NEXTera ENERGY SEABROOK

May 24, 2012

SBK-L-12106
Docket No. 50-443

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Seabrook Station
Response to Confirmatory Action Letter

Reference: NRC letter to NextEra Energy Seabrook, CAL No. 1-2012-002, Confirmatory Action Letter (CAL), Seabrook Station, Unit 1 – Information Related to Concrete Degradation Issues (ML121254172)

In the above reference, the U.S. Nuclear Regulatory Commission (NRC) issued a Confirmatory Action Letter, stating its expectation that NextEra Energy Seabrook, LLC (NextEra Energy Seabrook) will carry out the commitments outlined in the letter according to its previously provided schedule. Accordingly, NextEra Energy Seabrook is required to submit the root cause for the organizational causes associated with the occurrence of ASR at Seabrook Station and related corrective actions; and submit the evaluation, "Impact of ASR on Concrete Structures and Attachments" (Foreign Print 100716), by May 25, 2012.

Enclosure 1 of this letter contains the root cause for the organizational causes associated with the occurrence of ASR at Seabrook Station and related corrective actions. Enclosure 2 of this letter contains the evaluation, "Impact of ASR on Concrete Structures and Attachments" (Foreign Print 100716).

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Should you have any questions regarding this letter or the attachments to this letter, please contact Mr. Michael O'Keefe, Licensing Manager at (603) 773-7745.

Sincerely,

NextEra Energy Seabrook, LLC

for

Paul O. Freeman
Site Vice President

Enclosures:

1. Root Cause for the Organizational Causes Associated with the Occurrence of ASR at Seabrook Station.

2. The Evaluation, "Impact of ASR on Concrete Structures and Attachments" (Foreign Print 100716).

cc:

W. M. Dean, NRC Region I Administrator
J. L. Lamb, NRC Project Manager
W. J. Raymond, NRC Senior Resident Inspector

Mr. Christopher M. Pope, Director Homeland Security and Emergency Management
New Hampshire Department of Safety
Division of Homeland Security and Emergency Management
Bureau of Emergency Management
33 Hazen Drive
Concord, NH 03305

Mr. John Giarrusso, Jr., Nuclear Preparedness Manager
The Commonwealth of Massachusetts
Emergency Management Agency
400 Worcester Road
Framingham, MA 01702-5399

Enclosure 1 to SBK-L-12106

Root Cause for the Organizational Causes Associated with the Occurrence of ASR at Seabrook Station

A. Narrative of the event and response

In 2009, as part of the Seabrook License Renewal process, basis documents were being developed to support the aging management program. Included in these bases documents was a structures monitoring program. As part of the basis document for the aging management structures monitoring program, it was identified that the aggressiveness of the groundwater chemistry on concrete structures in contact with groundwater/soil needed to be determined. In 2010, concrete core samples were taken from the lower electrical tunnel areas for testing and examination. This area had been subjected to significant groundwater intrusion for several years. The core samples displayed the visual characteristics of high quality concrete. However, subsequent quantitative testing revealed a reduction in concrete properties. Further petrographic analysis identified the presence of Alkali-Silica Reaction (ASR). An extent of condition evaluation was performed which entailed removal of additional concrete core samples for testing and petrographic examination. In June 2011, after receiving the laboratory test and examination reports, Seabrook confirmed concrete degradation by ASR in selected areas of several safety-related structures. This discovery was unexpected since it was believed that the concrete constituents used at Seabrook would not normally be expected to be susceptible to ASR since:

1. the coarse aggregate is largely igneous rock that was routinely tested during construction and passed petrographic examinations and expansive reaction tests that normally detect alkali-silica reaction ; and
2. low-alkali portland cement was abundantly used.

During this extent of condition assessment, Design Engineering identified that years after the Seabrook concrete was placed, the ASTM standards were updated to caution that the tests specified may not accurately predict reactive aggregates when dealing with late- or slow-expanding reactive aggregates containing strained quartz or microcrystalline quartz such as the coarse aggregates used at Seabrook. It was also learned that the concrete industry in conjunction with ASTM developed new, more accurate and reliable test methods to assess potentially reactive coarse aggregates.

