



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

REGION I  
2100 RENAISSANCE BLVD., SUITE 100  
KING OF PRUSSIA, PA 19406-2713

August 18, 2016

Ms. Debbie Grinnell  
Research Advocate  
C-10 Research and Education Foundation, Inc.  
44 Merrimac Street  
Newburyport, MA 01950

Dear Ms. Grinnell:

I am responding to a series of questions received by the U.S. Nuclear Regulatory Commission (NRC) from you via email since mid-June 2016, regarding concrete degradation at Seabrook Station, Unit No. 1 (Seabrook). Due to the number and range of concerns provided, I am addressing them in an enclosure to this letter. In this enclosure, I have referenced a number of publicly available documents directly related to your concerns. These documents may be obtained online in the NRC's Agencywide Documents Access and Management System (ADAMS) public documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin a search for these documents, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). The ADAMS Accession Number for each document referenced in this document (if that document is available in ADAMS) is provided the first time that a document is referenced. Links to many of these documents are also provided at the following webpage: <http://www.nrc.gov/reactors/operating/ops-experience/concrete-degradation.html#publicly>, which is devoted to the NRC's oversight at Seabrook regarding concrete degradation.

I trust that this is responsive to the concerns you have raised.

Sincerely,

*/RA/*

Fred L. Bower III, Chief  
Reactor Projects Branch 3  
Division of Reactor Projects

Enclosure: **[2016-SST-0548]**  
Response to Questions and Concerns  
Raised by Debbie Grinnell of C-10

Ms. Debbie Grinnell  
 Research Advocate  
 C-10 Research and Education Foundation, Inc.  
 44 Merrimac Street  
 Newburyport, MA 01950

Dear Ms. Grinnell:

I am responding to a series of questions received by the U.S. Nuclear Regulatory Commission (NRC) from you via email since mid-June 2016, regarding concrete degradation at Seabrook Station, Unit No. 1 (Seabrook). Due to the number and range of concerns provided, I am addressing them in an enclosure to this letter. In this enclosure, I have referenced a number of publicly available documents directly related to your concerns. These documents may be obtained online in the NRC's Agencywide Documents Access and Management System (ADAMS) public documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin a search for these documents, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to [pdresource@nrc.gov](mailto:pdresource@nrc.gov). The ADAMS Accession Number for each document referenced in this document (if that document is available in ADAMS) is provided the first time that a document is referenced. Links to many of these documents are also provided at the following webpage: <http://www.nrc.gov/reactors/operating/ops-experience/concrete-degradation.html#publicly>, which is devoted to the NRC's oversight at Seabrook regarding concrete degradation.

I trust that this is responsive to the concerns you have raised.

Sincerely,

*/RA/*

Fred L. Bower III, Chief  
 Reactor Projects Branch 3  
 Division of Reactor Projects

Enclosure: **[2016-SST-0548]**  
 Response to Questions and Concerns  
 Raised by Debbie Grinnell of C-10

DISTRIBUTION: (via email):		
DDorman, RA	RVadella, DRP	BLEhman, NRR
DLew, DRP	PCataldo, DRP, SRI	DBroaddus, NRR
MScott, DRP	PMeier, DRP, RI	YLi, NRR
DPelton, DRP	ACass, DRP, Resident AA	BWittick, NRR
RidsNRRDorLp1-2Resource	JBowen, RI, OEDO	TTran, NRR
RLorson, DRS	DScrenci, PAO	GThomas, NRR
MGray, DRS	NSheehan, PAO	RidsNrrPMSeabrook
WCook, DRS	NMcNamara, SLO	Resource
FBower, DRP	DTiff, SLO	
RBarkley, DRP	ABuford, NRR	
MDraxton, DRP	JLamb, NRR	

DOCUMENT NAME: G:\DRP\BRANCH3\Action Items\2016\2016-SST-0548-Grinnell ASR TIA Hoop Yield\Resp Ltr to C10 emails\_final.docx

ADAMS Accession No. **ML16180A189** (package) ADAMS Accession No. **ML16231A134** (document)

