

March 1, 2019

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of)	
NextEra Energy Seabrook, LLC)	Docket No. 50-443
(Seabrook Station, Unit 1))	
)	

**C-10 RESEARCH AND EDUCATION FOUNDATION’S REPLY TO OPPOSITIONS
BY NEXTERA AND NRC STAFF TO EMERGENCY PETITION
FOR EXERCISE OF COMMISSION’S SUPERVISORY AUTHORITY TO REVERSE
NO SIGNIFICANT HAZARDS DETERMINATION AND IMMEDIATELY SUSPEND
LICENSE AMENDMENT AND LICENSE RENEWAL DECISIONS**

I. INTRODUCTION

C-10 Research and Education Foundation (“C-10”) hereby replies to oppositions submitted by NextEra Energy Seabrook (“NextEra”) and the U.S. Nuclear Regulatory Commission (“NRC” or “Commission”) Staff to C-10’s Emergency Petition asking the NRC Commissioners to exercise their inherent supervisory authority to require the NRC Staff to address the safety risk posed by Alkali-Silica Reaction (“ASR”) in the Seabrook containment before taking licensing actions on NextEra’s license amendment application (“LAR”) and license renewal application (“LRA”). If uncorrected, these licensing actions would allow Seabrook to continue to operate for as long as 30 additional years from now (until 2050) without a reasonable assurance that its containment complies with fundamental NRC requirements for safety during an earthquake.¹ Their arguments in opposition to C-10’s Emergency Petition are without merit.

¹ NextEra’s Answer Opposing C-10’s Emergency Petition (Feb. 25, 2019) (“NextEra’s Opp.”); NRC Staff’s Answer to C-10’s Emergency Petition (Feb. 25, 2019) (“NRC Staff Answer”).

NextEra’s and the NRC Staff’s Answers respond to Emergency Petition by C-10 Research and Education Foundation for Exercise of Commission’s Supervisory Authority to Reverse No Significant Hazards Determination and Immediately Suspend License Amendment and License

This Reply is supported by the attached Reply Declaration of Victor E. Saouma, Ph.D (March 1, 2019) (“Saouma Reply Declaration”).

II. ARGUMENT

A. The Staff Fails to Justify Its Lack of Independence or Regulatory Rigor in Deferring to NextEra’s Inadequate Tests and Methods for Assessing ASR.

The NRC stands at a crucial regulatory juncture with respect to ASR at Seabrook. The agency has closed out an enforcement action begun after ASR was discovered in the Seabrook containment in 2009, it is poised to approve the condition of the containment as part of the current licensing basis (“CLB”) for continued operation during the next ten years, and it is about to allow Seabrook to operate an additional 20 years beyond 2030, based on part on findings that ASR is adequately addressed in the CLB. These are all momentous regulatory decisions affecting the day-to-day safety of members of the public in the Seabrook area and beyond. However, the history of the NRC Staff’s licensing and enforcement oversight of ASR at Seabrook shows that the Staff has allowed NextEra to take over the NRC’s own regulatory role of addressing the significance of the newly-discovered phenomenon of ASR at Seabrook, without ensuring that basic scientific principles essential to effective regulation would be observed. The NRC Staff refuses to grapple with the gravity of its regulatory failure, and leaves the following critical questions unanswered:

Renewal Decisions (Feb. 13, 2019) (“Emergency Petition”). The Emergency Petition is supported by Declaration of Victor E. Saouma, Ph.D (Feb. 12, 2019) (“Saouma Declaration”) and Dr. Saouma’s Expert Report, *Concerns Regarding Structural Evaluation of Seabrook Nuclear Power Plant* (Feb. 12, 2019) (Attachment 4 to Saouma Declaration) (“Saouma Expert Report”). The non-proprietary Introduction and Summary to Dr. Saouma’s Expert Report is attached to his Declaration as Exhibit 4a.

- Why did the NRC Staff allow NextEra to test concrete that was not representative of Seabrook containment conditions in significant respects? Or to mis-apply the test results?
- Why did the NRC Staff accept NextEra's use of a simplistic linear and deterministic finite element analysis, ignoring probabilistic and nonlinear methods whose greater accuracy are well-established?
- Why did the NRC Staff fail to conduct any independent peer review of NextEra's work, or even to consult research that had been commissioned by the NRC itself and that would have demonstrated the inadequacy of NextEra's methods? Why does the Staff treat this relevant independent research as something to be consulted in the future rather than information to be relied on in its current regulatory decisions?
- Why did the NRC Staff accept NextEra's use of seismic regulatory standards that are applicable to construction and design of new reactors, but not to the longstanding operation of already-licensed reactors like Seabrook?

