
Seismic Hazard Updates

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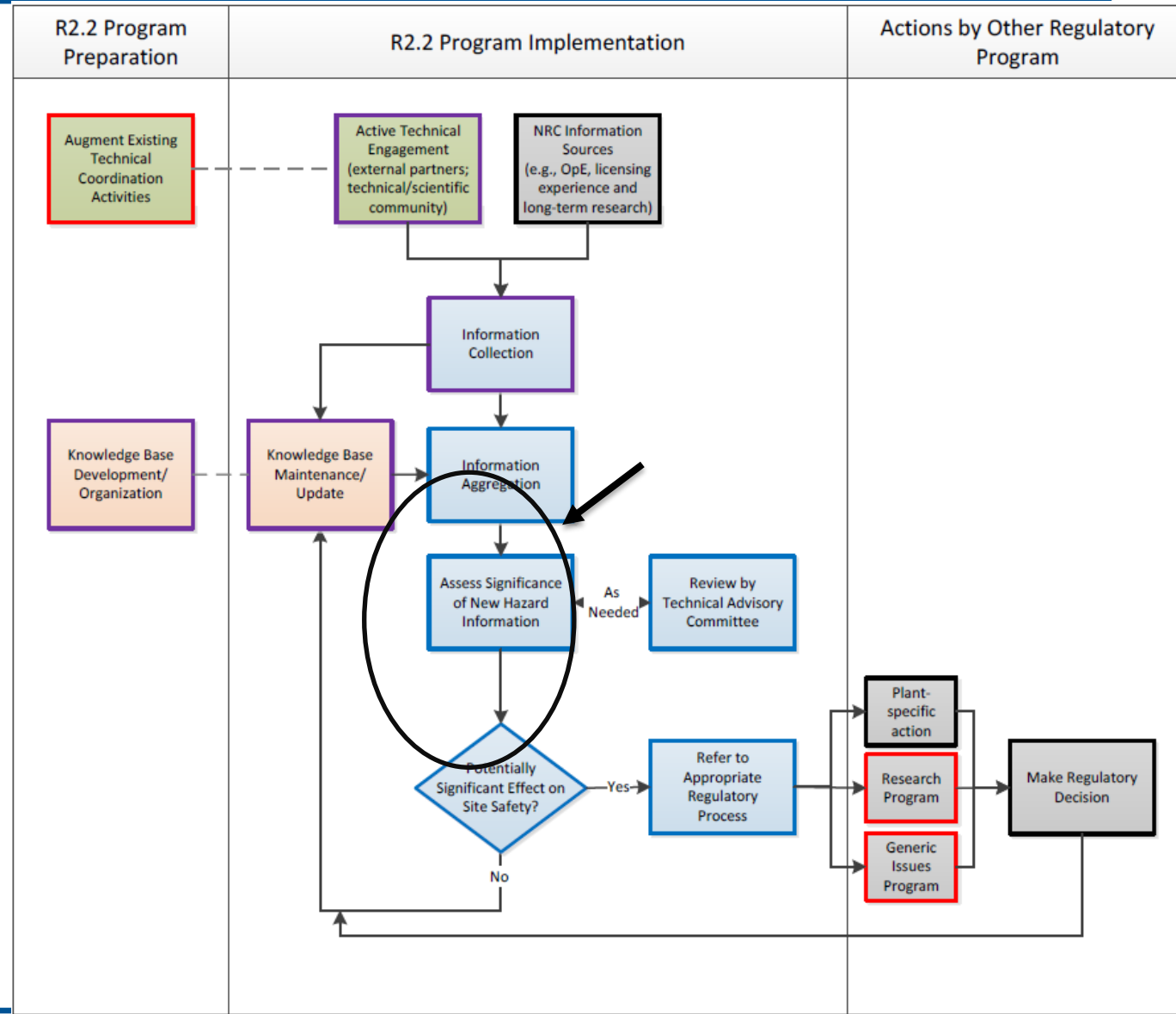
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Background

- In response to 10 CFR 50.54(f) request licensees developed updated seismic hazard curves and GMRS for each NPP
 - CEUS NPP sites used CEUS-SSC and EPRI (2013) seismic models and SPID
 - WUS NPP sites developed SSHAC L3 seismic models
- Most recent seismic hazard characterizations are found in NUREG/KM-017 published this year
 - NRC staff re-evaluated site geology to develop updated GMRS
- Under the POANHI framework NRC staff is evaluating
 - new seismic ground motion model NGA-East for the CEUS NPP sites
 - Updated approaches from recent site response analyses SSHAC research project

POANHI Framework

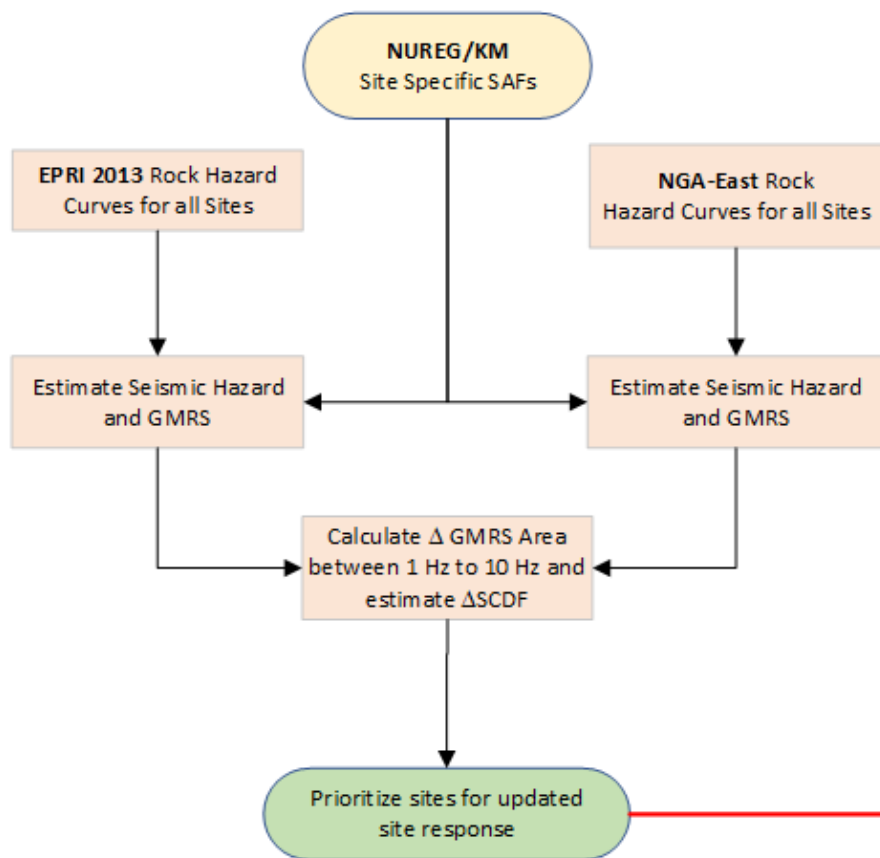
- POANHI process outlined by NRR LIC-208
 - Ongoing staff effort to collect and integrate external hazard information for operating nuclear fleet
- Currently in the aggregation and assessment phases



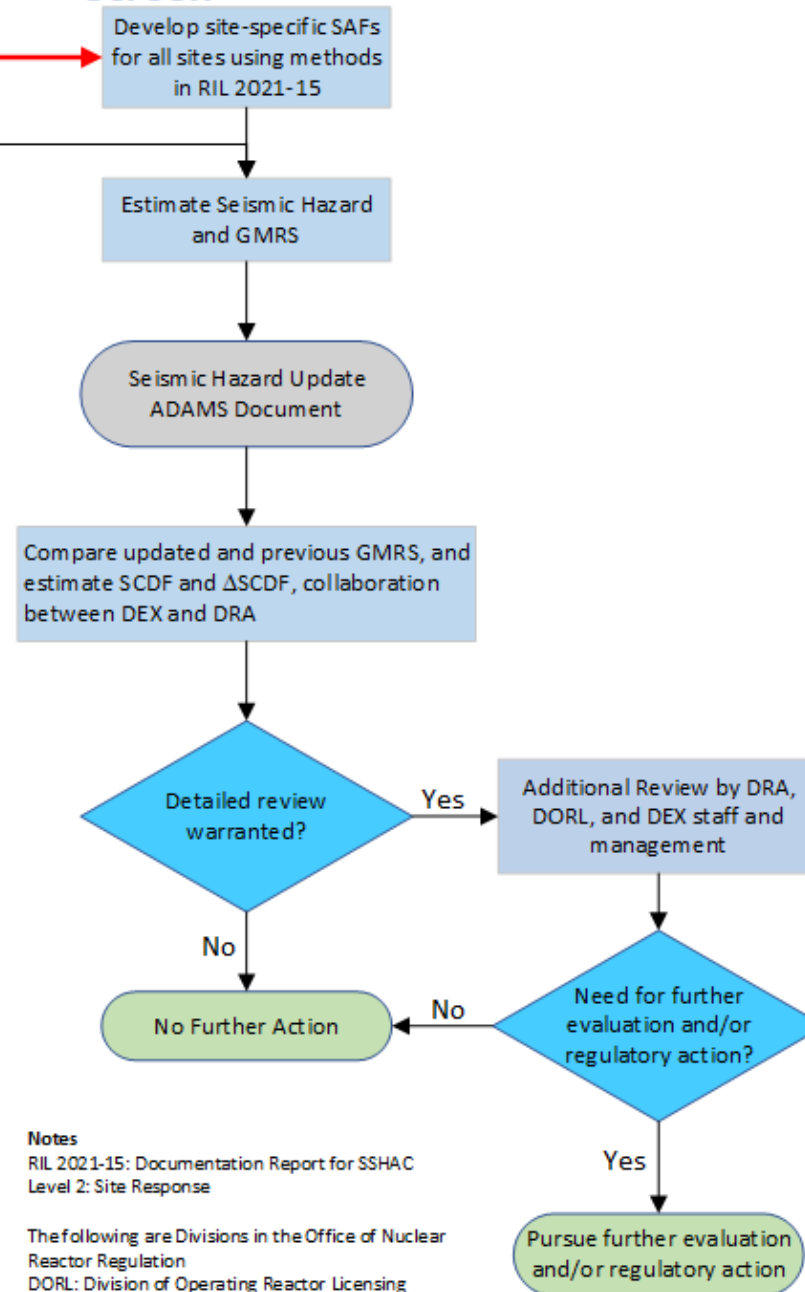
POANHI Seismic Hazard Update

- Reference rock seismic hazard curves using CEUS/SSC and NGA-East
- Re-evaluate site response analyses to capture SSHAC Site Response Lessons Learned
 - Expand logic tree to consider wider range of epistemic uncertainty
 - Consider comments on NUREG/KM-017 geologic interpretations
- Control point hazard curves and GMRS
- Seismic hazard update report with data sets available in ADAMs
- Screening evaluation

