June 30, 2010

MEMORANDUM TO: Scott Flanders, Director
Division of Site and Environmental Reviews
Office of New Reactors

Patrick L. Hiland, Director
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Michael J. Case, Director ***/RA/ S. Richards for***
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: TRANSMITTAL OF "PROCEDURES FOR RANDOM VIBRATION THEORY BASED SEISMIC SITE RESPONSE"

This memorandum transmits for your information and use the subject report, "Procedures for Random Vibration Theory (RVT) based Seismic Site Response Analyses." This report documents the results of the investigation of RVT based site response performed by the University of Texas at Austin. The research undertaken was conducted with input from NRO staff in the Division of Site and Environment Reviews as a result of NRO User Need request NRO-2007-002.

The seismic waves which reach a site, get amplified or de-amplified depending on the site and the earthquake characteristics. Currently, three methods of analysis are used to determine seismic site response: (i) equivalent linear methods, (ii) fully non-linear methods, and (iii) random vibration theory based methods. All three methods are accepted by the NRC. The RVT-based methods are now being used for the development of Early Site Permits (ESP) and Combined Operating License (COL) applications. In 2008, the University of Texas at Austin published the results of related work which had been supported by the US Geological Survey (USGS) National Earthquake Hazard Reduction Program. The Southern California Earthquake Center also published results of comparisons between the three methods of site response analysis. Furthermore the report published by the University of Texas at Austin indicated that, as compared to more widely used methods, the RVT method may have a systematic bias which is conservative in the high frequency range and an unconservative bias in the low frequency range. To support NRO staff in their regulatory activities, RES has contracted an investigation program to the University of Texas at Austin to better identify the source of the differences and the implications of the findings. This investigation will help to better understand the source of the bias and to update the technique to remove the systematic bias and to more clearly represent the sources of uncertainty.

CONTACT: Annie Kammerer, RES/DE
301-873-3923

The subject white paper describes the fundamentals of RVT and its application to seismic site response analysis of soil deposits. In this report, the input requirements specific to RVT site response are outlined, and sensitivity analyses are performed to assess the sensitivity of RVT site response results to the RVT input parameters. This study revealed that modification to the duration parameter used in RVT site response analyses can change the result. A comprehensive comparison between RVT and time domain EQL site response analyses is required to evaluate the appropriate durations that are to be used in future simulations.

Enclosure:
As stated

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DISTRIBUTION:
K. Manoly, NRR
M. Khanna, NRR
C. Munson, NRO
B. Karas, NRO
C. Cook, NRO

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OFFICE	RES/DE	RES/DE	RES/DE	RES/DE
NAME	A. Kammerer	M. Sircar (A. Kammerer for)	R. Hogan (S. Richards for)	S. Richards
DATE	6/30/10	6/30/10	6/30/10	6/30/10

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