These unanswered questions point to a systemic breakdown in the Staff's regulatory approach to ASR at Seabrook, with the result that the NRC Staff is now preparing to make the significant licensing decisions of amending and renewing the Seabrook operating licenses to allow operation for an additional 30 years from now (20 years past the current license expiration date), without an adequate regulatory basis. They also point to a breakdown in oversight by the Advisory Committee on Reactor Safeguards ("ACRS"), which completely failed to introduce any level of rigor or independence into the review process. *See* Saouma Reply Declaration, ¶ 5.

B. The NRC Staff Fails to Address C-10's Substantive Concerns.

Dr. Saouma's Declaration and curriculum vitae demonstrate his extremely high level of qualifications, as one of the world's leading experts on ASR, to evaluate the adequacy of

NextEra's tests and analyses to support NRC regulatory decisions. He was also an NRC contractor on appropriate methods for assessing ASR damage, and he reported his research results to the NRC in 2017. Yet, the Staff does not explain why it failed to apply Dr. Saouma's research results to ASR at Seabrook, or even consider them. And the Staff's Answer does not respond at all to the extensive and detailed technical criticisms in Dr. Saouma's Declaration and Expert Report regarding NextEra's inadequate and outdated ASR tests and analyses. The Staff is simply silent on these significant technical issues.²

Instead of addressing Dr. Saouma's criticism, the NRC Staff attempts to defend its approval of NextEra's testing and analysis programs by invoking the ACRS' positive review, and by making generalizations about the rigor of its own review. According to the Staff, for example, the ACRS "has evaluated the issue of ASR at Seabrook and concluded that the amendment request 'establishes a robust analytical methodology, supported by a comprehensive large scale test program, for the treatment and monitoring of [ASR]-affected Seismic Category I structures at Seabrook.'" NRC Staff Answer at 13 (quoting Letter from Michael Corradini, Chairman, ACRS, to Kristine L. Svinicki, Chairman, NRC, re: Seabrook Station Unit 1 License Renewal Application: Review of Licensee Program Addressing Alkali-Silica Reaction at 2 (Dec. 14, 2018)).

² If anything, the Staff tries to downplay Dr. Saouma's expertise, stating, for example, that Dr. Saouma's opinion constitutes the "mere articulation of possible grounds for reversal of an NRC decision." NRC Staff Answer at 9. As discussed in Dr. Saouma's Reply Declaration, his Expert Report does not present facts or opinions that are merely "possible," nor is his expertise in any way inadequate to fully assess NextEra's testing and analysis programs. Dr. Saouma's Expert Report describes those programs in detail, evaluates them against methodologies used by the scientific community as published in peer-reviewed journals, and fully explains why NextEra's work is fundamentally inadequate to support any conclusions about the safe operation of Seabrook in the presence of ASR. Saouma Reply Declaration, ¶ 4.

But NextEra’s methods were not “robust.” As explained by Dr. Saouma, they were both simplistic and inappropriate for any purpose related to seismic risk other than to assess new designs – a purpose not applicable to Seabrook. Saouma Reply Declaration, ¶ 5(a). Thus, the Staff’s reliance on the ACRS is misplaced.

The Staff also relies on the ACRS’ statement that during the past ten years, “a large body of ASR research similar to the [large scale testing program (LSTP)]” has “produced similar results to the LSTP, observing increased structural capacity in highly constrained, ASR-affected structures.” NRC Staff Answer at 31 (citing ACRS Letter at 2). This is not correct. Notably, none of the documents referenced by ACRS espouse the simplistic methodology used by NextEra for Seabrook. Saouma Reply Declaration, 5(d). Nor is there evidence in the record that the NRC Staff or the ACRS consulted the existing body of knowledge. *Id.* Had they done so, they would have found testing and analysis procedures that very much differed from those undertaken by NextEra. *Id.* Dr. Saouma’s own research (referenced in note 61 of the NRC Staff Answer), provides an example of a modern probabilistic based seismic analysis of a nuclear power plant affected by ASR. Dr. Saouma’s model is far more appropriate to use in 2019 than the simplistic linear and deterministic analysis used by SGH for Seabrook. *Id.*³ Similarly, the report of the Light Water Reactor Sustainability Program - A Summary of Collaborative Research and Development Activities by the Idaho National Laboratory (office of Nuclear Energy) (referenced in footnote 63 of the NRC Staff Answer) has a full chapter on “Risk-Informed System Analysis”