Prioritization



Screen



Notes

RIL 2021-15: Documentation Report for SSHAC Level 2: Site Response

The following are Divisions in the Office of Nuclear Reactor Regulation

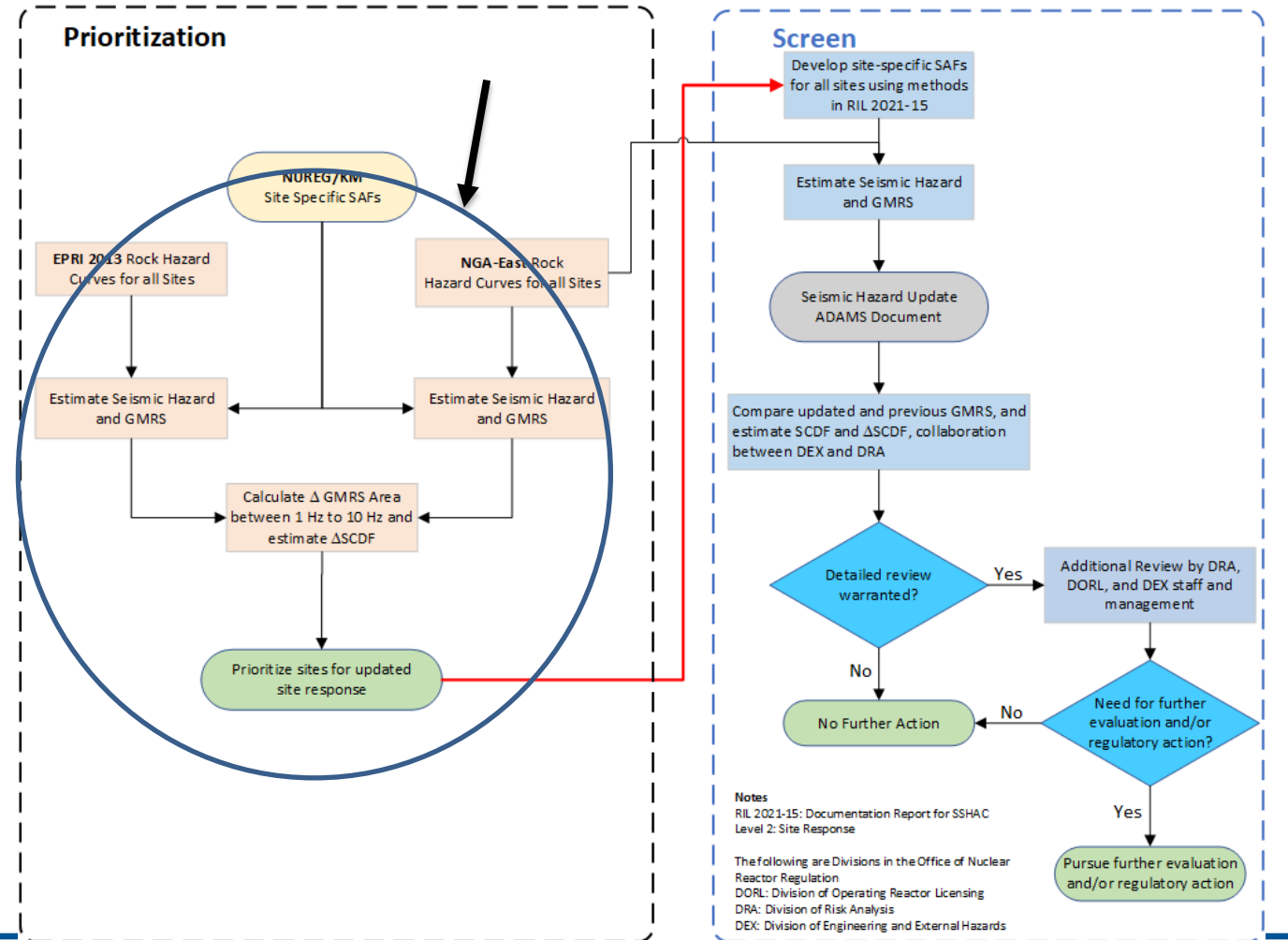
DORL: Division of Operating Reactor Licensing

DRA: Division of Risk Analysis

DEX: Division of Engineering and External Hazards

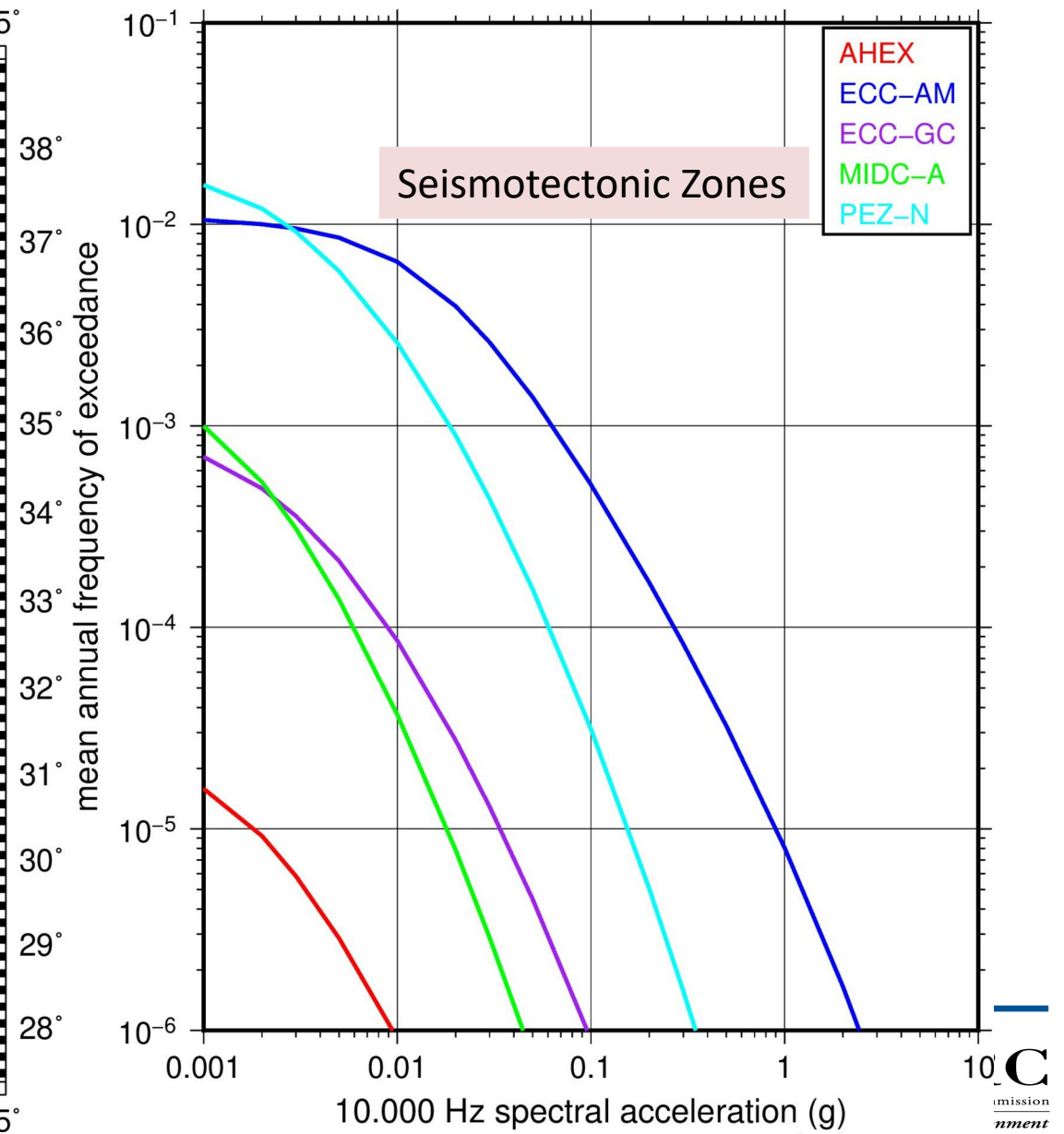
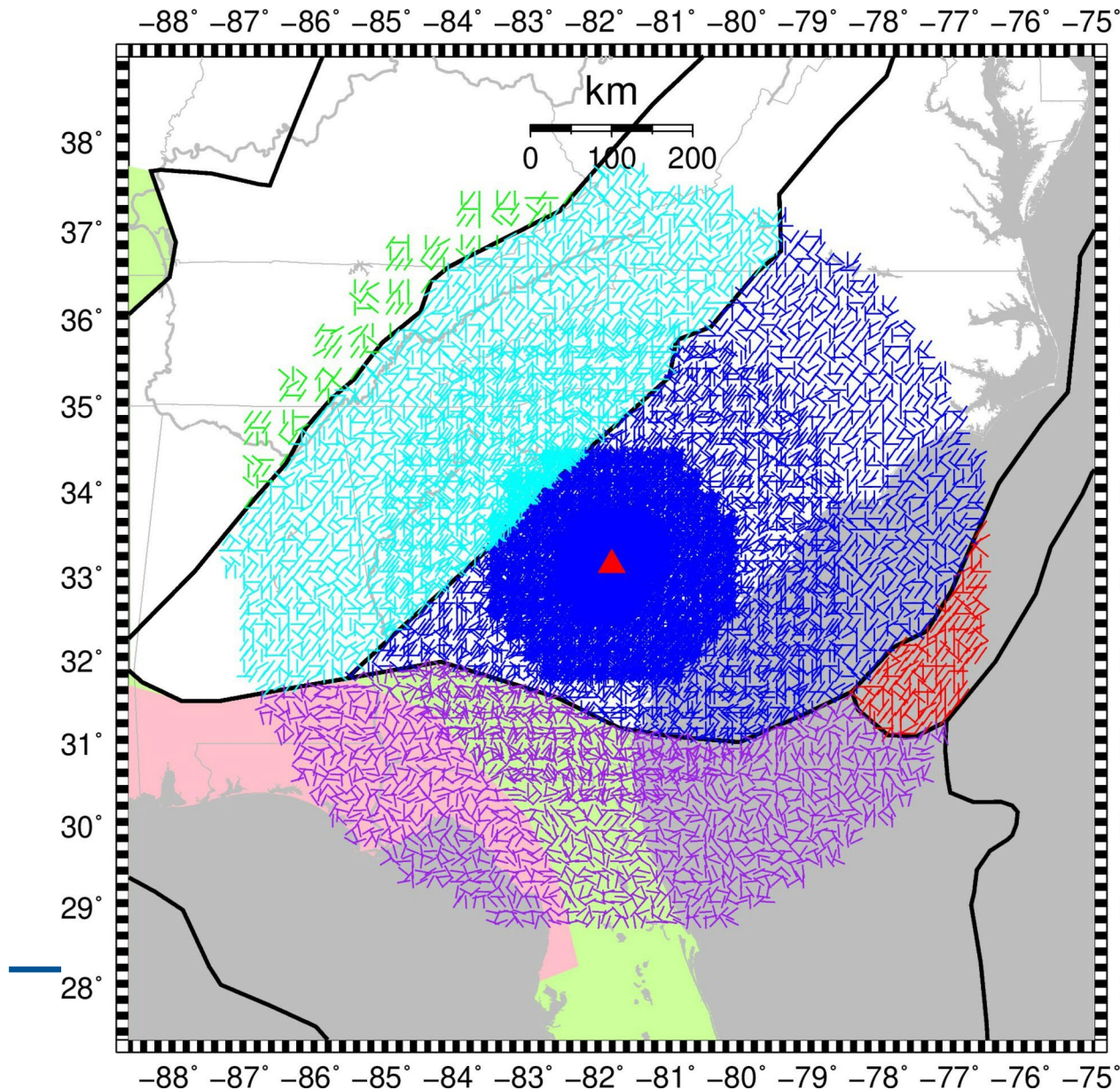
Example Site Prioritization

