Seabrook Station Public Meeting
Safety Implications and Status of Alkali-Silica Reaction Condition in Safety Related Structures

Nuclear Regulatory Commission
NRC Representatives

- Christopher Miller – Director, Division of Reactor Safety
- Michele Evans Director – Division of Operating Reactor Licensing
- Richard Conte – Senior Project Manager
- William Cook – Team Leader
- William Raymond – Senior Resident Inspector
NRC Representatives

Karl Farrar        Chris Miller        Michele Evans        Rich Conte

Bill Raymond        Bill Cook
Agenda

• What is Alkali-Silica Reaction (ASR)
• Virtual Tour of Plant
• Safety Implications
• Inspection Results, to date
• Future Activities
• Closing Remarks
• Respond to Questions
What is ASR?

Concrete Ingredients

**TYPICAL RATIO OF CONCRETE INGREDIENTS BY VOLUME**

- 6% Air
- 11% Portland Cement
- 41% Gravel or Crushed Stone (Coarse Aggregate)
- 26% Sand (Fine Aggregate)
- 16% Water
What is ASR?

Chemical Reaction

alkali (in cement) reacts with silica (in aggregate) and water

silica gel forms

+ H₂O

cracking occurs as gel expands
What is ASR?

Indications of ASR

- ASR has been identified in localized areas of Seabrook concrete structures.
- ASR is a chemical reaction in concrete, which occurs over time in the presence of water, between the alkaline cement and reactive silica found in some aggregates.
- ASR forms a gel that expands causing micro-cracks that affect concrete material properties.
Confirmed localized areas of ASR

- Effected Structures include:
  - “B” Electrical Tunnel
  - Containment Enclosure Building
  - Residual Heat Removal Vault
  - Emergency Diesel Generator Building
  - Emergency Feedwater Building
TOUR OF PLANT

30-inch Thick Enclosure Wall

48-inch Thick Containment Wall

Base Slab

Annulus area between Primary Containment and Containment Enclosure Building
TOUR OF PLANT

Other locations where ASR identified

- Primary Auxiliary Building
- Main Steam/Feedwater Pipe Chase East
- Alternate Cooling Tower
- Service Water Pump House
- Containment

VISUAL CRITERIA
- Pattern cracking
- Secondary deposits
- Staining and discoloration
- Deposits of alkali silica gel
Pattern Cracking (approx. 3 ft x 3 ft area)
TOUR OF PLANT

ASR Monitoring Method

June 2012

Stainless Steel Pins
SAFETY IMPLICATIONS

• NextEra engineering analysis (independently reviewed by NRC team) confirmed adequate design (safety) margin remains for ASR-affected reinforced concrete structures

• No significant visible deformations, distortions, or displacement identified in affected structures

• No indications of rebar degradation

• ASR limited to localized areas of the effected structures

• ASR degradation progressed slowly
Letter dated May 16, 21012, confirming eleven commitments made by NextEra, during a meeting with the NRC staff on April 23, 2012, associated with corrective actions to address ASR-affected reinforced concrete structures at Seabrook Station.
CAL Commitments

- Revise Prompt Operability Determination (POD) for B electrical tunnel
- Submit root cause evaluation
- Submit Interim Assessment
- Submit integrated corrective action plan
- Revise POD for buildings identified in extent-of-condition review
- Complete short term aggregate expansion testing
- Complete long term aggregate expansion testing
- Submit technical details of testing plan
- Update Structures Monitoring Program
- Perform six-month crack measurements
- Complete anchor testing program
Review of Confirmatory Action Letter (CAL) Items
(6 of 11 Reviewed, 5 Closed)

• Prompt Operability Determination for “B” Electrical Tunnel (CAL No. 1) - Closed
• Prompt Operability Determination for Other Affected Structures (CAL No. 5) - Closed
• Interim Structural Assessment (CAL No. 3) - Closed
• Complete Mortar Bar Test (CAL No. 6) - Closed
• Initial Six-Month Crack Measurements (CAL No. 10) - Closed
Other Areas Reviewed

• NextEra’s inspection of structures for evidence of ASR, independently reviewed by NRC staff
• Primary Containment engineering evaluation and operability assessment completed for ASR indications on three areas of the containment exterior surface
• Two issues closed, related to adequacy of operability determinations and engineering analysis calculations effected by ASR
INSPECTION RESULTS

Team Conclusions

• NextEra’s methods used for assessing operability of ASR-affected reinforced concrete structures - reasonable and generally comprehensive.
• NextEra’s margins assessment provided a reasonable operability basis; the degraded and non-conforming condition is being addressed via a testing program, expected to be completed mid-2014.
• NRC staff plans to review NextEra’s monitoring and testing program to address uncertainties in evaluating the current level and progression of ASR – early 2013.
Margins Assessment

As-Built Capacity

Code Nominal Capacity, $S_N$

Code Design Capacity, $S_D = \Phi \times S_N$

Conservatism
(engineering margin established by design calculations)

Design Load/Demand, $F_U = LF \times F_N$

Nominal Load/Demand, $F_N$

Operable

Assumed ASR degradation (Margin Loss)

Operable, but Degraded

Inoperable

(As-Built)

Materials Supplied

Code Required

Licensee Established

Code Required

(Predicted)
What is to be addressed in Next Report?

- Remaining six CAL items:
  - Root cause evaluation
  - Integrated action plan
  - Research and development plan
  - Anchor testing
  - Prism testing
  - Structures Monitoring Program

- Follow-up of observations from first report
CLOSING REMARKS

Chris Miller
Director Division of Reactor Safety
List of Key Documents

• Confirmatory Action Letter No. 2012-002, issued May 16, 2012 (ML12125A172)

• Inspection Report No. 05000443/2012009, issued December 3, 2012 (ML12338A283)

• NextEra Letter of May 24, 2012, in response to CAL Item No. 3, provided the Interim Structural Assessment (ML12151A397)
Contacting the NRC

• Report a safety concern
  • 1-800-695-7403
  • allegation@nrc.gov

General questions

• www.nrc.gov
• Region I Public Affairs
  • Diane Screnci, 610-332-5330
diane.screnci@nrc.gov
  • Neil Sheehan, 610-332-5331 or
neil.sheehan@nrc.gov