

LTR-14-0140

Enclosure 7
Licensing Approach DSRS 3.7-3.8 Topics
(REDACTED)

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mPower

Licensing Approach for DSRS 3.7-3.8 Topics

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(Redacted Version)

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This is a pre-application document and includes preliminary B&W mPower reactor design or design supporting information and is subject to further internal review, revision, or verification.

Agenda

- Objectives
- Seismic Site Interface Requirements
 - Farhang Ostadan / Michael McHood
- Key Locations for Seismic Response
 - Michael McHood
- Dynamic Soil Pressure
 - Jack Demitz / Farhang Ostadan
- Conclusions



Objectives

- Discuss specific guideline topics in DSRS for seismic area
- Share proposed plans to address NRC guidance
- Solicit feedback

Seismic Site Interface Requirements



Objective

- Review the following two items related to Draft DSRS 3.7.1 and 3.7.2
 1. Confirm seismic site interface requirements for applicability of the Certified Design to a candidate site
 2. Discuss and agree on site-specific SSI analysis requirements



Applicability of the Certified Design

- Seismic applicability of the certified design to specific site condition follows DC/COL-ISG-017

PRELIMINARY

Applicability of the Certified Design

- **DC/COL-ISG-017**

- **5.1 Position on Comparison of CSDRS with the Site-Specific Seismic Demand**

- **5.1.3 Embedded Structures Analyzed as Embedded Structures in the Certified Design**

“The procedure described in Section 3.1.3 of the NEI white paper (Ref. 3) is acceptable with the following considerations. The procedure in Section 3.1.3 of Ref. 3 states that the envelope of the CSDRS-based FIRS for all the generic soil properties is obtained and used for the comparison. This is acceptable if the design loads and the in-structure response spectra were based on the envelope of all the generic soil profiles in the DCD.”

Applicability of the Certified Design

- NEI white paper (Ref. 3)
 - 3.1.3 Embedded Structures Analyzed as Embedded Structures in the Certified Design

“If, in the certified design, CSDRS is used as outcrop motion in the free field at the foundation level of the structure, the CSDRS-based foundation motion is the same as the CSDRS. For this evaluation, CSDRS can be compared with the FIRS computed as outcrop (SCOR) motion for design applicability evaluation.”

Applicability of the Certified Design

SUMMARY

- Draft DSRS 3.7.1 and 3.7.2 did not change the basis for seismic evaluation of the applicability of the certified design to a candidate site

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- mPower will follow DC/COL-ISG-017 to assess applicability of the mPower design to a candidate site

Site Specific SSI Analysis

- **DC/COL-ISG-017**

- 5.2 Position on Site-Consistent Seismic Input and Soil Profiles Properties for the SSI

“When a site-specific SSI analysis is conducted, two approaches are acceptable to obtain the site-consistent seismic input for the SSI analysis. Either one of the two approaches can be used for this purpose. However, before conducting a detailed SSI analysis, it is essential to demonstrate that the PBSRS are enveloped by the FIRS convolved up to the surface using the three soil properties for the SSI model—upper bound, best estimate, and lower bound. The basic steps of these two options are described below. Whichever option is chosen, the detailed steps in the selected approach must be followed, as described in the NEI white paper (Ref. 3) for the first approach and the BNL report (Ref. 4) for the second.”

Site Specific SSI Analysis

- NEI white paper describes the process for computing FIRS and PBSRS. The FIRS can be used as SSI input motion for site specific SSI analysis as long as the envelope of the amplified surface motion using FIRS as input in the deterministic soil column analysis (typically 3 columns) exceeds probabilistically derived site specific PBSRS at the surface for both horizontal and vertical motions.
- If the check can not be made, the SSI input motion needs to be modified (or additional soil columns considered) so the surface motion exceeds PBSRS

Site Specific SSI Analysis

Draft DSRS 3.7.1 (I.1.A):

- Requires generation of PBSRS for H and V motions at the surface
- Requires generation of PBRs for H and V motions at various elevations
- Requires deterministic SSI analysis to be based on the free-field motion that envelops PBSRS and PBRs at multiple elevations
- For sites with uniform velocity, PBSRS and one PBRs at central depth are considered adequate
- For sites with unusual velocity characteristics one or more additional depths are selected to generate PBRs

Site Specific SSI Analysis

DISCUSSION

- For COL applicant, it is not clear how many PBRs are needed and the requirement for selection of the additional elevations are not described
- It is to be noted that both deterministic and probabilistic site response analysis capture the site profile stratigraphy and soil property variation in the response even for non-uniform soil sites

Site Specific SSI Analysis

SUMMARY

- It is suggested that the two site-specific motions, PBSRS at the surface, [] be considered for checking the adequacy and/or modification of the FIRS for site specific SSI analysis
- No additional PBRS are deemed necessary for site specific analysis

Key Locations for Seismic Response

Key Locations for Seismic Response

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- After a seismic event, recorded responses at selected key locations can be used for post event evaluation

PRELIMINARY

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PRELIMINARY

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[Proprietary per Affidavit 5(a)-(f)]

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PRELIMINARY

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[Proprietary per Affidavit 5(a)-(f)]

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PRELIMINARY

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Key Locations for Seismic Response

PRELIMINARY

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PRELIMINARY

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Locations for Seismic Instrumentation

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- Some of the proposed key locations may not be appropriate for instrumentation due to heat or radiation concerns and/or accessibility for maintenance (e.g. Reactor Vessel Upper Support).
- Will Regulatory Guide 1.12 “Nuclear Power Plant Instrumentation for Earthquakes” be revised in the near future?

Dynamic Soil Pressure

Dynamic Soil Pressure

- Draft DSRS Section 3.8.4 provides guidance consistent with SRP 3.8.4 Rev. 4 for the calculation of dynamic soil pressure
- Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral pressure loads are evaluated for the governing of the following three cases:
 1. Sum of the static earth pressure plus dynamic earth pressure calculated in accordance with ASCE 4-98 Section 3.5.3.2(2) {Wood Method}
 2. Sum of the static earth pressure plus dynamic earth pressure calculated using an embedded SSI/Finite Element Model
 3. Fraction of passive pressure that is effectively mobilized. Should include fraction of passive earth pressure assumed in stability calculations performed in accordance with SRP 3.8.5



Dynamic Soil Pressure

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PRELIMINARY

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[Proprietary per Affidavit 5(a)-(f)]

Dynamic Soil Pressure

- The basis for Wood solution is not directly applicable to the mPower design:

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Conclusion