

October 26, 2010

MEMORANDUM TO: Christiana H. Lui, Director
Division of Risk Analysis
Office of Nuclear Regulatory Research

THRU: Kevin A. Coyne, Branch Chief */RA/*
Division of Risk Analysis
Office of Nuclear Regulatory Research

FROM: Donald Helton */RA/*
Division of Risk Analysis
Office of Nuclear Regulatory Research

SUBJECT: ISSUANCE OF MASSACHUSETTS INSTITUTE OF TECHNOLOGY
REPORT "UNCERTAINTY AND SENSITIVITY ANALYSIS FOR
LONG-RUNNING COMPUTER CODES: A CRITICAL REVIEW"

From 2009 to 2010, the Massachusetts Institute of Technology performed work under an NRC cooperative agreement (NRC-04-08-150) related to sensitivity, uncertainty, and meta-modeling techniques for use with long-running computer codes that are, in turn, utilized for probabilistic risk assessment (PRA) purposes. The final report representing the culmination of that work is enclosed, and is being made publicly available.

This report presents a critical review of existing methods for performing probabilistic uncertainty and sensitivity analyses for complex, computationally expensive simulation models. In the context of PRA, these models are used to: (i) estimate the reliability of passive systems in the absence of operational data, (ii) inform Level 1 accident sequence development and event tree structure, (iii) establish Level 1 PRA success criteria, (iv) develop Level 2 PRA event tree structure and split fraction values, (v) perform Level 3 PRA offsite consequence analysis, and (vi) provide the simulation capacity for dynamic PRA tools. The report provides a critical assessment of the strengths and limitations of a spectrum of available uncertainty and sensitivity methods. Along with presenting case studies, the report also cites other relevant applications of these methods, and catalogues their key attributes for reference (see Appendices A – C).

Earlier versions of this report have been provided to interested staff in the Office of Nuclear Regulatory Research (RES) and the program offices, as well as to RES contractors. The attached report is substantively similar to these earlier versions (provided in October 2009 through February 2010), but incorporates the resolution of an extensive set of comments. A seminar at NRC is tentatively planned for January 2011 to further present and discuss the report's contents.

Enclosure:
As stated

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NAME	D. Helton	N. Siu	K. Coyne
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