ADDENDUM
to
MEMORANDUM OF UNDERSTANDING
between
U.S. NUCLEAR REGULATORY COMMISSION
and
ELECTRIC POWER RESEARCH INSTITUTE, INC.,
on
COOPERATIVE NUCLEAR SAFETY RESEARCH

SEISMIC RISK

I. Introduction

This Addendum No. 1 to Memorandum of Understanding (the "Addendum") is entered into by and between the U.S. Nuclear Regulatory Commission (the "NRC" or the "Regulator") and the Electric Power Research Institute, Inc. ("EPRI") effective as of the date of signature of the last of the parties to execute this Addendum (the "Effective Date"). The NRC and EPRI are parties to that Memorandum of Understanding on Cooperative Nuclear Safety Research, dated March 14, 2007 (the "MOU"). Pursuant to the MOU and to Section 31 of the Atomic Energy Act, the parties agreed to encourage cooperation in nuclear safety research, which provides benefits for the NRC, the nuclear power industry (the "Industry"), and the public.

This Addendum describes a cooperative research and development program in the area of nuclear power plant seismic risk assessment (SRA) research and development (R&D) between EPRI and the NRC's Office of Nuclear Regulatory Research (NRC/RES).

The NRC/RES and EPRI are currently supporting efforts aimed at evaluating the seismic risk, and the methods for determining the seismic risk, of new and operating nuclear power plants in the Central and Eastern United States (CEUS). EPRI SRA activities include work in the areas of seismic hazard assessment, seismic probabilistic risk assessment (PRA) methods and development, structure and equipment fragility, analysis of the effects of high-frequency ground motions, and the development and implementation of seismic damage predictive parameters and methods. EPRI and the NRC have independently participated in the development of the American Nuclear Society (ANS) standard, "External-Events PRA Methodology" (ANS 58.21-2007) approved March 1, 2007, which includes earthquakes.

This Addendum does not create a binding obligation or enforceable right of action on the part of any party. This Addendum does not obligate any funds and is subject to the availability of appropriated funds.

II. Objectives

The objective of the ongoing NRC/RES and EPRI seismic risk R&D programs is the improvement of seismic analysis methods, tools, data, and technical information useful to the regulator and the industry. The following are the specific objectives of this cooperative program:

1. Ensure the timely exchange of information (e.g., objectives, milestones, planned approaches) on planned and ongoing research activities.
2. Ensure the timely sharing of technical data needed by the NRC/RES and EPRI R&D programs.

3. Ensure the timely sharing of R&D results and tools.

4. Improve SRA data needed to support risk-informed applications.

5. Assess the capabilities of current and advanced SRA methods and tools.

III. Scope and Plan

This program includes a wide variety of collaborative activities (including information exchange meetings, support for expert panels, and jointly sponsored projects and experiments) aimed at achieving the preceding objectives.

The program elements are as follows:

1. Programmatic Information Exchange. Both parties will exchange information concerning the objectives, milestones, and planned approaches for their ongoing seismic R&D tasks.

2. Technical Information Exchange. Both parties will facilitate the exchange of technical information needed to satisfactorily complete each party's seismic R&D tasks. This includes the support of an annual seismic research program review meeting, to be hosted by each party on an alternating basis. It also includes support of working meetings between researchers (on an agreed upon as-needed basis), responding to data requests, and the timely exchange of research results and seismic analysis tools.

3. Jointly Sponsored and Cooperative Projects. NRC/RES and EPRI will pursue work on the following projects:

   A. Updated Seismic Hazard Assessments in Support of Generic Issue 199

   Recent seismological and geotechnical studies and recent probabilistic seismic hazard assessments for potential siting of new nuclear plants have indicated that seismic hazards in some areas of the CEUS may be greater than those found in previous comprehensive studies of CEUS seismicity (EPRI NP-6395-D, "Probabilistic Seismic Hazard Evaluation at Nuclear Plant Sites in the Central and Eastern United States: Resolution of the Charleston Issue," issued January 1989, and NUREG/CR-5250, "Seismic Hazard Characterization of 69 Plant Sites East of the Rocky Mountains," issued 1989). Many currently operating nuclear plants are located in these areas. The potentially higher hazard may result in site ground motion response spectra (GRS) that exceed the operating plant design GRS. Generic Issue (GI) 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," dated June 9, 2005, identifies a need to evaluate the effects of the higher perceived seismic hazards on the existing CEUS sites. EPRI, with the collaborative oversight of NRC/RES, has developed analytical tools to evaluate the effects of the new hazard information on the GRS for new plant sites. The same tools can be used for existing plant sites. The following are objectives for this project:

   a. Share information on seismic source characterization and attenuation models used to calculate site seismic hazard.

   b. Share results of site GRS calculations using the best available data and models.

   c. Collaborate on the development of methodologies for evaluating the impact and importance of the new hazards and spectra, specifically including assessments and ramifications of the use of methods to obtain risk values from seismic margins assessments such as those given in EPRI Report 1009648,

"Methodology and Case Study for Use of Seismic Margin Assessments in Quantitative Risk-Informed Decision Making," issued June 2004.

