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction in Transportation Structures," U.S. Dept. of Transportation, Federal Highway Administration, January 2010, Report Number FHWA-HIF-09-004.
  - "Structural Effects of Alkali-Silica Reaction: Technical Guidance on the Appraisal of Existing Structures," Institution of Structural Engineers (ISE), July 1992.
  - "In-Service Inspection Guidelines for Concrete Structures in Nuclear Power Plants," ORNL/NRC/LTR-95/14, December 1995.

Element 4 - Detection of Aging Effects

- Provisions for inspection of inaccessible areas of concrete are performed under the Structures Monitoring AMP. Engineering Design Standard (EDS) 36180 states the following:

> ...examination of areas not typically accessible, such as buried concrete foundations, will be completed during inspections of opportunity during work related excavations. An evaluation of these opportunistic inspections for buried concrete will be completed every 10 years to ensure that...buried concrete foundations on site will perform their intended function through the period of extended operation. Additional inspections may be performed in the event that an opportunistic inspection has not been conducted, or if visible portions of the concrete foundation reveal degradation due to the development of an aggressive groundwater environment.

EDS 36180 also states that periodic inspections of plant structures shall be performed at least once per five years (plus or minus one year) for structures exposed to a harsh environment. Portions of below-grade concrete structures are exposed to aggressive groundwater at Seabrook Station and would be considered to be exposed to a harsh environment.

Element 5 - Monitoring and Trending

- During the audit walkdown, the staff observed two locations meeting the Tier 3 acceptance criteria being monitored at a 6-month frequency, and two locations meeting the Tier 2 acceptance criteria, which are being monitored at a 2.5-year frequency.
- The current Structures Monitoring Program implementing procedures include inspection and monitoring criteria for the effects of ASR consistent with those described in the plant-specific ASR Monitoring Program. Although submitted as a plant-specific program in the LRA, to be implemented prior to the period of extended operation, a review of implementing procedures and operating experience indicates that this program is currently being implemented.

Element 6 - Acceptance Criteria

- The acceptance criteria was determined based on the applicant's review of the following reports:
  - "Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction in Transportation Structures," U.S. Dept. of Transportation, Federal Highway Administration, January 2010, Report Number FHWA-HIF-09-004.
  - "Structural Effects of Alkali-Silica Reaction: Technical Guidance on the Appraisal of Existing Structures," Institution of Structural Engineers (ISE), July 1992.
  - "In-Service Inspection Guidelines for Concrete Structures in Nuclear Power Plants," ORNL/NRC/LTR-95/14, December 1995.
- Locations meeting Tier 3 acceptance criteria require a structural evaluation. The applicant currently uses the structural evaluation documented in MPR 3727, "Seabrook Station: Impact of Alkali-Silica Reaction on Concrete Structures and Attachments." This report assesses each affected structure by applying a strength reduction factor the applicant determined was representative of

worst-case ASR degradation to each limit state in the design calculations and showing that the structures still meet the stress limit requirements.

Elements 7-9 - Corrective Actions, Confirmation Process, and Administrative Controls

- The quality assurance attributes of the ASR Monitoring Program, which include the "Corrective Actions," "Confirmation Process," and "Administrative Controls" program elements are consistent with the staff's guidance in SRP-LR, Appendix A.1, "Branch Technical Positions," Section A.2 "Quality Assurance for Aging Management programs (Branch Technical Position IQMB-1)."

Element 10 - Operating Experience

- Review of the inspection reports, program implementing procedures, structural evaluations and crack indexing results indicate the ASR Monitoring Program is currently being implemented.
- To the extent that it has been available, international industry operating experience has been considered and evaluated for its applicability, through the applicant's corrective action program (CAP).
- The applicant's CAP is being used to review plant-specific operating experience in order to track, trend and evaluate plant issues.

In order to obtain the information necessary to continue its review of the applicant's plant-specific ASR Monitoring Program, the staff will consider issuing requests for additional information (RAIs) for the subjects discussed below.