<input checked="" type="checkbox"/> SUNSI Review		<input checked="" type="checkbox"/> Non-Sensitive <input type="checkbox"/> Sensitive		<input checked="" type="checkbox"/> Publicly Available <input type="checkbox"/> Non-Publicly Available		
OFFICE	RI/DRP	RI/DRS	NRR/DORL	NRR/DLR	OGC (NLO)	RI/DRP
NAME	RBarkley	WCook	JPoole via email	BWittick via email	BHarris via email	FBower
DATE	08/15/16	08/15/16	08/16/16	08/16/16	08/17/16	08/17/16

**Response to Questions and Concerns Raised by Debbie Grinnell of C-10**

## 1) Concern Regarding the Seabrook Containment Enclosure Building (CEB) Reinforcing Steel

Question(s) and Concern(s):

In a June 23, 2016, email (ADAMS Accession No. ML16180A212) to Mel Gray, you attached a draft memorandum (ADAMS Accession No. ML12054A730) from J. Clifford, NRC, to R. Nelson, NRC, requesting technical assistance. You also inquired about an Attachment to this draft memorandum entitled: "DE/EMCB Comments on AR1644074 Evaluation of Containment Enclosure Building (CEB) (4-27-11)," and noted that Item 4 on page 6 of this Attachment stated that "The AR1644074 Evaluation of the local section does not evaluate the effect of reduced modulus on stress and strain in the rebar. The strain in the rebar could go beyond the yield strain. From page 47 of Calc CE-4 referenced in the evaluation for element 255, the stress in the hoop reinforcement is 61.493 ksi, which is already beyond yield." You seemed to be concerned with the resolution of this issue.

Response(s):

As noted in my acknowledgement email (ADAMS Accession No. ML16187A130) to you, the document that you had referenced was a draft. The final version of this technical assistance request is available at ADAMS Accession No. ML111610530. This request was ultimately withdrawn following an agreement between NRC Headquarters and Region I for continued structural engineering support to the Region I inspection staff and the establishment of the Seabrook Alkali Silica Reaction (ASR) Issue Technical Team. As you are aware, the ASR issue was discussed at a public meeting in Rockville, Maryland, on April 23, 2012, and NextEra subsequently made commitments that the NRC confirmed in a Confirmatory Action Letter (ADAMS Accession No. ML12125A172).

With respect to the resolution of Item 4 in the DE/EMCB attachment, the NRC staff determined that the Element 255 calculated hoop stress condition was addressed and appropriately resolved in NextEra Calculation CE-4, pages 157 and 158 (Please note that this is a Seabrook internal plant record that was inspected onsite and is not available for public release). The broader issue expressed by the DE/EMCB staff involving the impact of ASR on rebar, with respect to the rebar restraining the ASR expansion, was incorporated into NextEra's decision to pursue a large specimen ASR testing program at the University of Texas – Austin. The results of that testing program and their application to the conditions at Seabrook are an integral part of NextEra's license amendment request (LAR) to resolve the non-conforming ASR issue at Seabrook. On August 1, 2016, NextEra submitted this LAR to the NRC staff for review and the non-proprietary version is publicly available at ADAMS Accession No. ML16216A250. As was discussed at the Seabrook Annual Assessment Meeting on June 21, 2016 (ADAMS Accession No. ML16176A054, Slide 9), external stakeholders will be afforded an opportunity to review and participate in the LAR process.

## 2) Request for Spent Fuel Building Core Bore Test Results

Question(s) and Concern(s):

In two July 14, 2016, emails (ADAMS Accession Nos. ML16202A105 and ML16202A113) to Fred Bower, you requested information regarding a concrete core sample bored from Seabrook's spent fuel building in December 2015.