³ The Final Report of the Organisation for Economic Co-operation and Development (“OECD”), Nuclear Energy Agency, “*Phase II of the Assessment of Structures Subjected to Concrete Pathologies*” (referenced in footnote 65 of the NRC Staff Answer) is another example of a study whose methodology and results differed from the LSTP. The report summarizes presentations made at a workshop in Toronto under the auspices of the Canadian Nuclear Energy Agency and OECD. Shear walls affected by ASR were allowed to deteriorate with time, and were subsequently tested. Saouma Reply Declaration, ¶5(e).

that could have inspired NextEra to follow a more sophisticated and effective analytical method at Seabrook. But it was ignored. Saouma Reply Declaration, ¶ 5(f).⁴

Moreover, to the extent that the ACRS relied on “monitoring” as one of the key tools for addressing ASR (NRC Staff Answer at 13), it is not an effective substitute for an adequate current understanding of ASR. By the time cracks appear on the surface of the containment, corresponding inner expansion would be much higher and potentially at dangerous levels. As a result, monitoring may detect problems too late to be effective. Saouma Reply Declaration, ¶ 5(b). Thus, the ACRS failed to apply the necessary level of rigor and independence to its own review.

For its own part, the Staff claims to have consulted independent research on the issue of ASR, but fails to acknowledge the fact that some of the research results contradict NextEra’s methods, and none of them endorse those methods. Saouma Reply Declaration, ¶¶ 5(d), 5(f). And some of the papers cited by the Staff are simply irrelevant. *Id.*, ¶ 5(g).

The Staff also attempts to defend the adequacy of its own review of NextEra’s work by stating that the Staff “evaluated the [license amendment request (LAR)] against all applicable regulatory standards.” NRC Staff Answer at 16. As Dr. Saouma pointed out in his Expert Report (at page 11), however, the Staff misapplied NRC regulatory standards by using design standards for new reactors, instead of evaluating what was needed to ensure the safety of a reactor that already had been operating for many years. Equally important, the NRC *has no regulations* that are addressed specifically to ASR. Thus, this statement is not meaningful for purposes of assessing regulatory compliance. Saouma Reply Declaration, ¶ 7.

⁴ A number of other reports referenced by the ACRS and the NRC Staff are simply irrelevant or so general as to be unhelpful. Saouma Reply Declaration, ¶ 5(g).

The Staff's Answer also incorrectly suggests that it performed a peer review through Dr. Saouma -- by citing to his participation in a study of ASR. Staff Answer at 16 (citing NUREG/CR-7153, Vol. 4: Aging of Concrete and Civil Structures (2014). But Vol. 4 of NUREG/CR-7153 does not concern the evaluation of ASR behavior at Seabrook; instead it identifies ASR-related concerns that should be addressed in subsequent license renewal proceedings. Saouma Reply Declaration, ¶ 6. While experts were available who could have applied their significant expertise to peer review of NextEra's and the NRC's work, the NRC did not consult them. *Id.*, ¶ 7. Thus, the NRC Staff has demonstrated a fundamentally inadequate concept of what constitutes an independent peer review.

C. Exercise of the Commission's Supervisory Authority is Essential to Restore the Integrity and Effectiveness of the NRC's Regulatory Processes.

C-10 brings its Emergency Petition with the full understanding that it is the Commission's sole prerogative to decide whether and on what terms to review the Staff's conduct in this proceeding. *Carolina Power and Light Co.* (Shearon Harris Nuclear Power Plant), CLI-00-11, 51 N.R.C. 297, 299 (2000).⁵ The Commission also retains the discretion to determine the criteria for exercising its authority in "the special circumstances" of each case. *Pacific Gas and Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2), CLI-86-12, 24 N.R.C. 1, 5 (1986). Contrary to NextEra's suggestion, no Commission case holds that the Commission must apply traditional stay criteria in every case involving the discretionary exercise of the Commission's supervisory authority. In *Entergy Nuclear Vermont Yankee* (Vermont Yankee Nuclear Power

⁵ While members of the public have no right to insist on the Commission's exercise of its supervisory authority, neither is there any prohibition against requesting the Commission to exercise that authority as a matter of its discretion. While NextEra suggests otherwise (at page 8), it cites no case support for that proposition, nor can any be found. By the same token, the concept of waiver does not logically apply to circumstances where a petitioner seeks exercise of the Commission's supervisory authority. See NextEra Answer at 11.