Building structures including foundations for Seabrook Station seismic Category I buildings are conventionally reinforced concrete mats and walls of varying thicknesses. Foundation mats are supported on sound bedrock or on fill concrete extending to sound bedrock. Essentially, the site can be viewed as an excavated bowl carved out of the bedrock with varying cavities with depths as much as 80 feet below grade elevation. The concrete mix designs for Seabrook Station structural concrete and fill concrete were developed by the Architect/Engineer (A&E) and an independent testing laboratory in the mid to late 1970's. The mix designs were developed in accordance with the applicable ACI and ASME codes and ASTM standards. Concrete aggregates were routinely selected and tested based on ASTM standard tests at that time to ensure aggregates with low susceptibility to expansive reactions such as alkali-silica reaction. The concrete mixes were batched on site and placed in accordance with the A&E specifications and site procedures. All safety related concrete batching and placements were overseen by the civil contractor quality control and the A&E quality assurance personnel and tested by an independent testing company. The original site design utilized an impermeable elastomeric waterproofing membrane system under the foundations and around the outside perimeter of most of the below grade building walls to act as a groundwater barrier. This waterproofing membrane was installed in accordance with A&E specifications and site procedures and overseen by the civil contractor quality control and the A&E quality assurance personnel.

Seabrook has experienced groundwater inleakage into below grade structures since construction. The site was dewatered during original construction to facilitate construction activities below grade. The dewatering systems were removed or deactivated following construction and most are not available for current use. The groundwater inleakage is believed to be due to the waterproofing membrane being damaged during construction resulting in an ineffective barrier. Ground water flows through numerous fissures in the bedrock and through breaches in the membrane to the structures resulting in a complicated and changing groundwater flow picture. This groundwater inleakage was viewed as a corrosion threat to rebar, embedments and adjacent components/ supports, but was not recognized as a potential threat to the material properties of structural concrete. This has resulted in an organizational mindset that did not mandate the elimination or mitigation of this groundwater inleakage. Most of the efforts to date to address the groundwater inleakage have focused on local dewatering to reduce the hydrostatic head at specific locations. These efforts have had marginal success.

When evaluating condition reports for groundwater inleakage and/or degraded concrete, Engineering incorrectly believed that the cement and aggregate selection for the Seabrook concrete precluded ASR development, so Engineering viewed the water only as a corrosion threat to structure/components impacted by the in leaking groundwater. Calculations completed by Design Engineering after the ASR was identified have demonstrated that the reduced modulus of elasticity has negligible effect on the structural integrity or durability of the concrete, and no adverse effect on the design function of the effected buildings. Prompt Operability Determinations (PODs) were performed which concluded, with reasonable assurance, the structures are fully capable of performing their safety function and are operable with reduced margin.

Design Engineering has supplemented their concrete expertise with consultants and developed an action plan addressing concrete degradation by ASR which defines a strategy for establishing the service life of structures and identifies the actions necessary to execute the strategy.

The following problem statement for this root cause was developed by the Root Cause Evaluation (RCE) team and approved by MRC:

In 2010, Seabrook discovered ASR related concrete degradation in several structures. Determine how the ASR developed and why its presence was not identified until 2010.

B. Root Cause(s)

Based on the problem statement, the RCE team identified the following two root causes:

RC1 - The ASR developed because the concrete mix designs unknowingly utilized an aggregate that was susceptible to Alkali-Silica Reaction. Although the testing was conducted in accordance with ASTM standards, those testing standards were subsequently identified as limited in their ability to predict long term ASR.

RC2 – The health monitoring program for systems and structures does not contain a process for periodic reassessment of failure modes that were excluded from the monitoring criteria to ensure that the monitoring/mitigating strategies remain applicable and effective.

C. Corrective Actions to Prevent Recurrence

Corrective actions to prevent recurrence are:

RC1 – Nothing can be done to correct the concrete mix design issue for the existing buildings. The ASTM standard issue is outside the control of Seabrook Station. However, it should be noted that the standard has been updated to caution that the specified aggregate test is not effective in identifying slow reactive aggregate. Additional ASTM standards have been issued to better identify concrete mix strategies to minimize the potential for ASR. New concrete structures will be constructed with concrete mixes that include pozzolanic materials like fly ash or slag cement that prevent ASR. The focus of the Seabrook corrective actions associated with the ASR phenomenon will be to address the present material properties and in-situ strength of affected structures and the potential for continued degradation for below grade and above grade structures.

RC2 – Develop a process for system/program/structure monitoring plans focusing on vital failure modes, critical system parameters and utilizing the evaluation of specific OE for each failure mode and parameter. This process is to include the identification and tracking of long-term prevention strategies, and periodic reassessment of failure modes that were excluded from the monitoring criteria to ensure that the monitoring/mitigating strategies remain applicable and effective. Inclusive in this process will be periodic evaluation for new operating experience information. Include a feedback loop for re-evaluate the strategy if a failure does occur.