Response(s):

On page 9 of NRC Inspection Report (IR) 05000443/2016008 dated May 6, 2016 (ADAMS Accession No. ML16127A155), inspectors documented their review of the results of a December 18, 2015, concrete core removed from the Spent Fuel Pool telltale drain sump. This core was removed in accordance with a license renewal commitment (No. 67) and was tracked via AR 00392697. Petrographic examination of the core specimen (designated FSB-1) identified no evidence of boric acid degradation, but did reveal "minor ASR features." The examination was documented in Laboratory Report 151303-LR-1, Revision 0, "Microscopic Examination of a Concrete Core Removed from Seabrook Station for Deterioration Mechanisms," (Foreign Print 101052). The laboratory report (151303-LR-1) is a Seabrook internal plant record.

Discussions with the NRC inspection team determined that this record was reviewed onsite during the time periods identified in IR 05000443/2016008. The inspectors indicated that they did not remove these Seabrook internal plant records from the site and we are not aware that they are in the possession of any NRC staff member, so they are not available for public release as NRC records.

## 3) Request for Concrete Core Data

Question(s) and Concern(s):

In a June 23, 2016, email (ADAMS Accession No. ML16180A212) to Mel Gray, you asked: (1) whether the NRC has tested for data on cores, conducted petrography, and done calculations on Seabrook's containment; (2) for the calculations that the NRC has made since 2011 on the CEB; and (3) for the most recent core test data. You also requested that we send to you the core/petrography data and calculations on Seabrook's containment.

Response(s):

As the NRC inspection team documented in IR 05000443/2016008 (ADAMS Accession No. ML16127A155), the NRC concluded, based on its review of NextEra's recently completed operability determination documents, that ASR-affected structures at Seabrook are capable of performing their safety-related functions considering the observed cracking and deformation.

In a letter dated January 19, 2016 (ADAMS Accession No. ML16019A081), we provided to you information that the NRC has retained and provided references to information that is publicly available regarding NextEra's conduct of core sampling locations and material testing as part of its initial characterization of Seabrook's ASR-affected concrete structures.

Please note that, to date, NextEra has removed a number of core bores from concrete structures at Seabrook and has petrographically examined them to confirm the presence of ASR. NRC resident and specialist inspectors have observed a selected sample of the activities to extract and examine the cores and have reviewed the test results during onsite inspections. The inspections have confirmed that the cores have been extracted, examined, and tested using technically appropriate methods with procedures that conform to the quality standards required by NRC regulations. NextEra has maintained the records of these examinations and test results onsite as internal records and we are not aware that any of these results are currently available as records of the NRC. Please note that similar information and the location

of NRC inspection result documentation was previously communicated to you in an email from Glenn Dentel dated September 30, 2015 (ADAMS Accession No. ML15274A220).

As described in Sections 3.3.2, "Evaluation of Self-Straining Loads and Deformations for Seismic Category I Structures other than Containment," and 3.3.5, "Evaluation of Containment Enclosure Building," of the LAR (ADAMS Accession No. ML16216A250), NextEra and its contractors have developed an ANSYS finite element model (FEM) of the CEB to analyze the effects of ASR, including deformation, on this concrete structure. This FEM is specifically referenced (Reference 26) in the LAR. Development of this FEM has been an iterative process and information from this FEM has been used, in part, to support some of NextEra's operability determinations. Specialist inspectors from NRC Headquarters have conducted onsite inspections to assess the appropriateness of the methodology. NextEra has retained this information in its system of internal records that are available to NRC inspectors for review. We are not aware that any of this information is currently available as records of the NRC, so they are not available for public release. The NRC staff is reviewing the LAR and ongoing inspections at Seabrook continue to provide independent regulatory oversight of NextEra's activities consistent with the NRC's Reactor Oversight Program.

#### 4) Concern Regarding Onsite Inspection of Unresolved Item (URI) 05000443/2015-004-01

##### Question(s) and Concern(s):

In a July 7, 2016, email (ADAMS Accession No. ML16193A376) to Angela Buford and a July 12, 2016, clarifying email to Fred Bower (ADAMS Accession No. ML16202A098), you asked how long inspection staff were at Seabrook to review Unresolved Item(URI) 05000443/2015-004-01.