Station), CLI-06-08, 63 NRC 235 (2006), for example, the petitioner asked the Commission to “prevent or stay” the issuance of a No Significant Hazards determination on the grounds that it would be denied “effective redress and due process” if the license were issued before completion of a hearing. 63 N.R.C. at 237. The Commission applied traditional stay criteria to the request. In this case, in contrast, the relief sought by C-10 goes well beyond completion of the LAR hearing, and includes remedial supervision and instruction of the Staff.

Under the special circumstances of this case, the criteria applied in *Yankee Atomic Electric Co.* (Yankee Rowe Nuclear Power Station), CLI-91-11, 34 NRC 3, 12-13 (1991). Like *Yankee Atomic Electric Co.* this case involves new and important safety issues, not previously addressed by the NRC, that are also relevant to license renewal. As in *Yankee Atomic Electric Co.*, for example NextEra’s faulty work is likely to be offered as a regulatory model for any other reactors where ASR becomes an issue in the future – whether in ordinary enforcement or LRA reviews. Just as the manner in which the NRC Staff reviewed and accepted NextEra’s testing and analysis programs “was so devoid of scientific rigor or independence as to fatally undermine the credibility of its determinations regarding the safety of continuing to operate Seabrook in the presence of ASR” (Saouma Reply Declaration, ¶ 9), and therefore it is likely to undermine the credibility of any other regulatory decisions in which it is applied.

NextEra and the Staff argue that the issues raised by C-10 are more properly relegated to the ongoing LAR proceeding.⁶ In fact, however, the scope of that proceeding does not extend to any review of the Staff’s conduct. *See* discussion above at 6 and NRC Staff Answer at 17 and n.76.

⁶ NextEra also argues that C-10 improperly seeks to expand the scope of its admitted contention to include concerns that C-10 did not raise initially in the LAR proceeding. NextEra Answer at 3-4. But the focus of C-10’s Emergency Petition is the Staff’s conduct, which is not a subject of that proceeding. *See* discussion below at page 8. In any event, C-10 does not concede that its concerns fall outside the scope of the LAR proceeding.

Thus, the Staff's review and decision-making processes regarding ASR risks, including its review of NextEra's testing and analyses, its decision not to consult independent experts or conduct a peer review, and its acceptance of inappropriate standards for evaluating regulatory compliance with seismic standards, are not within the scope of the LAR adjudication. Yet they are extremely important subjects to address, given the safety significance of the Seabrook containment, the novelty of ASR as a regulatory issue, and the precedent-setting nature of the Seabrook review. Also not included in the scope of the LAR proceeding are the urgent and far-reaching policy questions raised by these circumstances about the degree to which the Staff should be permitted to delegate to licensees the ability to set standards for their own safe operation where no previous standards exist, without imposing effective regulatory oversight. Here, while the Staff had access to information about the current state of knowledge of ASR and state-of-the art methods for evaluating ASR effects, there is no evidence that it attempted to introduce that information into NextEra's tests or analytical methods, or that the Staff even consulted those experts. This serious abrogation of independence and rigor in setting safety standards is not the appropriate subject of the LAR proceeding, but of Commission oversight.

For all of these reasons, it is critical for the Commission to exercise its inherent supervisory authority to preserve the integrity of its licensing and oversight processes by suspending the impending approval of NextEra's LRA and LAR and reversing the No Significant Hazards determination for the LAR, while also giving the Staff direction and guidance for establishing appropriately rigorous standards and review procedures for evaluating and regulating ASR at Seabrook.

III. RENEWED REQUEST FOR RELIEF

For the foregoing reasons, C-10 renews its request that the Commission:

- Review and reverse the Staff's No Significant Hazards Determination to allow the prior completion of an adjudicatory hearing on C-10's admitted ASR-related contentions before the ASLB;
- To ensure that the Staff does not take licensing actions during Commission review of the NSH Determination, immediately order the suspension of the LAR and LRA decisions.
- Give due recognition to the significance, complexity, and lack of adequately rigorous study of ASR by opening an in-depth inquiry into best practices for assessing ASR, including consideration of all relevant research and use of peer review by an internationally recognized independent panel; and
- Provide guidance and instruction to the Staff for establishment of significantly more rigorous and sophisticated state-of-the-art methods and criteria for evaluating safety risks posed by ASR at Seabrook and other reactors.

