



# Seabrook Station

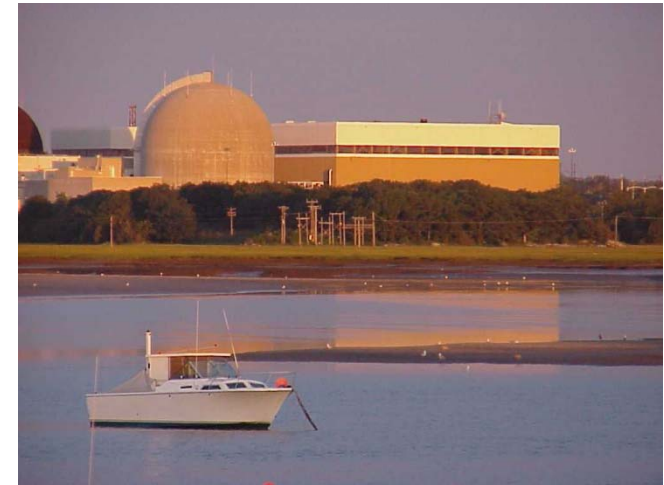
License Renewal Application  
Consideration of ASR

April 28, 2016

**Seabrook is one of the newest plants in the United States and was acquired by NextEra Energy in 2002**

## **Seabrook at a Glance**

- **Began commercial operations in 1990**
  - Initial operating license until 2030
  - 20-year license extension (2030-2050) in progress
- **INPO Excellence Rating for eight-consecutive rating periods (16 years)**
- **Record run leading into the latest refueling (525 days)**
- **Approximately 520 permanent employees**



**Seabrook Station provides approximately half of the electricity for New Hampshire, which is enough clean, reliable power for 1.2 million homes**

## NextEra Seabrook & MPR Attendees

- **Ken Browne**            **Seabrook ASR Project Manager**
- **Mike Ossing**        **Seabrook Licensing Manager**
- **Ed Carley**            **Seabrook License Renewal Supv.**
- **Brian Brown**        **Seabrook Principal Engineer**
- **Larry Nicholson**   **Fleet Licensing Director**
- **John Simons**        **MPR General Mgr Power Projects**
- **Chris Bagley**        **MPR Lead Engineer**

## Agenda

- **Update on UT/FSEL testing wrap-up**
- **Overview of Timeline**
  - Core testing
  - Extensometers
  - AMP refinement
  - LAR development
  - Walkdowns
- **AMP Discussion**
- **Closing remarks**

