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

CHAIRMAN

September 16, 2021

Ms. Natalie H. Treat
Executive Director
C-10 Research and Education Foundation
11 Chestnut Street
Amesbury, MA 01913

Dear Ms. Treat:

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am responding to your letter dated August 9, 2021, in which you requested responses to several questions and concerns about alkali-silica reaction at Seabrook Station, Unit No. 1 (Seabrook). Responses to the specific questions in your letter are enclosed.

I appreciate your letter and continued interest in the NRC's oversight at Seabrook. If you have additional questions or need more information, please contact Justin Poole, Project Manager, Office of Nuclear Reactor Regulation, at 301-415-2048 or Justin.Poole@nrc.gov.

Sincerely,

Christopher T. Hanson

Enclosure:
As stated

U.S. Nuclear Regulatory Commission
Responses to Questions in the August 9, 2021, Letter

Question 1

Because so much is unknown about the rate of ASR [alkali-silica reaction] expansion, why doesn't NRC require the use of error bars in modeling its progression? This is one area where independent experts could be of assistance to quantify the margin of error. We don't know where we are on the curve. That is cause for concern by C-10 and Dr. Saouma; it should be of equal concern to NextEra and the NRC. Indeed, determination of the out-of-plane expansion relies on the availability of concrete cores saved during construction, and the empirical curve to relate degradation of elastic modulus with expansion. Thus we have two related questions:

a) How many construction cores have been saved over the past 40 years? We would like to know under which protocol were they collected (how many cores per cast cubic yard), under which conditions (temperature and relative humidity) have they been stored, and how many have been saved from the concrete cast in the containment building from the base to five feet above ground—the most critical segment of the building? A picture of those cores would go a long way in assuaging our concerns.

b) How confident are you in using the calibration curve? Can you quantify its 90% confidence level in terms of the associated uncertainties (calibration curve, empirical relationship between compressive strength and elastic modulus, representativeness of the closest core to an arbitrary location of sudden ASR expansion)? Ultimately, how tall would you expect the error bars to be?

There is no NRC requirement to save the initial construction cylinders ("cores") beyond the original testing conducted during construction. The licensee collected wet concrete samples during actual construction pours of each structure, and standard cylinders were cast and tested in accordance with applicable American Society for Testing and Materials standards at specified times (e.g., 7 days, 28 days), as required by the construction codes of record (American Concrete Institute 318-71, "Building Code Requirements for Reinforced Concrete," for other category 1 structures, and the 1973 Edition of American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section III, Division 2, for containment). The NRC does not maintain construction records; the licensee maintains these records on site for future reference and use, as necessary. When extensometers are installed in reinforced concrete structures at Seabrook, cores removed from the place where the extensometer will be located are tested; any through thickness expansion to date is then determined using the methodology approved by the NRC in License Amendment No. 159 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18204A291).

As detailed in the NRC safety evaluation for that license amendment, the NRC staff found that the licensee's use of the calibration curve provided reasonable assurance of adequate protection of the public health and safety. While neither the licensee nor the NRC staff placed a quantified confidence level, or error bars, on the calibration curve (i.e., the "modulus-expansion correlation"), a conservative modulus reduction factor was applied to the calibration curve to account for uncertainty. Additionally, as part of License Amendment No.

159, the NRC imposed a license condition that the curve be corroborated with actual field measurements and observations as additional plant-specific data become available. The adequacy of the calibration curve, along with the use of error bars, was considered by the Atomic Safety and Licensing Board, and the Board found that the licensee's approach to the corroboration study (without the use of error bars) provided reasonable assurance of adequate protection (Atomic Safety and Licensing Board Initial Decision LBP-20-9 (slip op. at 167–70) (ADAMS Accession No. ML20254A339); Atomic Safety and Licensing Board Memorandum and Order, LBP-20-12 (slip. op. at 10) (ADAMS Accession No. ML20322A417)).

Question 2:

How can the NRC increase transparency about what inspectors see at the plant, in particular, with regard to ASR?

If NRC inspections do not identify findings of more-than-minor significance, the agency's practice is generally to document the inspection in a brief, straightforward manner, usually consisting of a sentence or two describing the subject of the inspection. When NRC inspections identify performance issues that involve findings or violations of more-than-minor significance, the inspectors document agency activities and conclusions in greater detail, following a systematic process. Inspectors also document observations and minor violations in accordance with the NRC's Enforcement Manual and applicable inspection manual chapters. For example, the most recent Seabrook inspection report (ADAMS Accession No. ML21222A126) provided several such observations and a description of NextEra's ASR monitoring-related activities, as well as observations and documentation of a minor violation related to several other inspections conducted during the quarter. As the NRC staff conducts its ongoing inspections at Seabrook, agency inspectors will continue to document their inspection results consistent with agency policy in sufficient detail so that stakeholders can adequately follow NRC inspection activities and regulatory conclusions. Inspection reports will continue to be publicly available in the NRC's ADAMS at https://www.nrc.gov/reading-rm/adams.html. Members of the public can also sign up to receive notice of plant-specific public documents as they become available at https://www.nrc.gov/public-involve/listserver/plants-by-region.html.

Question 3:

Under what circumstances might the agency revisit Seabrook's concrete aging management program?

The NRC has a number of processes to alert the agency to new information that may trigger further consideration of a licensee's aging management program (AMP). For example, information gathered through inspections of the licensee's activities, reviews of plant operating experience, or the results of research activities could prompt a review of an AMP. Additionally, the NRC's regulation at 10 CFR 2.206 permits any person to petition the NRC to modify, suspend, or revoke a license, or for any other action as may be proper.

With respect to Seabrook specifically, Seabrook's ASR AMP in the current license includes requirements for the licensee to monitor plant-specific and industrywide operating experience, including applicable ongoing industry studies and research, update the program as necessary. These provisions are discussed in the NRC staff's safety evaluation report for Seabrook license renewal (ADAMS Accession No. ML18362A370). The NRC staff continues to monitor Seabrook's implementation of its ASR programs and related license conditions through inspections under the Reactor Oversight Process. If inspection results indicate that the licensee

is not properly implementing its programs or meeting license conditions, then the NRC can take actions to increase inspections and oversight. The staff documented the results of the NRC's most recent inspection that included an ASR sample in Seabrook Station, Unit No. 1, Integrated Inspection Report No. 05000443/2021002, dated August 11, 2021 (ADAMS Accession No. ML21222A126).

Question 4:

After what you've learned in the Seabrook case, would you support the development of NRC regulations governing concrete testing, and more scrutiny of other material-aging issues?

The NRC continues to believe that compliance with the existing regulations in 10 CFR Part 50, "Domestic licensing of production and utilization facilities," and 10 CFR Part 54, as well as inspection and related activities under the NRC's Reactor Oversight Process provide reasonable assurance that concrete degradation due to ASR, or other material-aging issues, will be managed such that affected safety-related structures at nuclear power plants will remain capable of performing their intended functions. Existing NRC regulations require licensees to monitor the performance and condition of safety-related structures and to address conditions adverse to quality (including significant degradation) in a manner sufficient to provide reasonable assurance that intended functions will be maintained. NRC regulations are intended to provide generic rules or requirements.