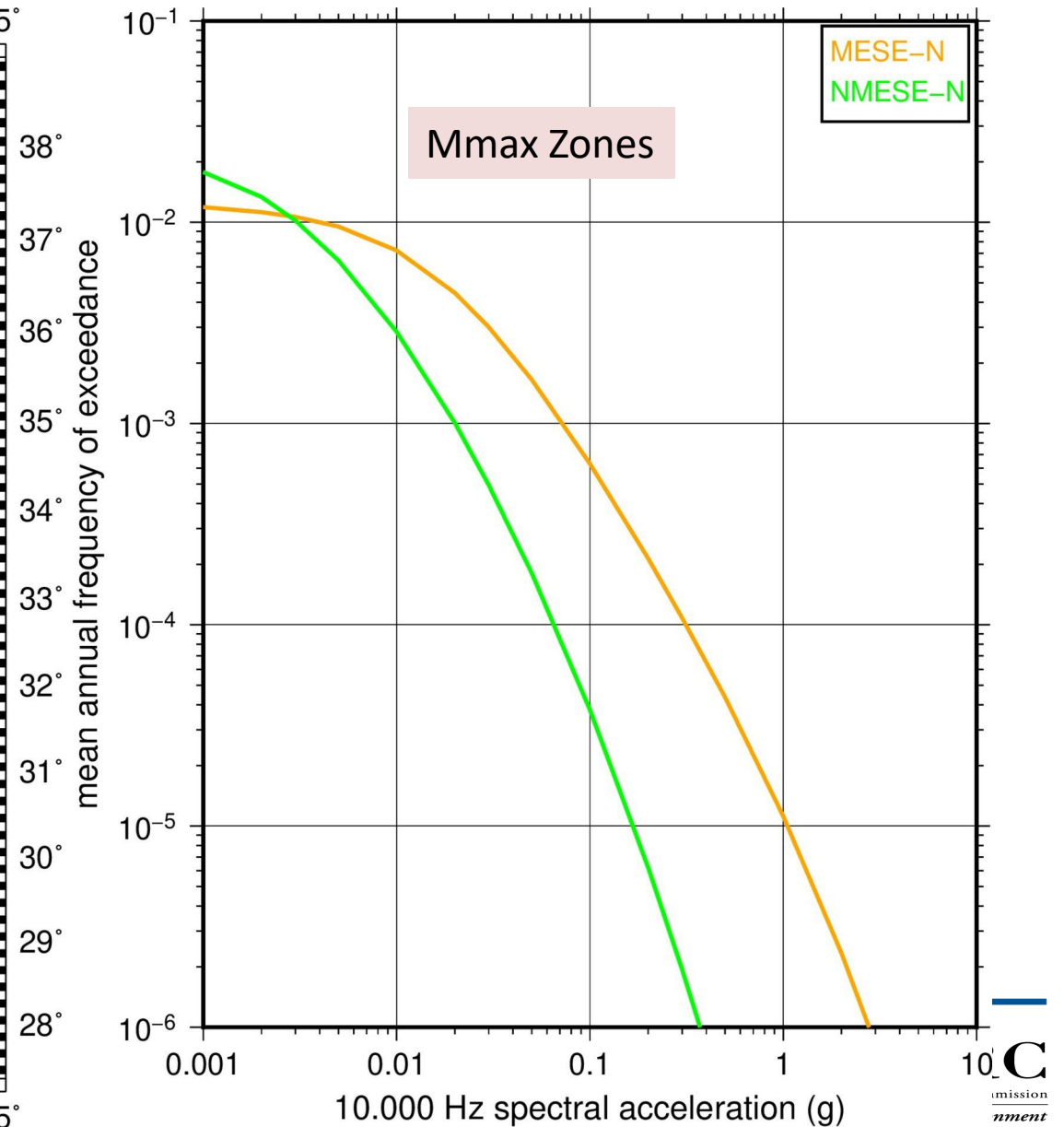
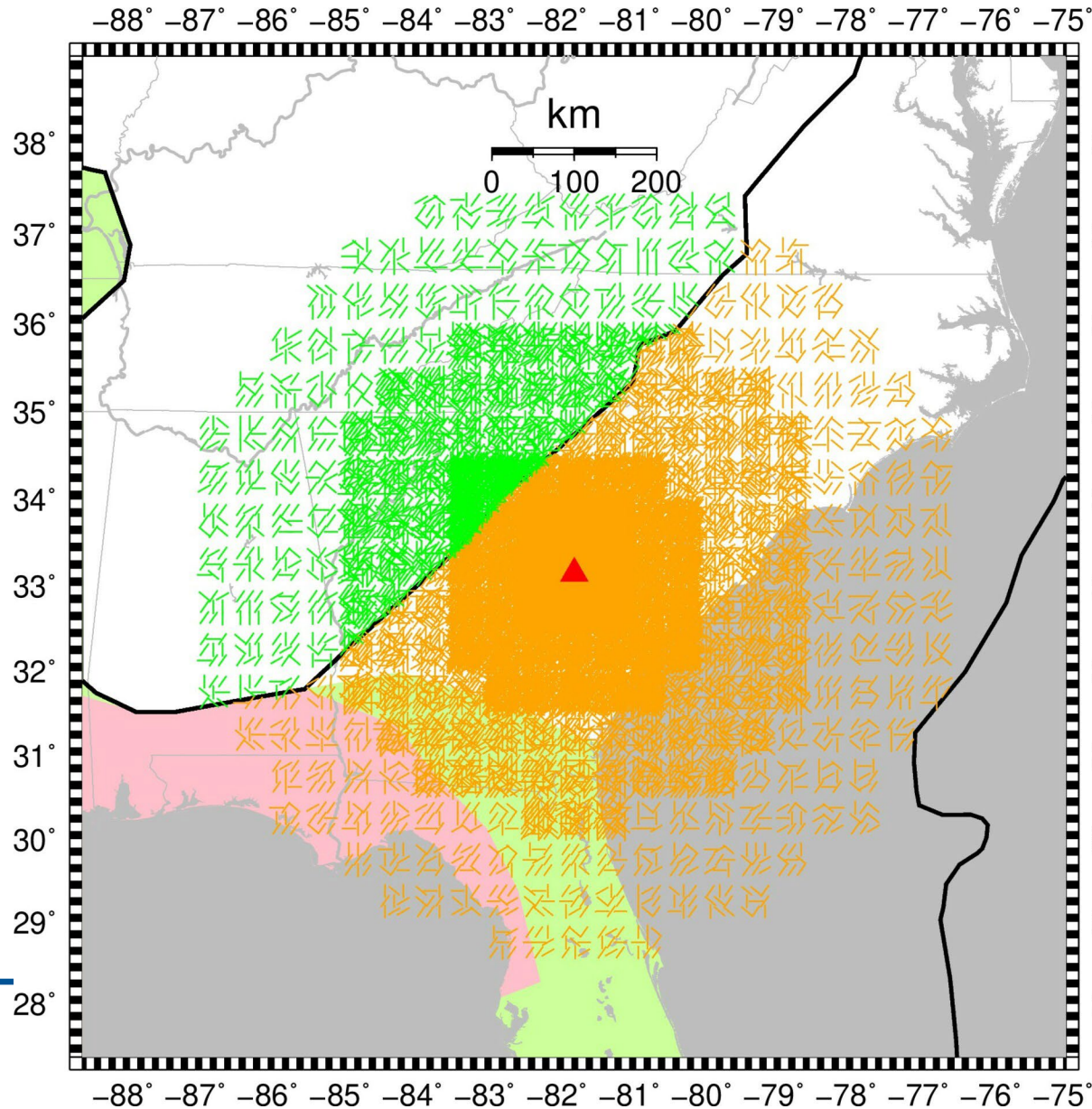
Savannah River Test Site
Reference Rock Hazard and
NUREG/KM-017 Site Response Analysis
GMRS