Respectfully submitted,

/signed electronically by/
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Under penalty of perjury, Victor E. Saouma declares as follows:

- ¹ My Expert Report, attached as Exhibit 4 to my Declaration, contains information proprietary to NextEra and therefore is not a public document. However, the Summary and Introduction section of the Expert Report do not contain proprietary information; and is attached to my declaration as Exhibit 4a, a public document.

used by the scientific community as published in peer-reviewed journals. and fully explains why NextEra's work is fundamentally inadequate to support any conclusions about the safe operation of Seabrook in the presence of ASR. In addition, although my Expert Report discusses my concerns in detail, neither the NRC Staff's nor NextEra's Answer provides any technical response. They simply restate general conclusions about the completeness and adequacy of NextEra's testing and analyses.

5. In defending the NRC Staff's approval of NextEra's testing and analysis programs, the NRC Staff asserts that the Advisory Committee on Reactor Safeguards (ACRS) "has evaluated the issue of ASR at Seabrook and concluded that the amendment request 'establishes a robust analytical methodology, supported by a comprehensive large scale test program, for the treatment and monitoring of [ASR]-affected Seismic Category I structures at Seabrook.'" NRC Staff Answer at 13 (quoting Letter from Michael Corradini, Chairman, ACRS, to Kristine L. Svinicki, Chairman, NRC, re: Seabrook Station Unit 1 License Renewal Application: Review of Licensee Program Addressing Alkali-Silica Reaction at 2 (Dec. 14, 2018)). I have read the ACRS Letter, as well as the transcript of an October 31, 2018 meeting of the ACRS Subcommittee on License Renewal regarding ASR. Based on my review of these documents, I find the ACRS' own review of the Seabrook testing and analysis programs lacks adequate rigor in several important respects.
 - a. First, as discussed in my Expert Report, NextEra's methods were not "robust," as claimed by Dr. Corradini. To the contrary, the FSEL tests were not representative of Seabrook conditions, and the linear and deterministic finite element analysis used by SGH were both simplistic and inappropriate for any purpose related to seismic risk other than to assess new designs. These significant testing deficiencies are discussed at page 1 and in sections 2.3, 3.3, and 4.3 of my Expert Report.
 - b. The ACRS Letter refers to "monitoring" as one of the key tools for addressing ASR. Though some instruments may indeed provide limited internal through thickness expansion (for instance, the Snap Ring Anchors by Geokon), the reported usage of in plane surface monitoring is unreliable. Besides, as stated in in my Expert Report (page 4, Fig. 1), ASR distribution in a major structure such as a NPP is very spotty and thus the probability that monitoring instrumentation would be placed in new "hot spots" is very small. Further, by the time cracks appear on the surface, corresponding inner expansion would be much higher and potentially at dangerous levels. Thus, monitoring may detect problems too late to be effective.
 - c. The ACRS Letter claims that during the past ten years, "a large body of ASR research similar to the [large scale testing program (LSTP)]" has "produced similar results to the LSTP, observing increased structural capacity in highly constrained, ASR-affected structures." (page 2). At page 15, the NRC Staff Answer also refers to this body of research, stating that "ASR is being investigated by the Electric Power Research Institute's (EPRI) Long Term Operations research program, the Department of Energy's (DOE) Light Water Reactor Sustainability research program, the Nuclear Energy Agency's (NEA) Committee on the Safety of Nuclear Installations (CSNI),

Working Group on Integrity and Ageing of Components and Structures, and France's Institut de Radioprotection et de Sûreté Nucléaire (IRSN).”

