



Guidance for Updating Accepted Existing Seismic Source Models, Given New Data or New Information

Presentation to USNRC

By NEI/EPRI

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Scope of Presentation

- State Purpose
- Distinguish between data and information
- Describe Procedure and evaluation guidance for new data
- Describe Procedure and evaluation guidance for new information
- Describe Risk-Informed significance criterion

Purpose

- Describe detailed procedure and evaluation guidance for determining whether new data or new information require updating an accepted existing seismic model for determining site-specific GMRS
 - Elaborate the guidance contained in Regulatory Guide 1.208
 - Support a stable process for meeting requirements of seismic regulations

Distinguish between data and information

- Data includes physical data obtained by monitoring or investigations, analyses of data, and interpretations of data
 - Examples: paleoliquefaction observations, paleoliquefaction interpretations, updated earthquake catalog
- Information is the product of an integrated assessment of data including a characterization of uncertainty
 - Example: assessment of a seismic source model such as the TIP study

Procedure and evaluation guidance for new data

- Present a progressive three-step procedure and evaluation guidance for new data
- Present a Risk-informed criterion for significant increase in GMRS
- Significant increase in GMRS is based on increase of site-specific generic rock GMRS due to new data
 - Generic rock for sites in CEUS is rock having properties used for development of the EPRI O4 Ground Motion Model

Procedure Step 1 Evaluations

- Develop site-specific generic rock GMRS using the accepted existing seismic source model
 - e.g., using site-specific application of the EPRI SOG model
- Determine sensitivity of GMRS to elements of the accepted existing seismic source model
- If needed, use these results as the base-line in Procedure Step 3 evaluations to assess significance of new data

Procedure Step 2 Evaluations

- Step 2 Evaluations consist of more specific and detailed implementation of Regulatory Guide 1.208 guidance
- Assess any new data using SSHAC Level II assessment process
 - Assessment is performed by experienced Technical Integrator (TI) team based on:
 - comprehensive consultations with scientists and seismic hazard experts informed about the new data
 - comprehensive understanding of the quality of the new data quality and of interpretations of the new data
 - comprehensive understanding of informed experts' understanding of uncertainty in new data and interpretations of new data
 - a balanced assessment that weighs scientific community's understanding of tectonic and earthquake processes
 - full documentation of assessment