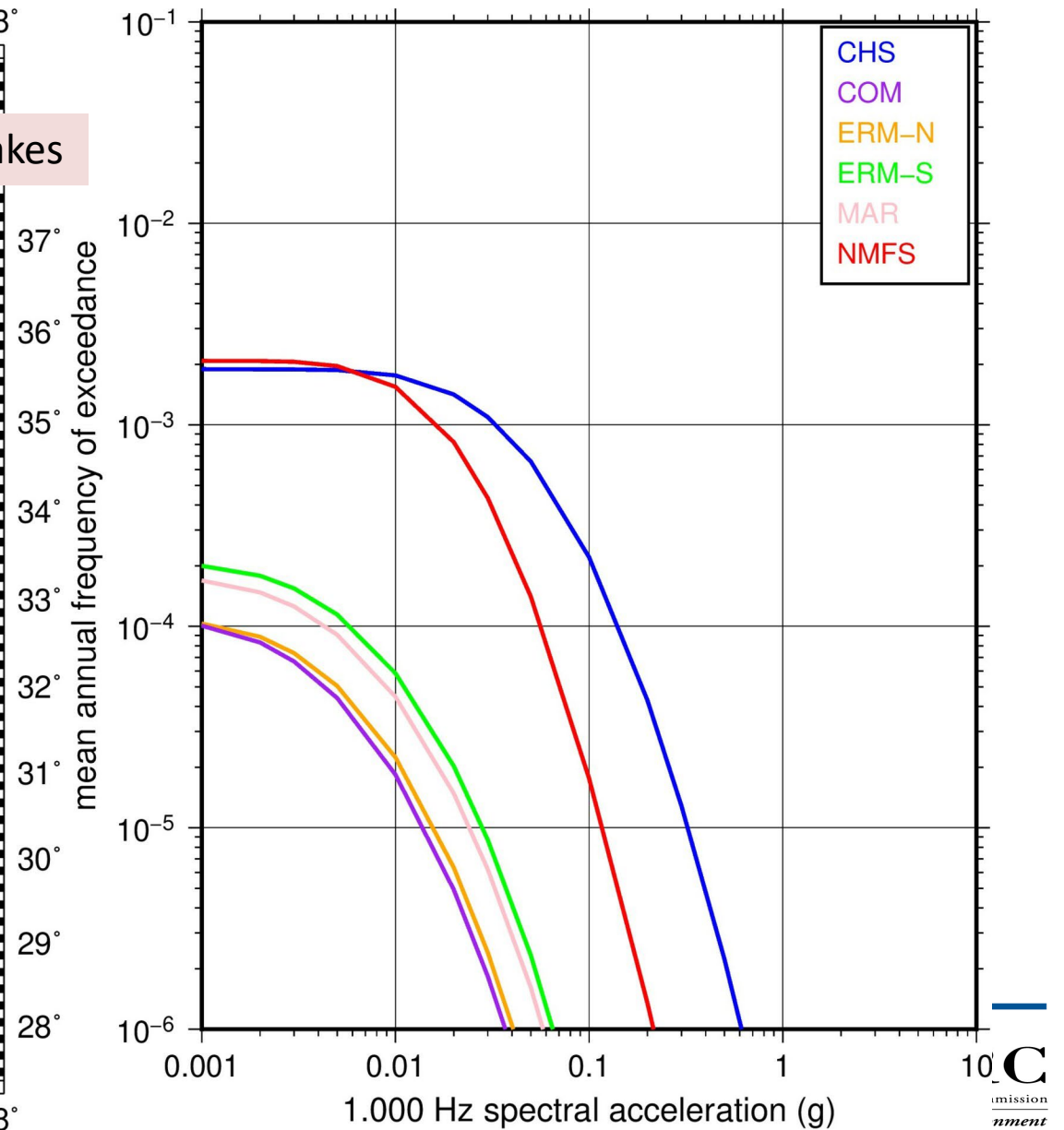
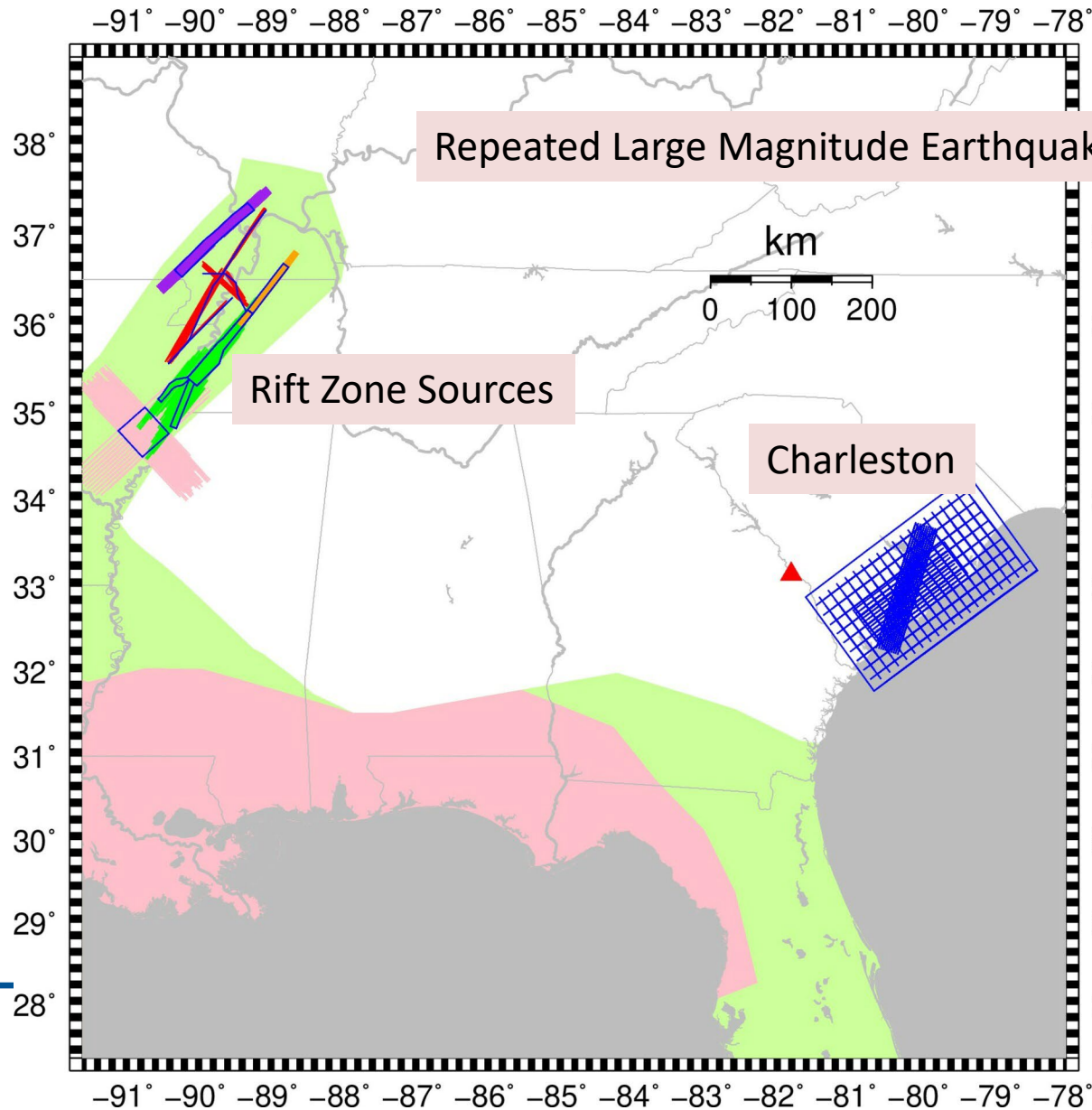


