Updating the SSHAC Implementation Guidance in NUREG–2117

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History and Purpose of NUREG–2117

- (1997) Senior Seismic Hazard Analysis Committee (SSHAC) described in NUREG/CR–6372
  - Need for methodological framework
  - Provide enhanced regulatory assurance
  - Primarily generalized and forward looking

- (2012) NUREG–2117 published as complementary guidance
  - Focused on Level 3 and Level 4 studies
  - Captured experience to date

- (2015) NUREG Update initiated
  - Capture additional experience
  - Expand and clarify guidance
NUREG–2117 Updating Process

- NRC formed a small working group to evaluate existing NUREG–2117
- Developed 4 major topics for consideration:
  - Criteria for how and when existing SSHAC studies should be updated
  - Guidelines for conducting SSHAC Level 1 and Level 2 studies
  - Detailed guidance updates for Level 3 studies
  - Recommendations for application of SSHAC principles to non-seismic hazard studies
NUREG–2117 Updating Process

- Developed “interview questions” for each topic
- Held interviews with SSHAC practitioners
- Consolidated feedback to develop topics for discussion
- Held group discussion among interviewees in-person and via webinar
- Followed up with individuals, as needed
I) SSHAC Study Updating Criteria

- Questions asked of interviewees:
  - How should existing hazard studies be evaluated relative to new data, models, and methods? How should these evaluations be documented?
  - What approaches should be used to assess whether changes in hazard inputs or to calculated hazard are significant? Are quantitative definitions of “significant” useful? If so, what metric is best to quantify “significant?”
  - Are the alternatives for evaluating an existing probabilistic seismic hazard assessment given in NUREG–2117 (accept, refine, replace) adequate? Are there other appropriate actions to consider?
  - Should a local “refinement” of a regional study be considered an update to the regional study; in the sense that a comparison is made between the hazard from the regional study and the hazard from the refined study? Are comparisons with the U.S. National Hazard map useful?
I) SSHAC Study Updating Criteria

- Questions asked of interviewees:
  - Are periodic updates to hazard studies necessary (for example, every ten years)? As an alternative, are periodic reviews on the need to update sufficient? If so, how should these periodic reviews be implemented?
  - How do your responses to the above questions relate to the SSHAC Level of existing hazard studies and the SSHAC Level of the update?
  - Should the guidelines for updating hazard studies be tied to the risk profile of the facilities for which the hazard is under review? For example, require periodic updates for highest risk category facilities (i.e. nuclear power plants) but suggest less stringent periodic or as-needed updates for facilities with lower risk profiles (spent fuel storage facilities and fuel cycle facilities)?
- Developed and distributed definitions for terminology
- Thirteen participants
Outcomes: Updating Criteria

- The discussion of what the “SSHAC brand” entails: a structured and controlled process for evaluation within a framework that is peer reviewed and documented
- Clarification that “updating” starts with an evaluation step that should be controlled by the SSHAC process
- All decision points within the evaluation should have some level of SSHAC for control and to maintain pedigree
- The framework for evaluation and updating requires tracking and centralized version control of regional models
- The updated NUREG needs to make careful use of well-defined terms
2) Conducting SSHAC Level 1 or 2 Studies

- Questions asked of interviewees:
  - All SSHAC studies have the same goals of conducting and documenting the evaluation and integration phases of the project, as defined in NUREG–2117. What is the minimum set of steps or attributes that would qualify a study to be considered a SSHAC Level 1 or 2 project? Does the focus of the study change what elements are required? For example, would there be differences for a study conducted for all elements of a hazard analysis vs. a study conducted to address one or two key issues?
  - What are the ways that the technical integration team demonstrates and documents that they have identified and evaluated all data, models, and methods during the evaluation stage?
  - What are the differences between SSHAC Levels 1 and 2, and between Levels 2 and 3, in terms of the products developed, costs, schedule, and regulatory assurance? Are there ways to reduce the large increment between the costs and benefits of Level 2 and Level 3 studies?
2) Conducting SSHAC Level 1 or 2 Studies

- Questions asked of interviewees:
  - Workshops in Level 3 and 4 studies are designed to demonstrate that a comprehensive evaluation and integration process has been followed. However, workshops involve considerable time and resources. Should one or more workshops be encouraged as part of Level 2 studies? If so, how should those studies be designated (e.g., “enhanced” Level 2; 2+; 2a,b,c)?
  - What is the role of the PPRP in Level 1 and 2 studies, including when and how they interact with the project teams, and what written products are expected from them? What are the pros and cons of a participatory process vs. a late stage review?

- Six participants
Outcomes: SSHAC Level 1 or 2 Studies

- The SSHAC process is designed to provide regulatory assurance, and higher SSHAC study levels are indicative of more rigorous reviews and can therefore contribute to increased regulatory assurance.