- d. Whereas none of the documents referenced by ACRS and the NRC Staff espouse the simplistic methodology used by NextEra for Seabrook, there is neither evidence that the NRC Staff or the ACRS consulted the existing body of knowledge. Had they done so, they would have found testing and analysis procedures that very much differed from those undertaken by NextEra. For reference, my own research, which is referenced in note 61 of the NRC Staff Answer, provides an example of a modern probabilistic based seismic analysis of an NPP affected by ASR. This model is far more appropriate to use in 2019 than the simplistic linear and deterministic analysis used by SGH for Seabrook. Indeed, the Idaho National Laboratory (INL) Grizzly Program has implemented my ASR model in its own code. (Huang, Spencer, and Cai, 2015 (cited in my Expert Report at page 13). Furthermore, the fitness of a probabilistic model is discussed at page 1 and Section 5 of my Expert Report as well as in Chapter 4 of the INL Report cited in footnote 63. Finally, a manuscript I submitted over two years ago to the peer-reviewed Journal of Nuclear Engineering and Design (*Seismic Capacity and Fragility Analysis of an ASR-Affected Nuclear Containment Vessel Structure*) has been accepted for publication after two rounds of peer reviews and 87 comments by anonymous peer reviewers. This last work is a direct outcome of my work for the NRC presented in Oct. 2017 at NRC headquarters.
- e. The Final Report of the Organisation for Economic Co-operation and Development, Nuclear Energy Agency, “*Phase II of the Assessment of Structures Subjected to Concrete Pathologies*” referenced in footnote 65 of the NRC Staff Answer is another example of a study whose methodology and results differed from the LTSP. The report summarizes presentations made at a workshop in Toronto under the auspices of the Canadian Nuclear Energy Agency and OECD. Shear walls affected by ASR were allowed to deteriorate with time, and were subsequently tested. Participants were asked to make prediction. It is noteworthy that:
 - None of the analyses made the same fundamentally flawed pre-analysis assumption in their finite element analysis as NextEra that the shear strength of the ASR affected concrete is higher than the unaffected one. Indeed, many (but not all) found that for a shear wall, reinforcement may increase the shear resistance. However, those results are not transportable to a full blown NPP as the (shear) reinforcement is much different.
 - All recognized the importance of temperature (and relative humidity), contrary to Next Era. Indeed, as discussed in my Expert Report, temperature and internal Relative Humidity will greatly affect the expansion of the thermodynamically driven alkali-silica reaction. Most of them, recognized the anisotropic nature of the ASR expansion. Both of these critical issues were ignored by NextEra.
 - The main objective of the workshop was to make long term prediction of the expansion, implicitly recognizing that the kinetic of the reaction has to be

modeled. This was not modeled either in NextEra analysis, through claims are being made that it can anticipate long term expansions.

- Some models (such as Vector 3 of the University of Toronto) used my ASR model.
 - To the best of my knowledge, the only presentation that was ultimately published is my own,
<https://www.sciencedirect.com/science/article/pii/S0141029618304206>
 - And yet, this workshop was co-organized by NRC's Jacob Philips who could have brought those analyses to the ACRS.
- f. Similarly, the report of the Light Water Reactor Sustainability Program - A Summary of Collaborative Research and Development Activities by the Idaho National Laboratory (office of Nuclear Energy) referenced in footnote 63 of the NRC Staff answer, has a full chapter on "Risk-Informed System Analysis" that could have inspired NextEra to follow a more sophisticated and effective analytical method at Seabrook. But it was ignored.
- g. A number of other reports referenced by the ACRS and the NRC Staff are simply irrelevant or so general as to be unhelpful. For example, the DOE's "Summary of Collaborative Research and Development Activities" referenced also in note 63 of the NRC Staff's Answer has barely half a page on ASR and does not reference any detailed report. In addition, EPRI's research on ASR has focused exclusively on nondestructive evaluation. The reports by Wong and Bernhoft referenced in footnote 63 are very general and put very little emphasis on ASR. The DOE's Light-Water Reactor Sustainability Program, Integrated Program Plan," referred to in footnote 64 of the NRC Staff Answer, provides a list of research priorities for subsequent license renewal.
6. In response to my criticism that the NRC Staff should use "peer review by an internationally recognized independent panel," the NRC Staff cites a study that I participated in and asserts that "the Staff has already used an expert panel to identify knowledge gap areas with regard to the aging mechanisms of concrete structures for subsequent license renewal to 80 years, which included consideration of ASR." NRC Staff Answer at 16 (citing Expanded Materials Degradation Assessment (EMDA), Vol. 4: Aging of Concrete and Civil Structures, NUREG/CR-7153 (Oct. 2014) (ML14279A430). But the only purpose of the expert panel in that case was to identify concerns that should be addressed if an NPP license is extended from 60 to 80 years, *i.e.*, subsequent license renewal (SLR). Not only is SLR not at issue here, but the study had nothing to do with evaluating appropriate testing or analytical methods for evaluating an NPP suffering from ASR.
7. I am also concerned that the NRC Staff does not have an appropriately rigorous concept of what constitutes an independent peer review. As recognized in the NRC Staff Answer at page 15 and footnote 63, a wide array of U.S. and international agencies and institutions have studied ASR (to various degrees of depths). The scientists and engineers who are responsible for this research, and many others not cited, could have been appropriate peer reviewers,