Implementation of Seismic Source and Ground Motion Models and Site Response Analysis

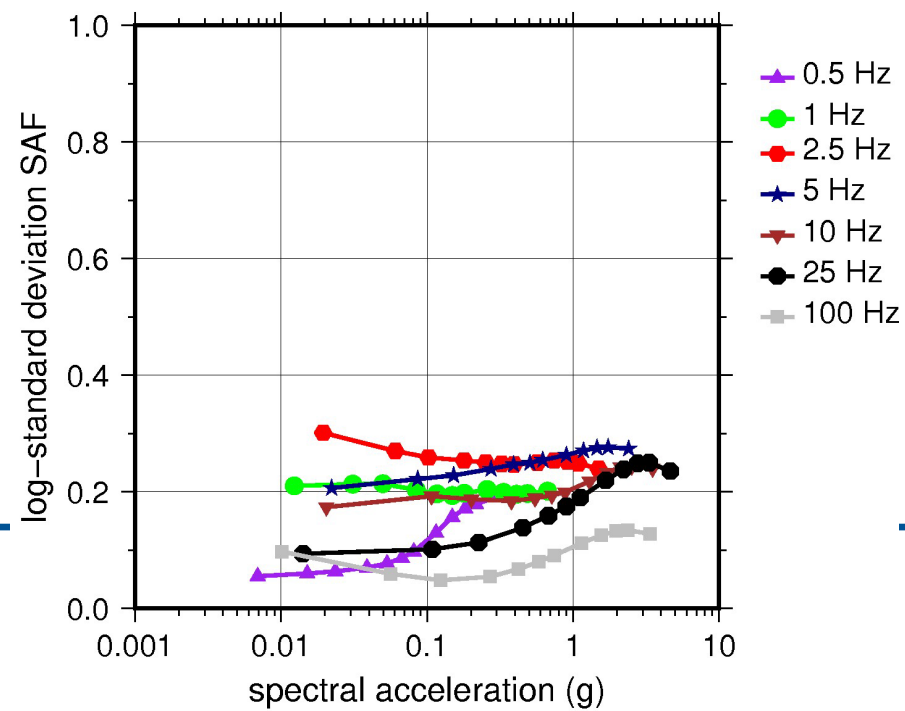
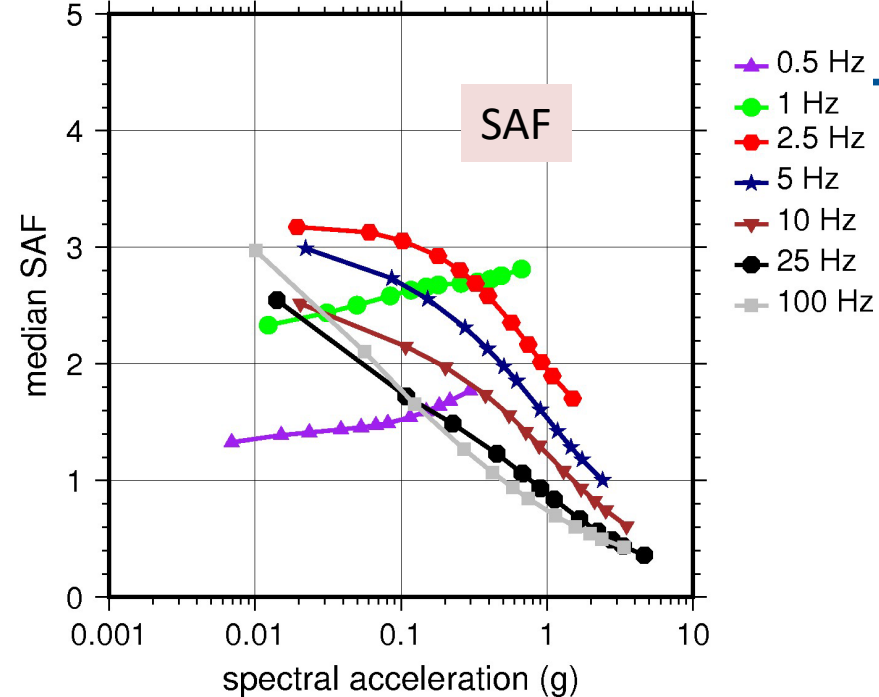
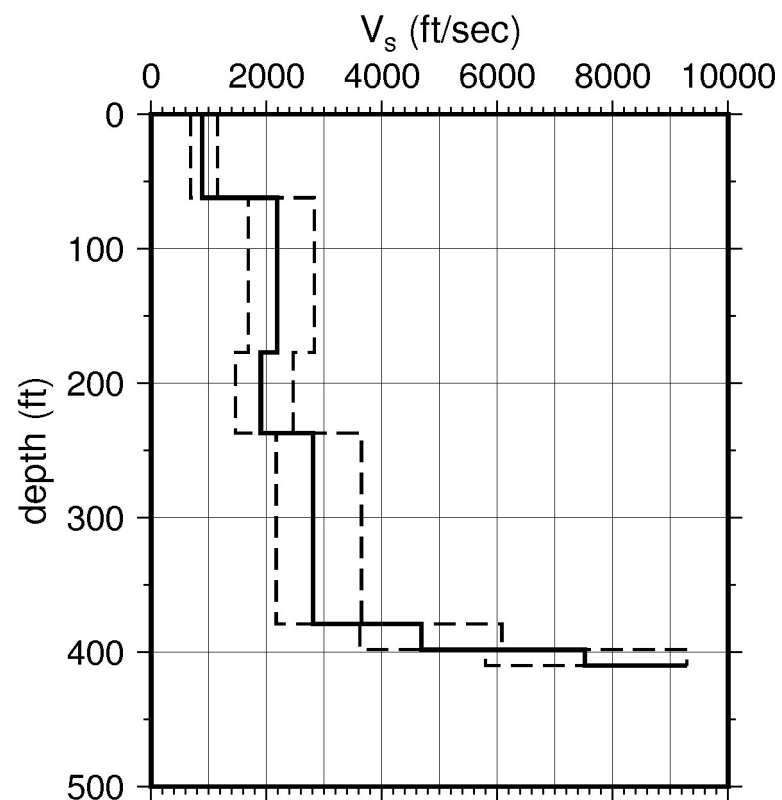
- Run CEUS-SSC seismic source (NUREG 2115) models
 - Extend radius for source zones out to 500 km
 - Include repeated large magnitude sources out to 1000 km
- Run EPRI GMM (2013)
- Run NGA-East ground motion model (PEER, 2018)
- Convolve reference rock hazard with NUREG/KM-017 site response analysis to determine control point hazard and GMRS



