TIA for Seabrook ASR Issue: GT thoughts (6/28/11) for internal consideration only

DE Expectations

1. DE will not review draft documents. Documents submitted for review should be complete and prepared and approved in accordance with the licensee's Appendix B Quality Assurance Program.

2. For each document submitted to the NRC, the licensee should provide a clear statement of what the document addresses or the document should be self-explanatory with regard to its purpose and problem statement.

3. Each important-to-safety structure affected or suspected to be affected by ASR degradation and being evaluated must be specifically identified by name (as described in the FSAR) upfront, rather than by general reference (such as 5 other seismic category 1 structures).

Fundamental Information Required to support TIA review :

1. Under what process is the licensee addressing the ASR issue at Seabrook?

2. What are the qualifications of personnel responsible for addressing this issue? Have you consulted specialists or specialized literature in the area of ASR to address the issue? If so,who and what.

3. Provide your detailed action plan developed to systematically address the diagnosis, prognosis, structural evaluation/appraisal and mitigation/management of the ASR induced degradation of important-to-safety concrete structures at Seabrook? This should include the plan for condition assessment (extent of condition and characterization) and root cause of the problem.

4. What is the current status of activities in the Action Plan? Provide a schedule of document submittal for NRC review.

5. Provide the documented condition survey (walkdown report) of the ASR issue at Seabrook. This document should identify the specific structures important-to-safety (as described in the FSAR) that are or suspected to be affected by ASR, or other degradation mechanism of significance. For each structure, it should quantitatively document observations of visual symptoms of the areas affected (notes, sketches, drawings and photographs), exposure conditions, level of cracking, design/construction features based on which decisions for further investigation can be made, if necessary. [Note: *The condition survey is the initial stage of the investigation whose purpose is to provide data on: (1) nature, extent and progress of distresses and deterioration of the structure; and (2) identify areas that may need further investigation. In a condition survey, each component of the structure should be examined and observations on the symptoms, type, extent (severity), location of the observed degradation and exposure*

conditions (presence of physical restraints, availability of moisture and/or aggressive conditions) are recorded in a consistent manner. Typical examples of distressed areas should be photographed (including an indication of scale) to enable comparison of degradation between various parts of the structure and between structures (some unaffected areas should also be photographed for comparison). Sketches, drawings and pictures should be used to qualitatively locate areas of low, medium or high damage severity.]

6. Provide as-built structural construction drawings and original design calculations of the affected structures for which DE review is requested.

Some technical questions to understand licensee approach:

7. Has the licensee developed or plans to develop a quantitative measure of expansion-to-date from ASR (such as cracking or expansion index, damage rating index (from petrography), stiffness damage test (SDT)) and a severity rating for the structures affected, based on which further decisions to address the issue can be made?

8. What is the licensee's plan to develop an estimate of potential-for-future-expansion rate due to ASR?

9. What is the licensee's plan for determining appropriate management of the ASR degradation during the period of the current operating license.

10. The staff understands that the licensee has been taking and testing core samples from the interior of some of the affected structures? How does the licensee plan to assess the degradation effects on the exterior of the structures in contact with the soil and ground water, which is likely to be more severe if the source of moisture is water infiltration from the outside?

11. What are the mechanical properties (compressive strength, tensile strength, modulus of elasticity, Poisson's ratio) of affected concrete that are being tested for structural design appraisal of the affected structures? What is the licensee's technical philosophy for measuring selective properties? Are these properties tested in some of the unaffected areas also for comparison to the affected areas (essentially are core samples for examination being taken from areas of (1) most severe degradation (2) less severe degradation and (3) no degradation for comparison) ? How would shear capacity (shear as a measure of diagonal tension) of concrete in affected structures be addressed?

Some good references from Specialized Literature for evaluating ASR of Concrete Structures

1. Structural effects of alkali-silica reaction – Technical guidance on the appraisal of existing structures, The Institution of Structural Engineers, London, UK, July 1992 and Addendum, April 2010

2. Report on the Diagnosis, Prognosis, and Mitigation of Alkali-Silica Reaction (ASR) in Transportation Structures, US Department of Transportation, Federal Highway Administration, January 2010