- Clear and transparent documentation is key and should include technical justification for all elements of the final assessment or model, as well as data, models, and methods that were considered during the evaluation but not incorporated.

- Aspects of updating criteria, as discussed in the first topic, provide context for where Level 1 and Level 2 processes may be used.

- Table 4-2 in NUREG–2117 should be updated; but there is an important distinction between “attributes” and “minimum requirements” for Level 1 and Level 2 processes.
3) Additional Guidance for Level 3 Studies

- Because of the breadth of experience, questions were more comprehensive
- Topics focused on:
  - Role of the PPRP (involvement in activities; whether and how to intervene; milestones and briefings)
  - Relative timing of workshop 3 and development of the final models (maturity of models, briefings)
  - Coordination among the seismic source and ground motion characterization models (what kinds of interactions are needed, and when?)
  - Role of the project manager (including recommendations and advice)
  - Flexibility for Workshops 1 and 2 (can they be integrated, swapped, or combined?)
- Nine participants
Outcomes: Guidance for Level 3 Studies

- General agreement on need for coordination and discussion of such in the NUREG
  - Applies to various roles
  - Applies to SSC and GMC teams
- Refinement of the roles and responsibilities discussion
- Workshops 1 and 2 should maintain current structure but have some flexibility with content
- Potential inclusion of project plan and communication flow charts in revised NUREG
4) Non-Seismic Applications of SSHAC

- For those who have SSHAC experience:
  - Describe your experience using SSHAC for a non-seismic evaluation
  - What was the purpose of your project (i.e., the regulatory and technical purpose of the project)? How well-defined was your objective/output going into this?
  - Where did you find the guidance helpful; where was it too ambiguous or difficult to apply to non-seismic issues?
  - How does application for a non-seismic compare to seismic? (for those that have done both)
  - Did this SSHAC achieve the SSHAC objectives through a transparent and robust process of integration and evaluation?

- For those who have not used SSHAC:
  - Describe your hazard assessment
  - What was the purpose of your project (i.e., the regulatory and technical purpose of the project)? How well-defined was your objective/output going into this?
  - How do you see SSHAC applying to this process?
  - What are potential advantages or disadvantages, from your point of view?

- For all:
  - Are there specific recommendations that you would make for updating NUREG-2117 in this regard?
  - Are there alternatives to the SSHAC process that are better suited to non-seismic hazards?

- Eight Participants
Outcomes: Non-Seismic Applications

- General consensus that aspects and principles of SSHAC can be applied to non-seismic studies
- Aspects such as documentation, roles, responsibilities, and process may not need to change
- Seismic hazard analyses generally recognized as “more mature”
- Use questions to formulate assessments:
  - “What is the output; how will it be used?”
  - “What are attributes that need to be developed?”
  - “What are the initiating events or inputs?”
  - “How are various events and processes related and interfaced?”
## Non-Seismic Applications of SSHAC

The equation for SSHAC can be represented as:

\[
\text{Hazard} = \text{Source} + \text{Path} + \text{Site}
\]

### Ground Motion Hazard (Seismic)
- **Source**
  - $M_{\text{MAX}}$
  - Recurrence
  - Fault Geometry
  - Faulting Style
- **Path**
  - Attenuation
  - Q
  - Source Model
- **Site**
  - Kappa
  - $V_s$ Profile
  - Damping
  - $G/G_{\text{MAX}}$

Annual Probability of Exceeding Spectral Ground Motion Level

### Riverine Flooding
- **Source**
  - Storm Parameters
  - Hyetographs
  - Precipitation Rate
  - Antecedent Conditions
- **Path**
  - Basin Characteristics (interception and infiltration)
  - Hydrographic conditions
- **Site**
  - Hydraulic Modeling
  - Channel Geometry
  - Land-Use Configuration

Annual Probability of Exceeding Flood Height/Elevation

### Ash Fall (Volcanic)
- **Source**
  - Volcano Type
  - Eruption Rate
  - Intensity
  - Distance
  - Particle Size
- **Path**
  - Atmospheric Conditions
- **Site**
  - Facility Location
  - Site Area

Annual Probability of Exceeding Ash Fall Depth

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Structural Changes to the NUREG

- “Streamline” the NUREG to focus on implementation
  - Removal of extensive sections of historical information
  - Removal of extensive discussions of PSHA methodology
- New sections
  - New detailed recommendations for conducting Level 1 and Level 2 studies
  - Addition of appendix describing the update
  - Brief discussion of application to other hazard studies
- Reorganization of sections to improve usability
- Development of additional figures and tables
Other Changes to the NUREG

- Updates and additional detail to roles and responsibilities
- Specificity in guidance on determining if an existing SSHAC needs to be updated
- Updates to terminology to improve clarity
- Development of additional figures and tables
- Recognition of applying key concepts to international studies
NUREG-???? coming in 2017

Thanks for listening!
Any questions?