Central and Eastern United States Seismic Source Characterization for Nuclear Facilities

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ABSTRACT

This report describes a new seismic source characterization (SSC) model for the Central and Eastern United States (CEUS). It will replace the *Seismic Hazard Methodology for the Central and Eastern United States*, EPRI Report NP-4726 (July 1986) and the *Seismic Hazard Characterization of 69 Nuclear Plant Sites East of the Rocky Mountains*, Lawrence Livermore National Laboratory Model, (Bernreuter et al., 1989). The objective of the CEUS SSC Project is to develop a new seismic source model for the CEUS using a Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 assessment process. The goal of the SSHAC process is to represent the center, body, and range of technically defensible interpretations of the available data, models, and methods. Input to a probabilistic seismic hazard analysis (PSHA) consists of both seismic source characterization and ground motion characterization. These two components are used to calculate probabilistic hazard results (or seismic hazard curves) at a particular site. This report provides a new seismic source model.

Results and Findings

The product of this report is a regional CEUS SSC model. This model includes consideration of an updated database, full assessment and incorporation of uncertainties, and the range of diverse technical interpretations from the larger technical community. The SSC model will be widely applicable to the entire CEUS, so this project uses a ground motion model that includes generic variations to allow for a range of representative site conditions (deep soil, shallow soil, hard rock). Hazard and sensitivity calculations were conducted at seven test sites representative of different CEUS hazard environments.

Challenges and Objectives

The regional CEUS SSC model will be of value to readers who are involved in PSHA work, and who wish to use an updated SSC model. This model is based on a comprehensive and traceable process, in accordance with SSHAC guidelines in NUREG/CR-6372, *Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts*. The model will be used to assess the present-day composite distribution for seismic sources along with their characterization in the CEUS and uncertainty. In addition, this model is in a form suitable for use in PSHA evaluations for regulatory activities, such as Early Site Permit (ESPs) and Combined Operating License Applications (COLAs).

Applications, Values, and Use

Development of a regional CEUS seismic source model will provide value to those who (1) have submitted an ESP or COLA for Nuclear Regulatory Commission (NRC) review before 2011; (2) will submit an ESP or COLA for NRC review after 2011; (3) must respond to safety issues resulting from NRC Generic Issue 199 (GI-199) for existing plants and (4) will prepare PSHAs to meet design and periodic review requirements for current and future nuclear facilities. This work replaces a previous study performed approximately 25 years ago. Since that study was

completed, substantial work has been done to improve the understanding of seismic sources and their characterization in the CEUS. Thus, a new regional SSC model provides a consistent, stable basis for computing PSHA for a future time span. Use of a new SSC model reduces the risk of delays in new plant licensing due to more conservative interpretations in the existing and future literature.

Perspective

The purpose of this study, jointly sponsored by EPRI, the U.S. Department of Energy (DOE), and the NRC was to develop a new CEUS SSC model. The team assembled to accomplish this purpose was composed of distinguished subject matter experts from industry, government, and academia. The resulting model is unique, and because this project has solicited input from the present-day larger technical community, it is not likely that there will be a need for significant revision for a number of years. See also Sponsors' Perspective for more details.

Approach

The goal of this project was to implement the CEUS SSC work plan for developing a regional CEUS SSC model. The work plan, formulated by the project manager and a technical integration team, consists of a series of tasks designed to meet the project objectives. This report was reviewed by a participatory peer review panel (PPRP), sponsor reviewers, the NRC, the U.S. Geological Survey, and other stakeholders. Comments from the PPRP and other reviewers were considered when preparing the report. The SSC model was completed at the end of 2011.

Keywords

Probabilistic seismic hazard analysis (PSHA)
Seismic source characterization (SSC)
Seismic source characterization model
Central and Eastern United States (CEUS)

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甲　　号証（Central and Eastern United States Seismic Source Characterization for Nuclear Facilities）の訳

「原子力施設のための中東部合衆国震源特性」

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要約（ix）

この報告書は、中東部合衆国（ＣＥＵＳ）の新しい震源特性（ＳＳＣ）モデルについて記したものです。この報告書は、電力研究所（RPRI）作成のレポートＮＰ－４７２６「中東部合衆国のための地震ハザードの方法論」（１９８６年１１月発行）とローレンス・リバモア国立研究所モデルである「東部とロッキー山脈地域の６９の原子力発電所の地震ハザードの特徴」（バーンルーター他　１９８９年発行）に代わるものになります。ＣＥＵＳ　ＳＳＣ　プロジェクトの目的は、上級地震ハザード分析委員会（ＳＳＨＡＣ）レベル３評価手続において使用することになる中東部合衆国の新しい震源モデルを発展させることにあります。ＳＳＨＡＣ手続の目標は、既存の観測記録、モデルや方法論に関し、技術的に弁護可能な解釈理論の中心と骨格、適用範囲を示すことにあります。確率論的地震ハザードへ向けて入力するのは、震源特性と増幅特性の２つです。これら２つの内容は、特定のサイトにおける確率論的ハザード結果（ないし地震ハザード曲線）を計算することにより求めて来ました。この報告書では、新しい震源特性モデルを提示します。

後略