##### Response(s):

URI 05000443/2015-004-01 was opened in Section 4OA2 of IR 05000443/2015004 (ADAMS Accession No. ML16043A391) that was issued on February 12, 2016. As documented in IR 05000443/2016008 (ADAMS Accession No. ML16127A155) dated May 6, 2016, an inspection was conducted to review this URI. The onsite periods for this inspection were February 1 – 5 and March 21 – 24, 2016. The NRC inspectors that participated in the inspection are documented on the cover page of this report. This report documents that URI 05000443/2015-004-01 was closed and a Notice of Violation (NOV 05000443/2016-008-01) was opened. NextEra responded to this NOV in a letter dated June 6, 2016 (ADAMS Accession No. ML16161A534). By letter dated June 29, 2016 (ADAMS Accession No. ML16182A031), the NRC acknowledged NextEra's response and informed NextEra that the NRC staff would review the implementation of NextEra's corrective actions to determine their adequacy and to verify that full compliance has been achieved in a future inspection. This follow-up inspection is currently planned for later this year. These issues were raised relative to the current operating license for Seabrook that was issued in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 of the NRC's regulations.

#### 5) Concern Regarding ASR Aging Management Requests for Additional Information (RAIs)

##### Question(s) and Concern(s):

In a July 7, 2016, email (ADAMS Accession No. ML16193A376) to Angela Buford and a July 12, 2016, clarifying email to Fred Bower (ADAMS Accession No. ML16202A098), you asked about audit results documented in a December 17, 2015, report (ADAMS Accession No.

ML15337A047) regarding an October 2, 2015, letter (ADAMS Accession No. ML15251A333) in which the NRC staff issued new and follow-up RAIs to NextEra regarding the aging management of ASR-affected concrete structures at Seabrook in support of license renewal under 10 CFR Part 54 of the NRC's regulations.

Response(s):

With regard to the new and follow-up RAIs documented in a letter dated October 2, 2015 (ADAMS Accession No. ML15251A333), to NextEra and the audit results documented in the December 17, 2015, report (ADAMS Accession No. ML15337A047), please note that NextEra responded to these RAIs in a letter dated December 3, 2015 (ADAMS Accession No. ML15343A470). On April 28, 2016, NextEra met with the NRC staff to discuss its plan to address the staff's concerns relative to the aging management of ASR as part of the Seabrook license renewal application. Information on this meeting, including the meeting summary and NextEra's presentation, can be found under the "Public Meetings" section of the NRC webpage devoted to ASR at Seabrook at: <http://www.nrc.gov/reactors/operating/ops-experience/concrete-degradation.html#mtgs>. On August 9, 2016, NextEra submitted to the NRC staff for review additional information regarding the aging management of ASR at Seabrook in support of its license renewal application; these records are expected to be publically available shortly.

6) Concern Regarding Concrete Performance Issues Noted in IR 5000443/1987007

Question(s) and Concern(s):

In a July 12, 2016, email (ADAMS Accession No. ML16197A002) to John Lamb, you stated that NRC IR 5000443/1987007 (ADAMS Accession No. ML16208A278) involved unresolved issues that the NRC did not follow up on after plant construction.

Response(s):

Sections 2.4 and 2.17 of IR 5000443/1987007 (ADAMS Accession No. ML16208A278) relate to concrete issues. This IR documented additional inspection of these issues that were first reviewed in IR 5000443/1986052 (ADAMS Accession No. ML16208A279) in response to a series of allegations regarding the quality of construction at Seabrook that were raised in a letter from the Employee's Legal Project (ELP) (ADAMS Accession No. ML16208A281). Specifically, the allegations involved the corrosion of rebar due to seepage and unresolved cracks in concrete structures at Seabrook. The details of the inspection activities completed were documented in IR 5000443/1987007 (ADAMS Accession No. ML16208A278). The specific inspection conclusions were documented on page 12 (PDF page 18 of 71) of the report. In general, the inspectors concluded that there were no immediate safety concerns relative to the corrosion of rebar due to seepage or cracking for the buildings in question.