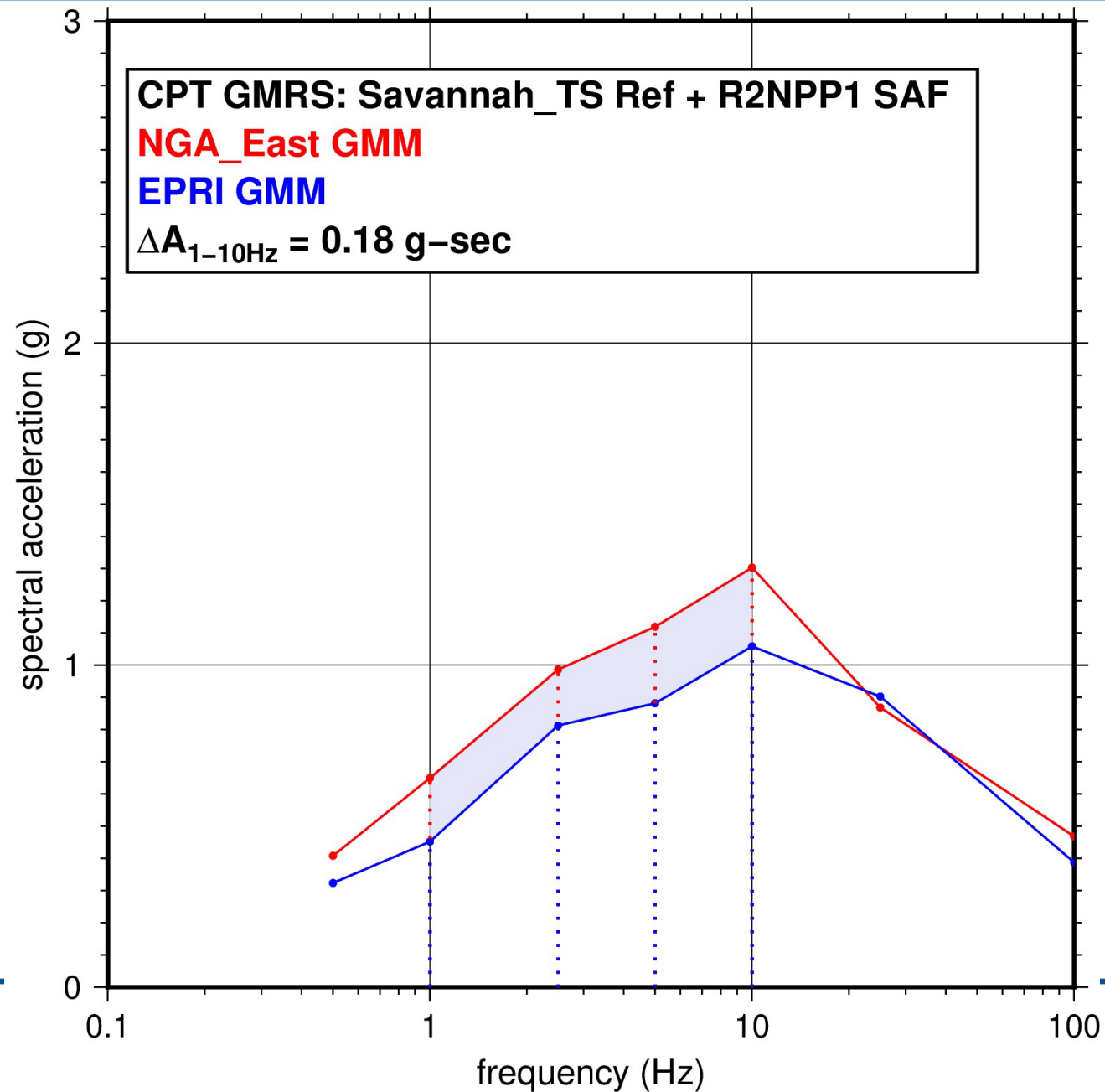




NUREG/KM-017 Site Response Analysis



GMRS Comparison
Used for Prioritization



RG 1.174 Acceptance Guidelines

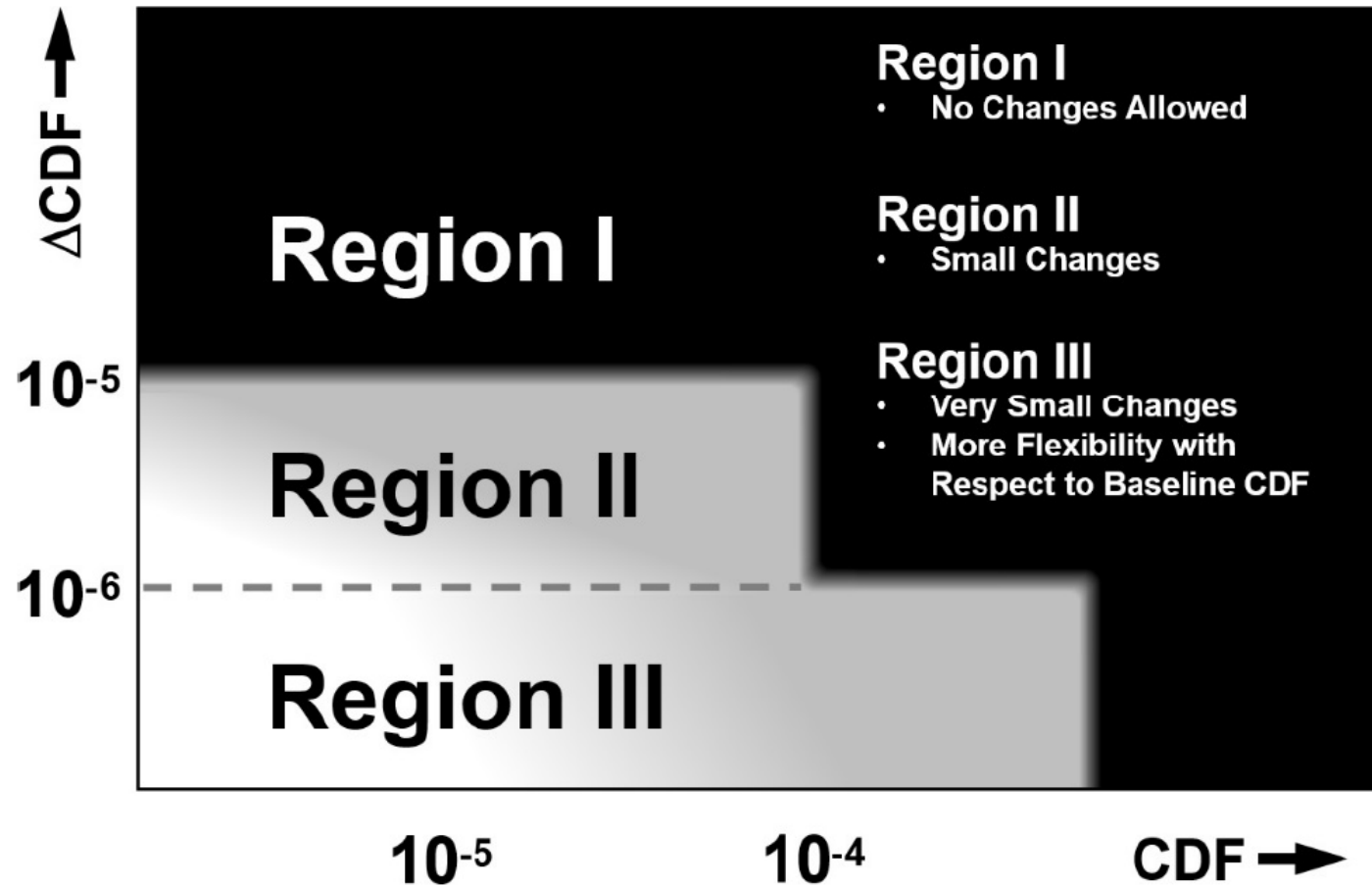
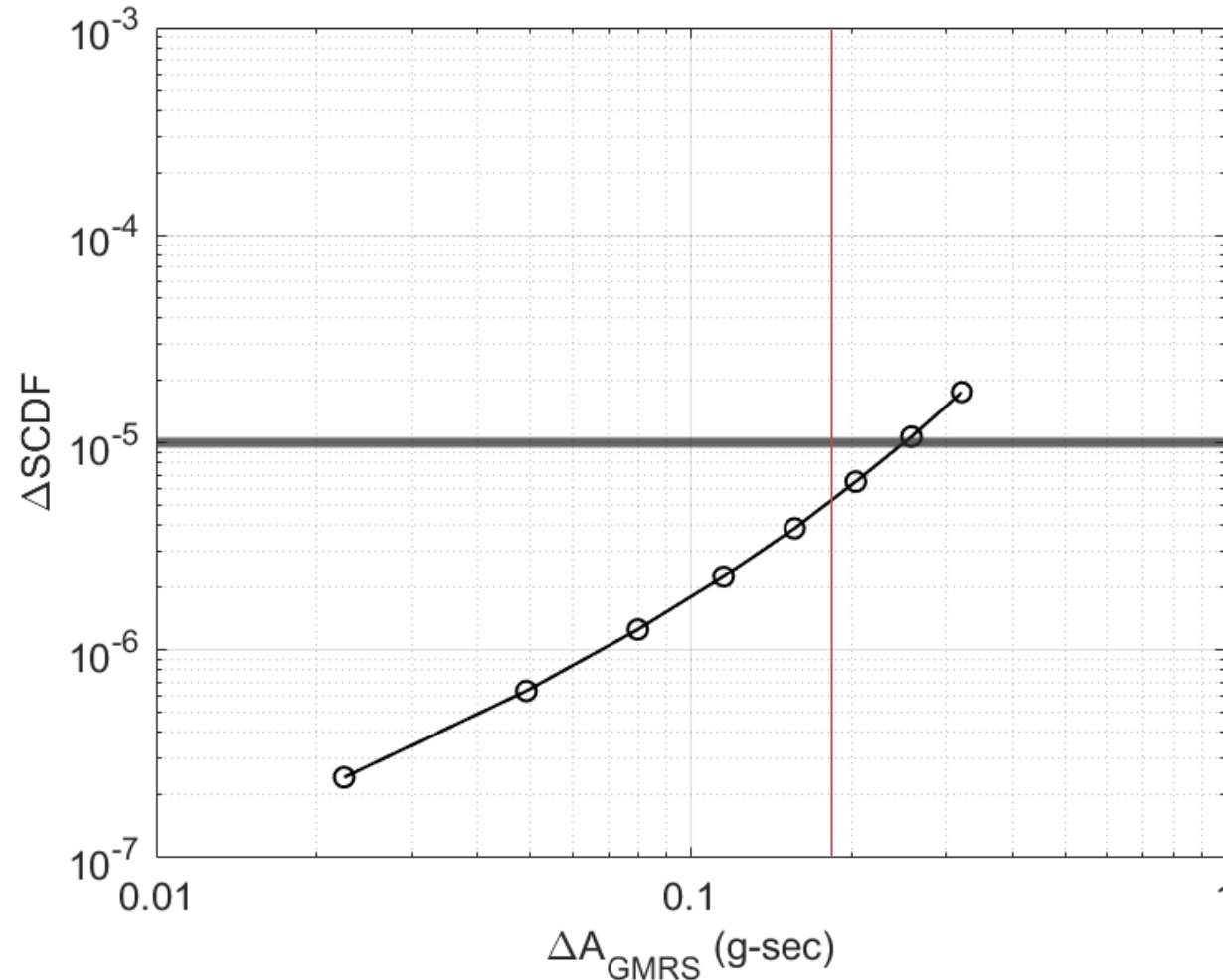