B. Central and Eastern United States Seismic Hazard Update

The NRC (through Lawrence Livermore National Laboratory) and EPRI performed separate and parallel studies of CEUS seismicity in the late 1980s (EPRI NP-6395-D, "Probabilistic Seismic Hazard Evaluation at Nuclear Plant Sites in the Central and Eastern United States: Resolution of the Charleston Issue," issued January 1989, and NUREG/CR-5250, "Seismic Hazard Characterization of 69 Plant Sites East of the Rocky Mountains," issued 1989). These studies have served as the cornerstone for CEUS hazard assessments and seismic probabilistic risk assessments (SPRAs) from 1989 to the present. Since then, ongoing seismological studies have produced new information and new interpretations. This new information indicates a need to update the source data and attenuation models used in the 1989 studies. In December 2003, EPRI published Report 1003647, "CEUS Ground Motion Project." NRC/RES has a plan to examine CEUS attenuation models as well. The following are the objectives for collaborative research in this area:

a. Jointly collect and assemble seismic source data and develop source characterizations. (EPRI – lead)

b. Share plans for the study and development of CEUS ground motion attenuation models. The EPRI model is complete as referenced above. The NRC intends to undertake a project entitled Next Generation Attenuation (NGA) East to formulate a new CEUS attenuation model. This effort will seek to achieve a single consensus model. (NRC – lead)

c. Explore alternate ground motion parameters for use in attenuation models and possibly for fragility calculations.

C. American Nuclear Society Standard Pilot Seismic Probabilistic Risk Assessment

EPRI and the NRC were both involved in the development and review of ANS 58.21-2003 and its first revision, ANS 58.21-2007. However, the standard is as yet untested, and there are concerns that it may be difficult or unfeasible to implement. The standard provides guidance for performing an SPRA to each of three categories or levels. The concerns are that Category 1 is not sufficient to obtain robust risk values, Category 2 may be difficult to achieve, and Category 3 is widely regarded as unattainable under the present state of the art. Before the industry attempts to use the standard for "production" SPRAs, EPRI has undertaken a pilot project to perform a Category 2 SPRA on a volunteer operating plant. The objective of collaboration between the NRC and EPRI in this area is to ensure a common understanding and consensus opinion of the outcome and to agree on and advocate any needed changes to the standard. NRC/RES will review the EPRI/utility effort at predetermined stages of the analysis. EPRI and NRC/RES will meet as needed to discuss progress.

D. Kashiwazaki Lessons Learned

EPRI and the NRC have both been involved in the study of the results of the Niigata-Ken Chuetsu-Oki earthquake on the nuclear plant facilities at Kashiwazaki-Kariwa. The objective of this project is to share information on the effects of the earthquake and

improve the methods and procedures for evaluating and responding to significant earthquakes affecting nuclear power plants. Notwithstanding anything to the contrary herein, EPRI shall have no obligation to share or disclose any information (i) which is not owned by EPRI, or (ii) for which EPRI has not received prior written approval to disclose to the NRC and other parties.

E. Emerging and Other Issues

As other issues of mutual interest in the area of seismic risk technology arise, each party's single designated point of contact for this Addendum (the "Addendum Contacts") will communicate at least once per quarter to discuss the possibility and/or need for additional tasks. Should there be a need to pursue a new issue, the Addendum Contacts will bring this to the attention of their respective managements for further discussion and possible revision of this addendum.

4. Other Parties. NRC/RES and EPRI management will jointly develop and review recommendations concerning the participation of other parties (e.g., contractors, industry groups).

A designated point of contact for each party will manage all technical interactions. EPRI will submit all data and materials subject to commercial or other use restrictions to the NRC under a general affidavit addressing all documents, data, and materials to be shared with the NRC pursuant to this addendum and request that such documents, data, and materials be withheld from disclosure to the public pursuant to Title 10, Section 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the *Code of Federal Regulations* (10 CFR 2.390), as provided in the MOU. Should the NRC reject the EPRI request to withhold the EPRI data or materials from public disclosure, the project will not proceed.

IV. Period of Performance

The initial period of performance will be from the Effective Date through December 31, 2009, to be extended in writing if mutually agreeable to EPRI and the NRC.

V. Project Direction and Coordination

While Addendum Contacts will work on high-level issues related to the Addendum, the individuals each party designates as the point of contact for each project (the "Project Contacts") will manage all technical interactions. The respective Project Contacts will arrange all technical meetings to coordinate this effort and to discuss project progress. The following are the Addendum Contacts:

NRC:	EPRI:
Andrew J. Murphy Senior Level Advisor U.S. Nuclear Regulatory Commission 11545 Rockville Pike, MS T10M5 Rockville, MD 20852 301-415-6011 Andrew.Murphy@nrc.gov	Robert Kassawara Senior Project Manager Electric Power Research Institute, Inc. 3420 Hillview Avenue Palo Alto, CA 94304 650-855-2775 rkassawa@epri.com

VI. Cost and Schedule

EPRI and the NRC are responsible for their respective costs in implementing this Addendum. The costs of this cooperative program (above and beyond the costs of the existing SRA R&D programs of both parties) are associated with the support of (1) annual SRA cooperative R&D program review meetings, (2) working meetings between researchers, (3) responses to data requests, and (4) the activities identified under Item III.3 above. Additional costs may be incurred if other parties (especially international parties) join the program. Key milestones, contingent upon the availability of adequate funding, are as follows:

Date	Task	Milestone
In Process		Draft of Seismic Risk Addendum
Summer 2008	III.3.A.a–c	NRC/EPRI Workshop on GI-199
Summer 2008		NRC/EPRI management/technical meeting
		Draft detailed action plan for Areas III.3.A–E
2008–2009	III.3.A.	
2008–2009	III.3.B	
2008–2009	III.3.C	
2008–2009	III.3.D	
Ongoing	III.3.E	

VII. Dispute

If a dispute arises out of or relating to this Addendum, or any breach thereof, the parties will first attempt to settle the dispute through direct negotiation between the Addendum Contacts. If the Addendum Contacts cannot settle such a dispute, the parties shall submit the dispute to the Senior Management Contacts (as defined in the MOU) for resolution.

AGREEMENT

Brian W. Sheron, Director — Date
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

7/11/08

Christian Larsen — Date
Vice President, Nuclear Power
and Chief Nuclear Officer
Electric Power Research Institute

7/22/08