RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

QUESTION NO. RAI 03.07.02-62:

In MUAP-11002 (R0) Subsection 5.1, "Soil-Structure Interaction Analysis methodology," the tenth bullet of the second paragraph (page 15) states, "The final relative displacement time histories of selected TI nodes were computed by combining algebraically, at each time-step, the three independent displacement time history components."
The applicant is requested to explain how the algebraic combination of the three independent displacement time history components is performed at each time step and how it yields conservative results.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-11249, dated August 1, 2011 (ML11215A104).

For the Turbine Building (T/B) complex soil-structure interaction (SSI) analyses, the time history method was used by performing separate analyses for each of the three components of earthquake motion. The relative displacement time histories with respect to the free-field ground motion of the selected T/B complex nodes were obtained for each ground motion component using the RELDISP module in the ACS SASSI program. There are nine relative displacement time histories* generated at each node from the SSI analyses as shown below:

1. Relative displacement time history in the X (East-West) direction due to X (East-West) direction ground motion.
2. Relative displacement time history in the Y (North-South) direction due to X (East-West) direction ground motion.
3. Relative displacement time history in the Z (Vertical) direction due to X (East-West) direction ground motion.
4. Relative displacement time history in the X (East-West) direction due to Y (North-South) direction ground motion.
5. Relative displacement time history in the Y (North-South) direction due to Y (North-South) direction ground motion.
6. Relative displacement time history in the Z (Vertical) direction due to Y (North-South) direction ground motion.
7. Relative displacement time history in the X (East-West) direction due to Z (Vertical) direction ground motion.

8.   Relative displacement time history in the Y (North-South) direction due to Z (Vertical) direction ground motion.
9.   Relative displacement time history in the Z (Vertical) direction due to Z (Vertical) direction ground motion.

Note: *Please see the response to RAI 909-6315 Question number 03.07.02-210, for additional discussion on the number of time histories.

Since the three components of earthquake motion are statistically independent (Technical Report MUAP-10006 Rev. 3, Section 01.5.1.2), the combined relative displacement time history in each of the X, Y and Z directions is obtained by combining algebraically, at each time-step, the three relative displacement time history components due to the three direction ground motions (i.e., the combined relative displacement time history in the X direction is the sum, at each time-step, of the relative displacement time history in the X (East-West) direction due to X (East-West) direction ground motion, the relative displacement time history in the X (East-West) direction due to Y (North-South) direction ground motion, and the relative displacement time history in the X (East-West) direction due to Z (Vertical) direction ground motion).

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on a Technical/Topical Report.

This completes MHI's response to the NRC's question.