- For the "scope of program" program element, the ASR Monitoring Program indicates that the containment building, which is within the scope of the ASME Section XI, Subsection IWL Program, is also within the scope of the ASR Monitoring Program. However, the program description in LRA Section B.2.1.31A indicates that the ASR Monitoring Program only augments the Structures Monitoring Program described in LRA Section B.2.1.31. Although it is clear from onsite documentation that the current 10-CFR-5055a-required ASME Section XI, Subsection IWL Inservice Inspection program includes visual inspection for ASR, it is not clear if the ASME Section XI, Subsection IWL AMP will also be augmented by the ASR Monitoring Program, or how the results from the containment inservice inspection will be incorporated into the ASR Monitoring Program. The LRA does not address the ASR monitoring program in the IWL AMP.
- For the "parameters monitored or inspected" and "detection of aging effects" program elements, the applicant has proposed to monitor cracking due to expansion from reaction with aggregates by (1) using a CCI measurement as a relative measure of expansion; and (2) measuring individual crack widths at the surface of the concrete. ASR causes concrete to expand in all directions, and the crack widths and number of cracks that appear on the surface of the concrete may not be indicative or bounding of the expansion in the out-of-plane, or transverse direction. This may be the case for many of the structures at Seabrook which do not include transverse reinforcement, and therefore expansion is not restrained by reinforcing steel. It is not clear that the parameters being monitored (i.e., combined cracking index and individual crack width in the "x-y" direction at the surface of the concrete) would provide sufficient information to appropriately monitor cracking due to expansion, since the surface expansion of the concrete may not be indicative of the out-of-plane expansion.

- For the "detection of aging effects" program element, the SRP-LR, Appendix A.1, Section A.1.2.3.4 states that for a condition monitoring program, when sampling is used to represent a larger population of structures and components (SCs), applicants should provide the basis for the inspection population and sample size. For the "monitoring and trending" program element, the applicant has proposed to monitor the cracking index and individual crack widths of at least 20 areas identified in the baseline inspection as having the largest CCI at 6-month intervals. During the audit, the applicant clarified that all locations meeting the Tier 3 acceptance criteria will be monitored at 6-month intervals. In its review of the ASR Monitoring Program, it is not clear that the locations being monitored at 6-month intervals include all locations meeting the Tier 3 acceptance criteria, as opposed to being a sample size representing a larger population.
- For the "detection of aging effects" program element, the applicant credits the inspection of buried concrete performed under the Structures Monitoring AMP, which is implemented through the CLB Structures Monitoring Program (used to satisfy the requirements of 10 CFR 50.65, Maintenance Rule), for the evaluation of inaccessible areas of concrete affected by ASR. The applicant has an opportunity to evaluate an inaccessible area of the spent fuel pool through Commitment No. 67, which states that the applicant will "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 staff may inquire as to whether Commitment No. 67 will include examination of concrete degradation due to ASR when it performs the shallow core bore.
- For the "detection of aging effects" and "monitoring and trending" program elements, the SRP-LR, Appendix A.1, Section A.1.2.3.4 states that this discussion should provide justification that the technique and frequency are adequate to detect the aging effects before a loss of SC-intended function. The ASR Monitoring Program submittal does not specify a frequency for monitoring Tier 2 locations, although during the staff's audit, the applicant stated that that locations meeting Tier 2 acceptance criteria will be monitored at a 2.5-year frequency. In addition, the basis for the 2.5-year inspection frequency was not provided in the LRA.

The staff also reviewed the description of the ASR Monitoring Program provided in the updated final safety analysis report (UFSAR) Supplement. The staff verified this description is consistent with the description provided in the SRP-LR. In order to obtain the information necessary to verify the sufficiency of the UFSAR Supplement program description, the staff will consider issuing RAIs for the subject discussed below.

- In its September 13, 2013 supplement to the ASR Monitoring Program, the applicant added language to the UFSAR supplement, which suggests that the large-scale destructive testing being conducted at the University of Texas may provide the technical basis to show that the parameters monitored are appropriate. However, the objectives of the large scale testing described in the program description portion of the AMP do not link the testing to the basis for the parameters being monitored. It is not clear whether the testing provides the technical basis for the parameters monitored or if the testing is meant to be confirmatory in nature.

Audit Results. Based on this audit, the staff verified that the "preventive action," "acceptance criteria," "corrective actions," "confirmation process," and "administrative controls" program elements of the ASR Monitoring Program contain sufficient information for the staff to continue its review and evaluation. The staff also identified certain aspects of the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements for which additional information or additional evaluation is required.

Based on this audit, the staff also found that additional information is needed before the staff can determine that the applicant's operating experience supports the sufficiency of the LRA AMP. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the UFSAR Supplement.