Figure 4. Acceptance guidelines* for core damage frequency

Δ SCDF for Test Site

$$C_{50} = 0.76 \quad \beta_C = 0.4$$

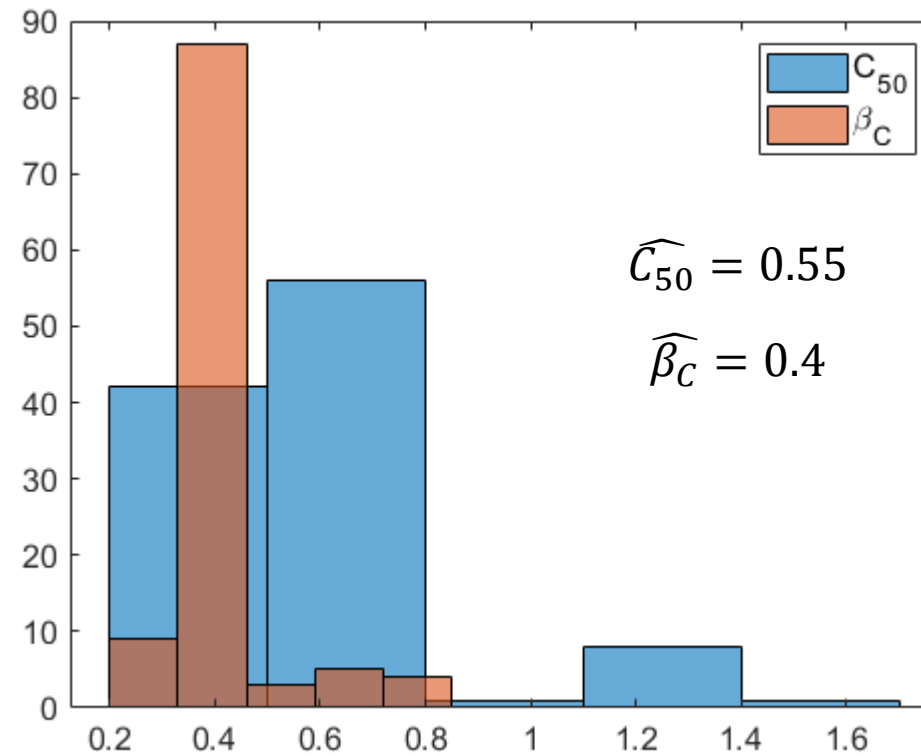


Calculate Δ SCDF

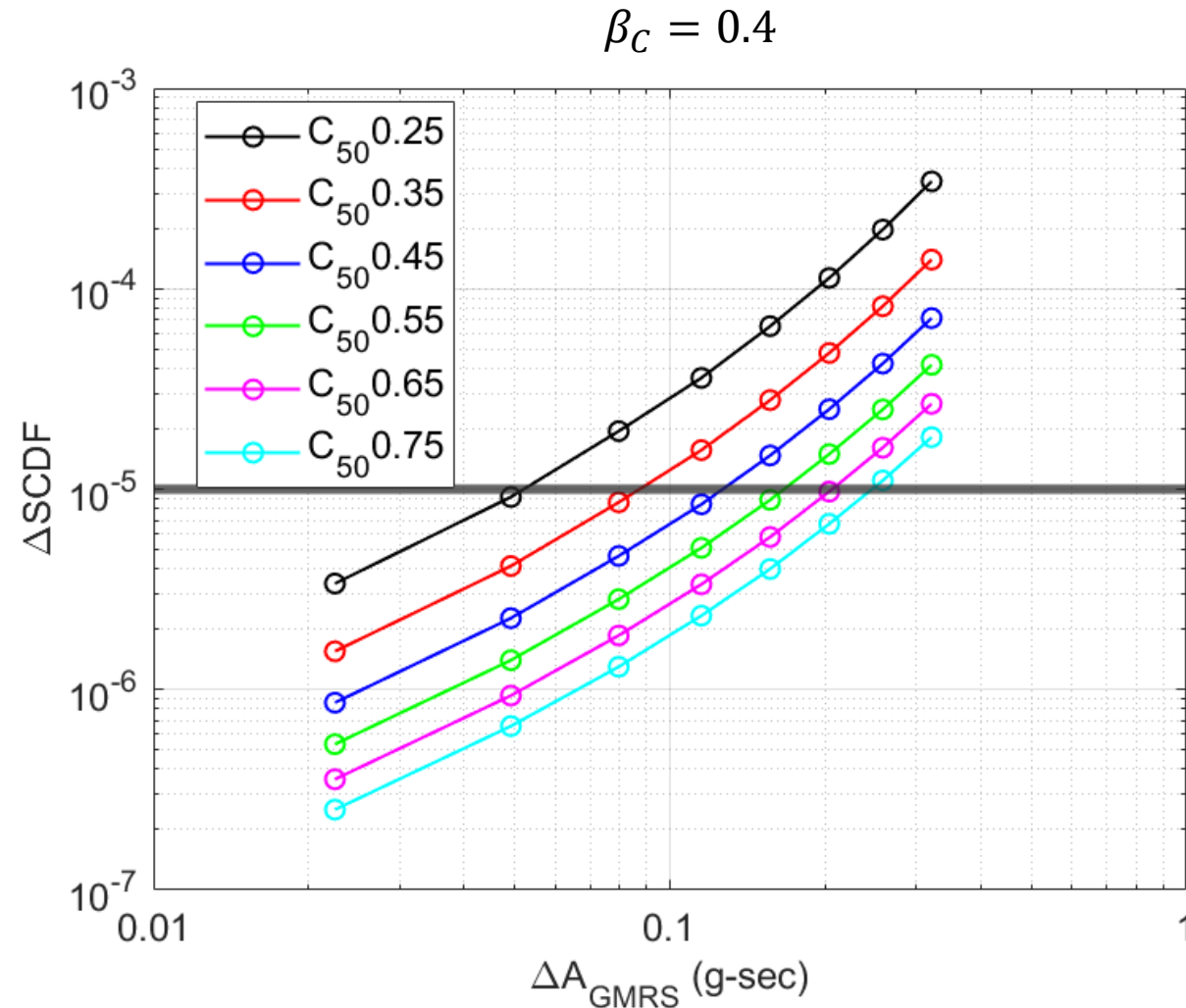
1. EPRI-GMM control point hazard
2. NGA-East control point hazard
3. Convolve hazard with fragility curves for 1, 5 and 10 Hz
4. Average SCDF_{1Hz} SCDF_{5Hz} SCDF_{10Hz}