because (a) they are outside the NRC, (b) they have significant expertise in ASR (as evidenced by scientific publications in peer reviewed journals), and (c) their work covers a range of topics and disciplines. Given that ASR was only discovered in U.S. NPPs during the past ten years, it is particularly important to perform an adequately rigorous and independent review. Of course, the work of independent researchers must be adapted to the problem at hand (unique characteristics of ASR in an NPP, and the simultaneous occurrence of an earthquake), but at no time should any regulator disregard or violate scientifically accepted premises for investigating ASR. Yet, one can find no indication in documents regarding the Seabrook tests and analysis that independent expert scientists were consulted. Instead, the NRC engineers in one branch of the agency consulted engineers in another branch of the same agency. In my opinion, a review by employees of the same government agency, which does not include scientists who are actively engaged in research on the issue, does not qualify as a peer review.

8. The NRC Staff also defends the adequacy of its own review of NextEra's work by stating that the Staff "evaluated the [license amendment request (LAR)] against all applicable regulatory standards." NRC Staff Answer at 16. As I pointed out in my Expert Report (at page 11), however, the Staff misapplied NRC regulatory standards by using design standards for new reactors, instead of evaluating what was needed to ensure the safety of a reactor that already had been operating for many years. Equally important, the NRC *has no regulations* that are addressed specifically to ASR. Thus, this statement is not meaningful for purposes of assessing regulatory compliance.
9. In my expert opinion, the manner in which the NRC Staff reviewed and accepted NextEra's testing and analysis programs was so devoid of scientific rigor or independence as to fatally undermine the credibility of its determinations regarding the safety of continuing to operate Seabrook in the presence of ASR. Since, 2009, when ASR was first discovered as an unprecedented and previously unregulated phenomenon, the NRC has failed to exercise autonomous or rigorous regulatory oversight of NextEra. Instead, the Staff permitted NextEra, a licensee without the necessary qualifications or lack of self-interest, to write its own regulatory program for addressing ASR. This regulatory program included the entire gamut of relevant issues, such as testing protocols, analytical methods, and the choice of self-written industry guidance that would be applied. While the NRC was aware of international ASR research by highly qualified experts, including research commissioned by the NRC itself, the agency accepted the conceptual framework provided by NextEra and never inquired into the much more advanced methods being employed by independent recognized experts, or whether the methods pursued by NextEra are indeed on solid and rigorous scientific ground. Although some of the independent research (including my own) had been completed by late 2017 and showed that NextEra's methods were overly simplistic, that work was disregarded. Furthermore, NRC failed to take the standard step in scientific inquiry of conducting a peer review by independent experts with significant expertise in the subject of ASR. The result is that NRC appears to be poised to accept an analysis of ASR at Seabrook by the licensee that is far below basic standards of scientific rigor required to effectively address the phenomenon of ASR, and that fails to provide an adequate assurance of the safety of Seabrook's operation.

The statements of fact in this Reply Declaration are true and correct to the best of my knowledge, and the opinions stated therein are based on my best professional judgment.



Victor E. Saouma

Dated: March 1, 2019

CERTIFICATE OF SERVICE

I certify that on March 1, 2019, I posted the following documents to the NRC's EIE Adjudicatory Submissions Portal:

- C-10's Motion for Leave to Reply to Oppositions to Emergency Petition for Exercise of Commission's Supervisory Authority to Reverse No Significant Hazards Determination and Immediately Suspend License Amendment and License Renewal Decisions
- C-10 Research and Education Foundation's Reply to Oppositions to Emergency Petition for Exercise of Commission's Supervisory Authority to Reverse No Significant Hazards Determination and Immediately Suspend License Amendment and License Renewal Decisions
 - Attachment 1: Reply Declaration of Victor E. Saouma, Ph.D (March 1, 2019)

[Electronically signed by]

Diane Curran