## Update on MPR/UT Testing

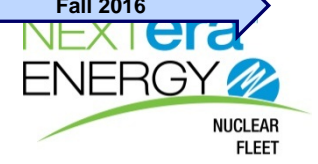
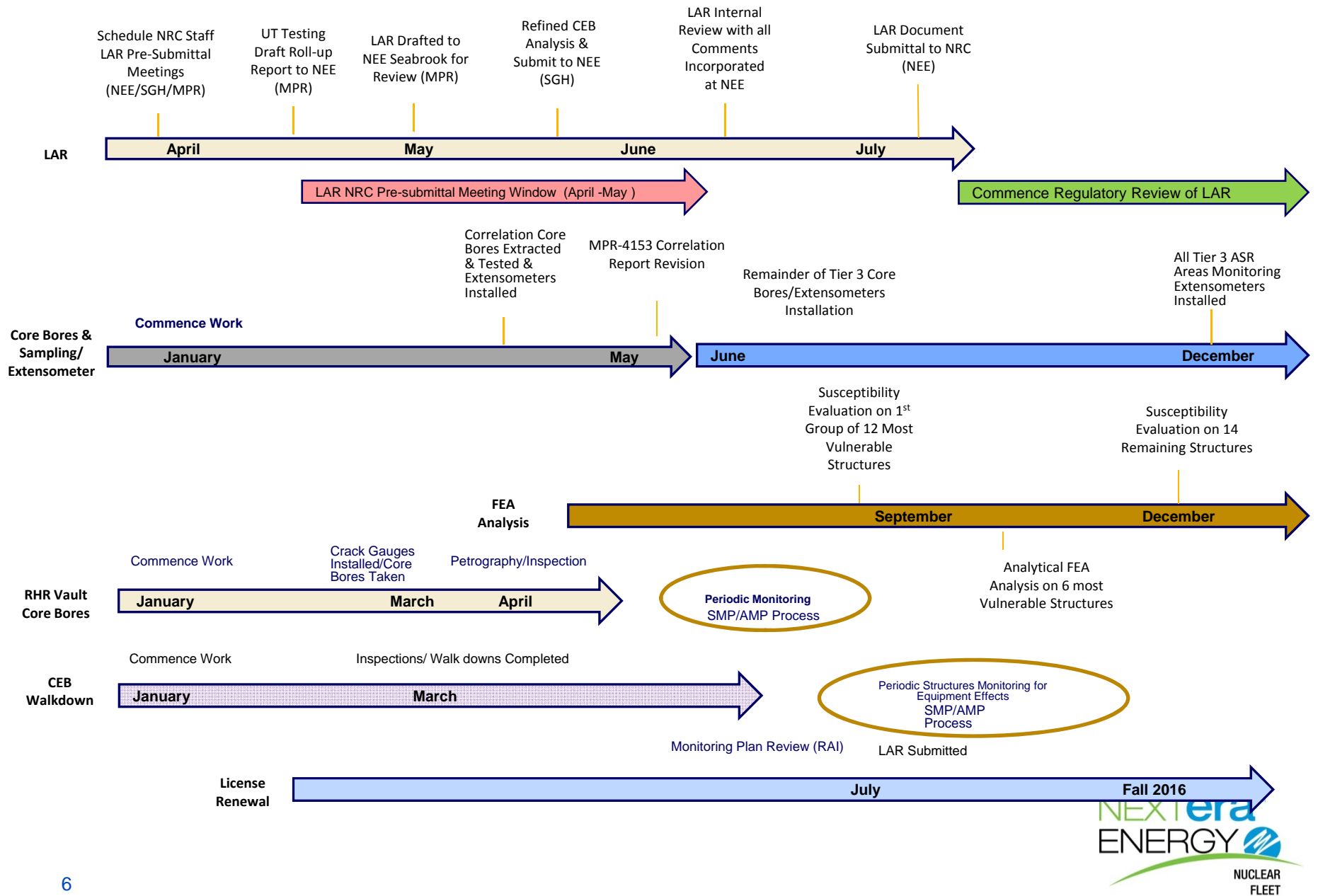
### Status

- All test programs complete
- Owner's Acceptance Review of test reports in progress

### Results

- Structural test programs showed no reduction in capacity for ASR expansion levels greater than plant
  - Shear
  - Reinforcement Anchorage and Flexure
  - Anchor Bolts
- Instrument program demonstrated accuracy and reliability of extensometers

# Seabrook Alkali Silica Reaction Issue Timeline 2016



## NRC Questions

### Topic:

**Incorporation of future research into ASR AMP**

### Response:

- **Seabrook will remain fully engaged in ongoing research and industry experience**
  - Seabrook plant specific OE will be documented for analysis
  - Industry leadership role with EPRI and NEI
  - Monitoring of various government sponsored and international research
- **Insights will be evaluated against adequacy of AMP**
- **AMP will be revised to ensure effectiveness**

## NRC Questions

### Topic:

**Validation that Large-Scale Testing Results are Comparable to Behavior of Seabrook Structures**

- Expansion behavior
- Applicability of modulus/expansion correlation from MPR-4153 for determining expansion to date at plant

### Response:

- **AMP will include evaluation of plant data for consistency with expansion behavior observed in test programs**
  - Qualitative comparison of trends for in-plane versus through-thickness expansion
  - Expansion within limits set based on test programs
  - Cores inspected to confirm lack of edge-effect cracking
- **Modulus correlation in MPR-4153 compares favorably to published data for expansion**



## NRC Questions

### Topic:

ASR effect on rebar

### Response:

- **AMP to be revised as a result of ASR effects with respect to current licensing basis**
- **Structural analysis to confirm rebar stresses will be within Code provisions**
- **Expansion limits will be set from building structural analyses**

## NRC Questions

### Topic:

#### **Effect of Concrete Backfill on Below Grade Structures**

- **Reconciliation of 12/2015 RAI response against plant experience with building deformation**
- **Representativeness of testing**

### Response:

- **Clarification: expansion of structures monitored in all directions**
- **Effect of concrete backfill on structure**
  - Applies an external load to the adjacent structure
  - Does not prevent expansion in through-thickness direction (can move inward)
- **Structural analysis will account for the external load**

## NRC Questions

### Topic:

## Uniform ASR versus Localized ASR

### Response:

- **Structural Capacity**
  - Uniform ASR expansion has a higher impact on structural performance.
- **Building Deformation**
  - Impact of localized expansion addressed in analyses