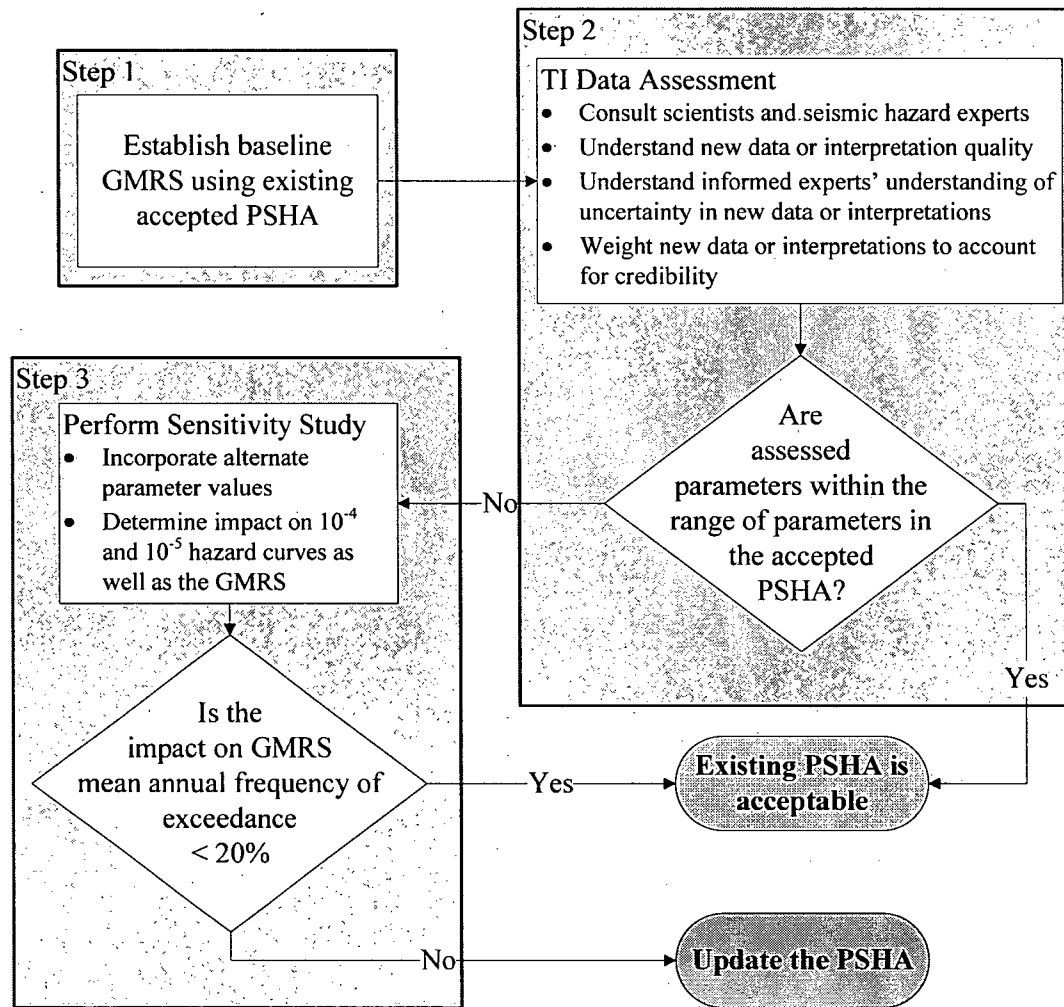
Procedure Step 2 Evaluation, continued

- If the TI determines that the assessed seismic source parameters based on new data are within the range of parameters of the accepted existing seismic source model, the accepted existing model is suitable for developing site-specific GMRS
- If the assessed seismic source parameters based on new data require parameters of the model to be modified, the modified seismic source model will be used to perform sensitivity analysis as described in procedure Step 3

Procedure Step 3 Evaluations

- Determine site-specific generic rock GMRS using updated seismic source model developed in Step 2
- Perform sensitivity analysis as in Procedure Step 1
- Compare updated site-specific generic rock GMRS with site-specific GMRS developed in Procedure Step 1
- Use Risk-Informed criterion to determine whether any increase in site-specific generic rock GMRS is significant

Evaluation Steps



Procedure and evaluation guidance for new information

- New information is considered to be integrated assessments of data including uncertainty for development of a new seismic source model
 - New seismic source model may or may not be based on assessment of new data
 - Examples are seismic source assessments for non-nuclear facilities, for research purposes or for the purpose of demonstrating an assessment methodology

Evaluations of New Information

- Determine the SSHAC level assessment process used to develop the new seismic source model
 - New models developed using fully implemented SSHAC Level II or higher process are considered to satisfy the requirements for nuclear facility application
 - If the new model was not developed using a SSHAC Level II assessment or higher
 - It does not meet the requirement for nuclear facility application
 - Evaluate and document the assessment in enough detail to support an informed review
 - Any new data considered in assessment of the new source model should be evaluated using the procedure and evaluation guidance for new data

Evaluations of New Information

- If a new model does not include assessment of new data,
 - Combine with the accepted existing seismic source model with weight equal to a single expert team's model
 - Use as the updated site-specific seismic source model for the site and perform sensitivity evaluations as in Step 3

Evaluations of New Information

- If the new the seismic source model does include assessment of new data,
 - New data should be evaluated following the guidance in New Data Procedure Step 2 to determine whether updating the accepted existing seismic source is required
 - If the TI determines that the accepted existing seismic source model should be updated, the site-specific updated seismic source model should be combined with the new seismic source model with weight determined by the degree to which the new model satisfies a fully implemented SSHAC Level II or higher assessment
 - These appropriately weighted models should be used to perform the sensitivity evaluations as in New Data Procedure Step 3

Risk-informed significance criterion

- Less than a 20% cumulative increase in the mean annual frequency of exceedance of the generic rock GMRS defined in Step 1 resulting from the sensitivity evaluation performed in Step 3 is sufficiently small as to not warrant revision of the GMRS
 - Accepted existing seismic source model may be used to determine the site-specific GMRS

Considerations for Sensitivity Study Result Significance

- Universal need for stability
- Stability is achieved through the use of EPRI SOG source models unless new data dictates a change
- However, sensitivity studies should be performed when differing interpretations exist, such as Eastern Tennessee Seismic Zone.
- Need a criterion by which to assess these sensitivity study results
 - Are differences in hazard curves large enough that differences must be resolved, or
 - Are differences small enough that stability of the EPRI SOG should be maintained?
- Recommend that differences of less than a 20% change in mean annual frequency of exceedance of the GMRS are sufficiently small that the stability of the EPRI SOG should be maintained.

Basis for Allowing Up to a Cumulative 20% Increase in the Annual Frequency of Exceedance of the GMRS

- The DF Used to Compute the GMRS From The 10^{-4} and 10^{-5} UHRs Are Conservative Biased So As To Achieve FOSID Levels Which On-Average Are 20% Less Than Target Level of $1 \times 10^{-5}/\text{yr}$
- SCDF Levels Are A Factor Of 2 to 10 Times Less Than FOSID Levels (Average Factor Is About 3)

Reference

Robert P. Kennedy. "Risk (Performance-goal) Based Approach for Establishing the SSE Design Response Spectrum for Future Nuclear Power Plants", Appendix A in R. McGuire 2005. "Assessment of a Performance-Based Approach for Determining the SSE Ground Motion for New Plant Sites, V1: Performance-Based Seismic Design Spectra", EPRI TR-1012044, Electric Power Research Institute, Palo Alto, CA.

Frequency of Onset of Significant Inelastic Deformation Range of FOSID Results for 28 CEUS Sites

	ASCE Method FOSID $*10^{-5}/\text{yr}$			
β	0.3	0.4	0.5	0.6
Range	0.71-1.17	0.66-0.99	0.51-0.75	0.41-0.58
Median	1.07	0.93	0.69	0.54

Range of SCDF Results for 28 CEUS Sites

	ASCE Method SCDF $F_{1\%}=1.67$ $*1 \times 10^{-5} / \text{yr}$			
β	0.3	0.4	0.5	0.6
Range	0.075-0.54	0.060-0.40	0.058-0.29	0.058-0.22
Median	0.38	0.26	0.19	0.15