North Anna Fuel/Control Blade Seismic Issues

The staff has examined SER-DMN-044 and 003N5344 and provides the following comments:

SER-DMN-044:

1. In Ss~~s~~ection 3 of the report, it states that the possible eight directional combinations are considered in calculating the two horizontal accelerations at each time step. Please clarify the meaning of the "eight directional combinations".

2. In ~~s~~Section 3 of the report, it cites the use of the Newmark 100:40 equation in calculating the resultant earthquake force, in determining which cases are limiting, instead of using time history analysis. The following equation is used:

$$a_h = \sqrt{\left(max|a_x, a_y|\right)^2 + \left(0.4min|a_x, a_y|\right)^2}$$

   Instead of the equation below from Regulatory Guide 1.92, ASCE 4 and Newmark (1972) (which GEH references as the methodology):

$$a_h = max|a_x, a_y| + 0.4min|a_x, a_y|$$

   Please provide information and clarification of the equation used in calculating the resultant earthquake load, and its acceptability for use in the calculation.

   Reference:

   Newmark, N.M. (1975). "Seismic design criteria for structures and facilities: Trans Alaska pipeline system, "Proceedings of the U.S. National Conference on Earthquake Engineering, Ann Arbor, Michigan, June 18-20, 1975. (Available through Agencywide Documents Access and Management System (ADAMS) ML060870055).

3. The staff noted that for all six calculated time domain cases, resultant accelerations at the upper nodes of the fuel bundle model are less than one directional (NS) acceleration. Please explain the probable causes of this general discrepancy between the time history method and the ~~one directional (~~NS~~)~~ acceleration. Also, please provide information/confirmation in the report that the time history file used for the SER-DMN-044 calculation results is the same time history file used in Final Safety Analysis Report 3.7.

In addition to the above new comments, the staff is including the following comments which were previously discussed at a high level during the closed portion of the public call on April 20, 2016, ~~4/20/16~~ in order to include more detail:

Revised Request for Additional Information (RAI)~~AI~~ response to NRC RAI Letter 130:

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1. The sStaff does not consider the reporting of a single horizontal directional acceleration, as was done for a design certification document (DCD) RAI response, to be a method or approach. The revised RAI response should refer instead only to the referenced comprehensive methodology, as presented in Revision 1 to WG3-002N9544 in demonstrating whether the fuel meets GDC2. Further, the RAI response is revised, not supplemented, and as such should stand alone without reference to a prior version of the response.

~~1.~~

a. On Ppage 4, the last full paragraph from the bottom, the first sentence should ~~therefore~~ be deleted. The second sentence, ~~the~~ first clause should be deleted, and instead read, "An assessment of combined loads on the fuel assemblies has been completed and is described in ~~a revision to~~ Reference 3." Further, the last sentence should not refer to a "DCD approach" with respect to whether or not the fuel is acceptable to North Anna 3 (NA3), and should read, "The results indicate that the combined load accelerations meet the acceptance criteria."

~~a.~~

b. The last paragraph starting on Ppage 4 should have the first sentence referring to a "DCD approach" deleted, and the next sentence should instead refer to the assessment performed as a NA3 site-specific control rod assessment.

~~b.~~

2. On Ppage 6, the second paragraph under the bullet, "Completing the ITAAC for Control Rods," the second sentence should mention scram time requirements/verification in addition to what is already noted for stresses and strain requirements.

~~2.~~

***WG3-002N9544, Revision~~ 1**:*

1. Please change the document to a licensing technical report or other appropriate title instead of a supplement/supplementary information for the topical report.

~~1.~~

2. On Ppage 5, the second paragraph under 3.2.2, the paragraph should be edited to identify the reported DCD and NA3 acceleration values shown as single direction accelerations only. Also, because the acceleration limits for GE14E are based on seismic (full methodology, not single direction) and hydrodynamic loads, the phrase ending the second sentence of that paragraph, "…these accelerations are less than the demonstrated capability of the GE14 fuel," should be deleted. Further, the last sentence of that paragraph should be deleted. Alternately, the paragraph could be deleted entirely.

~~2.~~

3. Similarly, on Ppage 5, the third paragraph under 3.2.2, the first clause should be deleted, and instead the sentence should read, "A site-specific analysis, using approved DCD methods, has been performed to ~~provide more detailed information regarding the margin available in response to follow-up questions from the NRC~~ demonstrate the capability of the GE14E fuel to meet the NA3 site-specific combined loads.

~~3.~~

4. Both Ssections 3.2.2 (current analysis) and 3.3 (ITAAC analysis) should state that all nodes of the fuel bundle are compared to the acceptance limits.

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002N8005, Revision~~.~~ 2

1. The analysis presented should provide some estimate or representative values for the hydrodynamic loads in demonstrating the acceptance limits are met.

~~1.~~

2. On P~~p~~age 1, paragraph 2, the reference should be provided for the NA3 site-specific seismic evaluation.

~~2.~~

3. On P~~p~~age 1, paragraph 2, and in S~~s~~ection 2.3, the values for fuel channel displacement should be referred to as single directional displacement and it should be indicated that final values will be determined at the ITAAC stage (or otherwise clarify if this is not the case).

~~3.~~

4. On P~~p~~age 3, the last paragraph of ~~s~~Section 2.2, the first sentence states “the maximum stress remains well below the material allowable stress.” The “allowable stress” should be changed to the “true ultimate tensile strength.”

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