## Scope of Program

### Topic:

**Define structures in scope of AMP for deformation and discrete macro cracking due to ASR**

### Response:

- **All buildings within the scope of License Renewal are currently included in the revised AMP program**
- **Deformation and discrete macro cracking will be included as a program element for all buildings in scope of License Renewal**

## Parameters Monitored or Inspected

### Topic:

**Provide the link between the parameters monitored and the structural functionality and building deformation**

### Response:

- **AMP monitoring will include localized ASR-induced expansion strain as well as deformation of the concrete structures**
  - Data - CCI, through-thickness expansion, deformation inspections, crack gauges, invar wire
  - Limits defined in the structural analysis will corroborate the extent of degradation including determination of limits prior to loss of intended function
- **Link to structural functionality is established via analysis of the structure to assess rebar yielding**
- **Analysis will establish parameters monitored**

## Parameters Monitored or Inspected

### Topic:

**Monitoring for discrete macro cracking and deformation**

### Response:

- **Parameters to be monitored will include localized ASR induced expansion strain as well as deformation of the concrete structures.**
  - Examples include Seismic gap measurements, building measurements, building specific monitoring methods (Invar wire, Laser targets), SMP walkdowns

## Parameters Monitored or Inspected

### Topic:

**Aging management of non-structural components for ASR**

### Response:

- **In-scope Non-Structural Equipment and Components impacted by deformation will be age managed by a new plant specific AMP**

# Detection of Aging Effects

## Topic:

Early detection of degradation before loss of intended function.

## Response:

- **A new plant specific AMP will be developed using a tiered approach based on available margin.**
  - Monitoring and detection prior to significant margin reduction
  - Enter into corrective action program
  - Input into SMP
  - Restore equipment to original condition



## Detection of Aging Effects Continued

### Topic:

**Monitoring of structures not adjacent to misaligned components**

### Response:

- **Misaligned components are not the only parameters monitored for building deformation**
- **Monitoring will utilize a combination of inputs including ASR monitoring techniques, (CCI, extensometers, deformation) and monitoring of key assumptions in structures analysis along with equipment impacted by deformation**

## Monitoring and Trending

### Topic:

Monitoring and trending activities will provide a prediction of the extent and rate of degradation

### Response:

- Data will be trended based on design limits and frequencies utilizing a tiered approach and frequencies established to ensure that timely corrective actions

# Monitoring and Trending

## Topic:

Data collection and evaluation

## Response:

- Analysis of the structure includes additional margin on structural design to ensure that timely corrective actions are taken prior to exceeding design code limits. Data will be trended based on limits and frequencies established in the structural analysis.
- Margin is defined through a tiered approach where threshold limits are defined as the maximum allowable measurement for each monitoring element that limits the self-straining loads to some fraction of the maximum allowable self-straining load.

# Monitoring and Trending

## Topic:

Describe how the data will be trended over time

## Response:

- Data will be trended based on limits and frequencies established in the structural analysis to ensure that timely corrective actions are implemented prior to exceeding design code limits.
- Parameters monitored will be established and trended based on bounding limits in the structural analysis.

# Acceptance Criteria

## Topic:

**Process for calculating conditional acceptance criteria to ensure structure and component intended functions will be maintained under all CLB design conditions**

## Response:

- **A structural model is developed where ASR induced expansion is applied to the structure.**
- **Added load due to ASR is combined with other CLB loads.**
- **Resultant load combinations are evaluated to validate compliance with CLB structural design code requirements**

## Operating Experience

### Topic:

Impacts of internal Operating Experience will be adequately considered in AMP.

### Response:

- **AMP will consider operating experience—current & future**
- **Assigned Project Manager**
- **Engaged structural engineering firms**
  - Inspection of concrete structures
  - Analysis of concrete structures
- **Leveraging CEB experience to other ASR-affected structures**
  - Walkdown process
  - Evaluation process

## Closing Remarks

- **MPR/UT testing demonstrated no reduction in structural capacity and the effects can be monitored**
- **Extensive onsite work in 2016**
  - Withdrawing 115 core bores samples in areas throughout plant
  - Installing 52 extensometers to provide monitoring capability
  - Installing 19 crack gauges
- **Seabrook plans to submit in July 2016**
  - Part 50 License Amendment Request to reconcile the current licensing basis to address ASR and deformation
  - Revised Part 54 Aging Management Program to address ASR and deformation