However, the allegations of the corrosion of rebar due to past seepage, the effectiveness of the licensee's corrective measures, and the long-term effects of seepage, if the corrective measures were not effective, were considered matters of concern to the NRC. Therefore, this aspect of the issue was considered unresolved pending further review and analysis of the licensee's actions and surveillance measures by the NRC staff (URI 5000443/1987-07-01). Additionally, at that time in 1987, for the issue relative to the cracking of concrete structures, the NRC requested that the licensee perform additional assessments of the concrete cracking to ensure that the original assessments were valid in light of the conditions and aging at that time. This

item was also considered unresolved pending the completion of the licensee's and NRC staff's reviews (URI 5000443/1987-07-02).

The NRC reviewed and closed URIs 5000443/1987-07-01 and 1987-07-02 in Section 4, "Licensee Action on Previous Findings," of IR 5000443/1988017 (ADAMS Accession No. ML16211A051). This report documents that an evaluation to resolve two concrete construction concerns was conducted by an NRC civil engineer with assistance from staff from the Brookhaven National Laboratory (BNL). The results of this evaluation were documented in the IR and a BNL Technical Evaluation Report that was appended to IR 5000443/1988017 as Attachment B to the IR. The specific issues closed were: URI 1987-07-01, "Corrosion of Reinforcing Steel Inside Concrete," and URI 1987-07-02, "Concrete Cracking." These issues were closed with no safety issues or violations identified.

The staff notes that it recently addressed your questions regarding the corrosion of the steel reinforcing bar in ASR-affected concrete in a letter dated December 3, 2012 (ADAMS Accession No. ML12339A233).

#### 7) Concern Regarding Concrete Core Testing

##### Question(s) and Concern(s):

In a July 12, 2016, email (ADAMS Accession No. ML16197A002) to John Lamb, you asked about five concrete cores that were discussed in a 2011 email from Richard Conte. In a subsequent July 28, 2016, email (ADAMS Accession No. ML16211A112) to John Lamb, you provided a copy of Mr. Conte's email dated November 17, 2011.

##### Response(s):

The staff notes that you had previously asked an almost identical question in an email to Mel Gray, dated August 5, 2014 (ADAMS Accession No. ML14246A605). Mel Gray responded to you in an email dated September 3, 2014 (ADAMS Accession No. ML14246A605). This response remains valid.

#### 8) Concern Regarding Quantitative Crack Definition and Data Request

##### Question(s) and Concern(s):

In emails dated July 21, 2016 (ADAMS Accession Nos. ML16207A078 and ML16207A087), to Fred Bower, you stated that C-10 has not seen data or measurements on Seabrook's "wide and discrete cracking" in publicly available NRC documentation. You asked what is the definition of such cracking and where is the data. You also requested measurement data over time for Seabrook's structural "gaps" so that the rate of progression of ASR may be determined.

##### Response(s):

The NRC staff has discussed unexpected cracks in concrete in various agency documents. Various qualitative descriptors of the observed cracks, including "discrete wide cracks," have been used to communicate conditions that the NRC staff has seen in safety-related concrete structures at Seabrook. For instance, on May 23, 2014, inspectors identified several instances of concrete conditions in the 'A' and 'B' residual heat removal (RHR) vaults that exceeded the quantitative Tier II criteria specified in NextEra's procedure 36180, "Structural Monitoring

Program.” The Tier II criteria mirror the requirements specified in the American Concrete Institute standard ACI 349.3R-96, “Evaluation of Existing Nuclear Safety Related Concrete Structures.” As documented in IR 05000443/2014003 (ADAMS Accession No. ML14212A458), the specific conditions observed by the resident inspectors included: spalling greater than 20 millimeter (mm) in depth, passive cracks greater than 1 mm, and staining of an undefined source on concrete surfaces. NextEra’s structural monitoring program procedure states that measurable discontinuities exceeding specified Tier II quantitative limits shall be considered unacceptable and in need of further technical evaluation. Since the issues identified exceeded the threshold (i.e., Tier II) for NextEra to take action, no additional quantitative descriptions were deemed necessary. Additional publicly available information on this issue identified by the inspectors can be found in this IR. In subsequent correspondence between the NRC and NextEra (for example ADAMS Accession Nos. ML15251A333 and ML16127A155), the qualitative descriptor “discrete wide cracks” has been sufficiently effective to communicate issues associated with the conditions first identified by inspectors in the RHR vaults in May 2014.

