

ADDENDUM
to
MEMORANDUM OF UNDERSTANDING
between
U.S. NUCLEAR REGULATORY COMMISSION
and
ELECTRIC POWER RESEARCH INSTITUTE
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 (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 (the MOU, found under Enclosure 1). 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. 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 Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA Standard (ASME/ANS RA-Sa-2009), 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. Topics in Seismic Fragility

The goal of this cooperative project is to obtain from existing information consensus estimates on plant level fragilities for operating nuclear plants. These consensus fragility estimates can be used for assessments at specific plants as well as fleet assessments of the risk significance of updates and changes in seismic hazards.

- Information on Plant Level Seismic Fragility has been utilized for a number of purposes in the past. These have included the safety assessment of GI-199 and as the basis for the arguments for continued operability of the operating reactor fleet in response to the NTF Recommendation 2.1 seismic re-evaluations. Past discussions between the NRC and EPRI have confirmed alternative assumptions and available information for specific plants, which lead to alternative results vis-a-vis plant level fragility estimates.
- Sharing all new developments on establishing a consistent process for the development of structure, system and component (SSC) fragilities from previously existing design data.

B. Central and Eastern United States Seismic Hazard Update

The NRC, EPRI and DOE collaborated in the development of the Central and Eastern U.S. Seismic Source Characterization (CEUS-SSC) model. The results of that study were published in 2011 and have been used in the analysis of both existing and proposed nuclear facilities. The data for the study were current through 2008. As time passes and new information becomes available it is necessary to consider the appropriate mechanisms for updating the study. In particular, it is appropriate for the NRC and EPRI to consider the framework (both technical and funding) to keep major

studies of this type current in an efficient and cost effective manner. This project will explore and describe the potential options for continuing the collaborative framework.

C. Issues in Site Response and High-Frequency Ground Motions

The objective of this project is to share insights, information and research results on the issues related to site response, soil-structure interaction and structural analysis that may give rise to very high in-structure motions.

The potential for large amplitude ground motions in the high-frequency portion of the seismic spectrum at sites in the central and eastern U.S. has been known for some time. This knowledge has influenced the recent high-frequency testing program of components and previous research on high-frequency ground motions. This issue becomes very important for beyond-design basis situations, which are important for seismic risk analyses.

D. Aggregation and Synthesis of Seismic Performance Data from Past Earthquakes

EPRI and the NRC have both been involved in the study of the results of facility performance following the occurrence of earthquakes (Kashiwazaki-Kariwa, Onagawa, Fukushima and North Anna). The objective of this project is to share information and insights on the effects of these earthquakes 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 September 30, 2021, 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: Jon P. Ake Senior Level Advisor U.S. Nuclear Regulatory Commission 11545 Rockville Pike, MS T-10A36 Rockville, MD 20852 301-415-2269 Jon.Ake@nrc.gov	EPRI: John Richards Principal Technical Leader Electric Power Research Institute, Inc. 1300 West WT Harris Blvd Charlotte, NC 28262 704-595-2707 jrichards@epri.com
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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:

<u>Date</u>	<u>Task</u>	<u>Milestone</u>
Fall 2016	III.3.A-D.	NRC/EPRI management/technical meeting Draft detailed action plan for Areas III.3.A–D
Winter 2017	III.3.A	Seismic fragility
Ongoing	III.3.E	

VII. Disputes

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

<u>/RA/</u>	<u>9/28/16</u>
Michael F. Weber	Date
Director of Nuclear Regulatory Research	
U.S. Nuclear Regulatory Commission	

<u>/RA/</u>	<u>9/30/16</u>
Neil Wilmshurst	Date
Vice President and Chief Nuclear Officer	
Electric Power Research Institute	