NextEra has procedures in place to obtain measurements of Seabrook’s structural “gaps” periodically. Data from these measurements are in Seabrook’s internal plant records. While selected samples of these records have been inspected onsite by resident inspectors and specialist inspectors from NRC Region I and Headquarters, we are not aware that any of this information is currently available as records of the NRC, so they are not available for public release.

#### 9) Concern Regarding NextEra Response Letter to an NRC violation

##### Question(s) and Concern(s):

In an email dated July 28, 2016 (ADAMS Accession No. ML16215A043), to Fred Bower, you asked for information on NextEra’s response letter to the NRC violation discussed in an NRC acknowledgement letter dated June 29, 2016 (ADAMS Accession No. ML16182A031).

##### Response(s):

A response to this question was previously provided to you in an email dated August 1, 2016 (ADAMS Accession No. ML16215A043), and this response remains valid.

#### 10) Concern with NextEra’s Full Compliance with an NRC violation

##### Question(s) and Concern(s):

In an email dated August 1, 2016 (ADAMS Accession No. ML16230A374), you referred to NextEra’s reply to a Notice of Violation (NOV) (EA-16-101) and the statement made in Section IV, “Date When Full Compliance Will Be Achieved,” of Attachment 1 to this reply (ADAMS Accession No. ML16161A534), in which NextEra stated, in part, “Full compliance for the cited violation was achieved on February 19, 2016, when the second POD [prompt operability determination] discussed in the notice of violation was approved by the Shift Manager.” You requested that the NRC provide you with NextEra’s full compliance.

Response(s):

As documented in the cover letter that forwarded IR 05000443/20160008 and the NOV to the licensee (ADAMS Accession No. ML16127A155), NextEra was cited for two examples where initial and prompt operability determinations were not completed by NextEra staff when additional information regarding the effects of ASR on safety-related concrete structures was identified. The NRC cover letter goes on to state that prompt operability determinations have since been developed and were reviewed during this inspection. The IR noted that the NRC inspection team concluded, based on its review of recently completed operability determination documents (PODs) by NextEra, that Seabrook's ASR-affected structures are capable of performing their safety-related functions considering the observed cracking and deformation. The timing and additional details regarding the inspection activities are documented in IR 05000443/20160008 (ADAMS Accession No. ML16127A155).

The NOV required additional actions by the licensee and these were identified in the letter (ADAMS Accession No. ML16127A155) and NextEra's reply to the NOV (ADAMS Accession No. ML16161A534). As stated in the acknowledgement letter (ADAMS Accession No. ML16182A031) to NextEra, future NRC inspections will review the implementation of NextEra's corrective actions to determine their adequacy and to determine that full compliance has been achieved. This inspection will be documented in a future publicly available IR.

Please note that the prompt operability determinations are in Seabrook's internal plant records. While these records were inspected onsite, the inspectors have indicated that they did not remove these from the site and we are not aware that they are in the possession of any NRC staff member thus they are not available for public release as NRC records.

11) Concern with NextEra's Full Compliance with an NRC violation

Question(s) and Concern(s):

On August 4, 2016, and August 11, 2016, you sent emails to Angela Buford (ADAMS Accession Nos. ML16224A220 and ML16228A016, respectively) and attached a summary of a June 15, 2016, "Pre-Submittal Meeting with NextEra Energy Regarding Proposed License Amendment Request on Alkali Silica Reaction," dated July 29, 2016 (ADAMS Accession No. ML16204A261). Your email states that based on your review of the meeting summary, the NRC staff asked questions but did not document them in the meeting summary. You requested to be provided with the questions stated or given to NextEra.

Response(s):

A response to this question was previously provided to you in emails dated during the period from August 15 to 16, 2016 (ADAMS Accession Nos. ML16228A212, ML16230A348, ML16230A358, and ML16230A360), and these responses remain valid.