Distribution of C_{50} and β_C Across the Fleet

Using GI-199 dataset

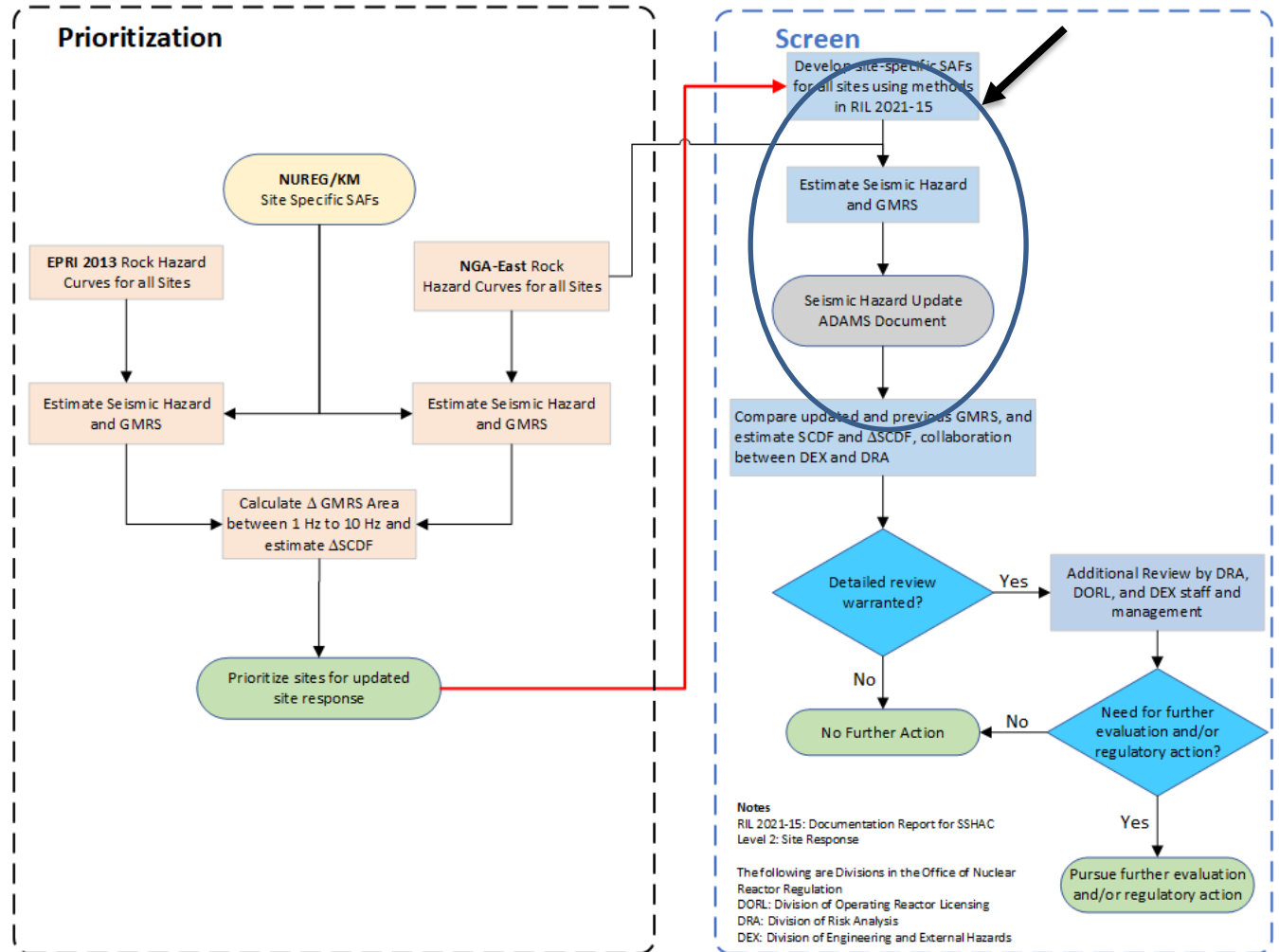


Δ SCDF For Alternative C_{50} Values



Updated Site Response Analysis and PSHA

Savannah River Test Site
Updated Site Response Analysis and
PSHA

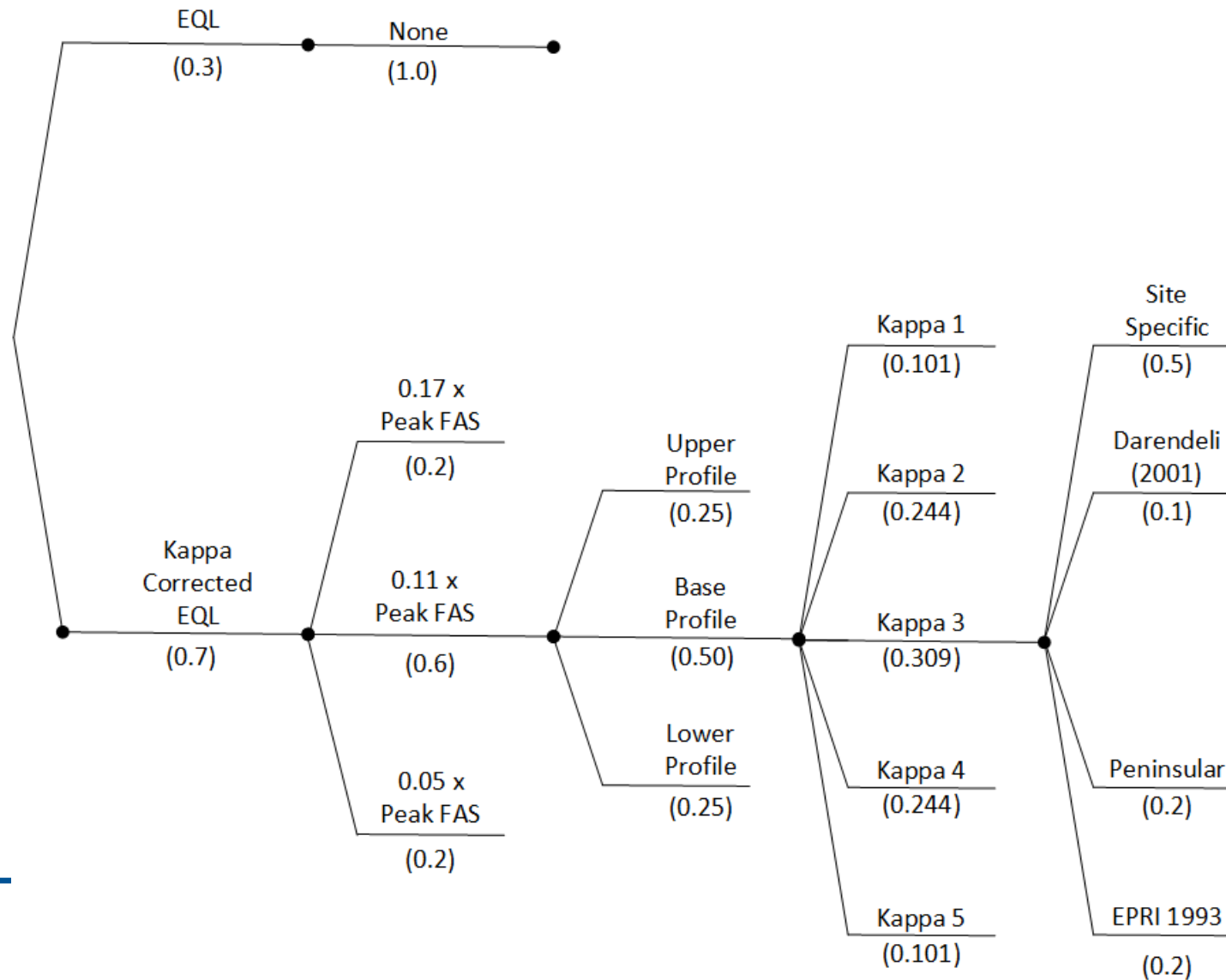


Implementation of Latest Site Response Analyses Models and Methods

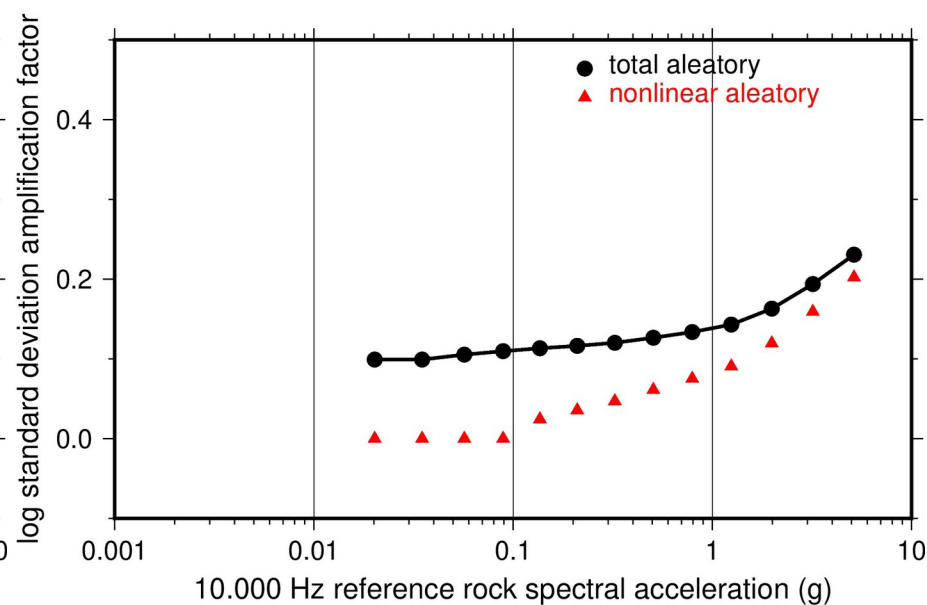
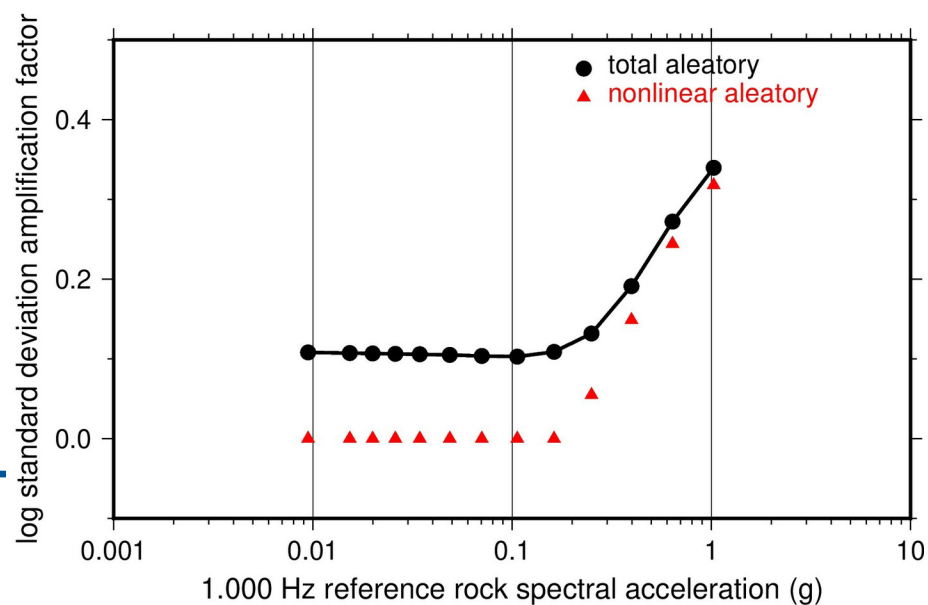
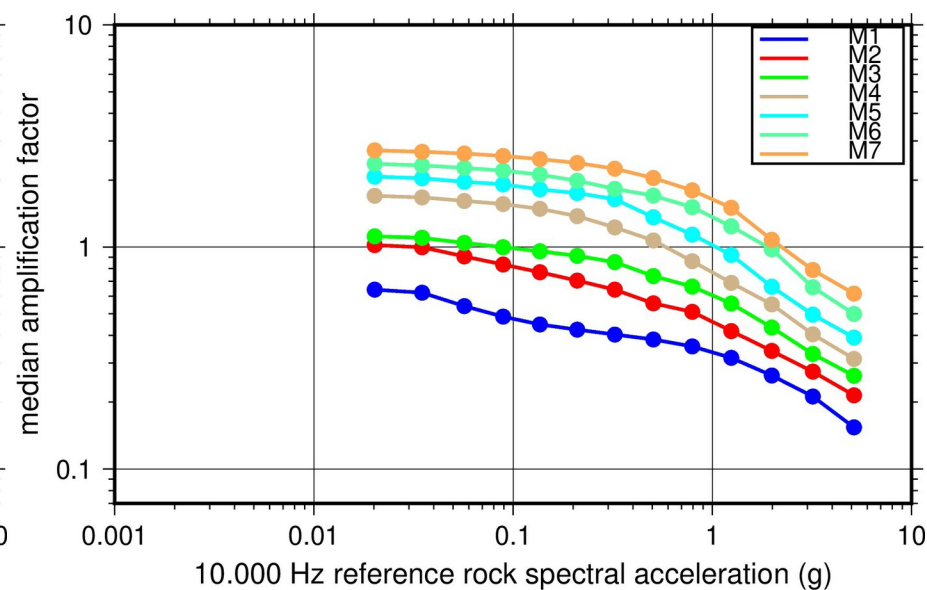
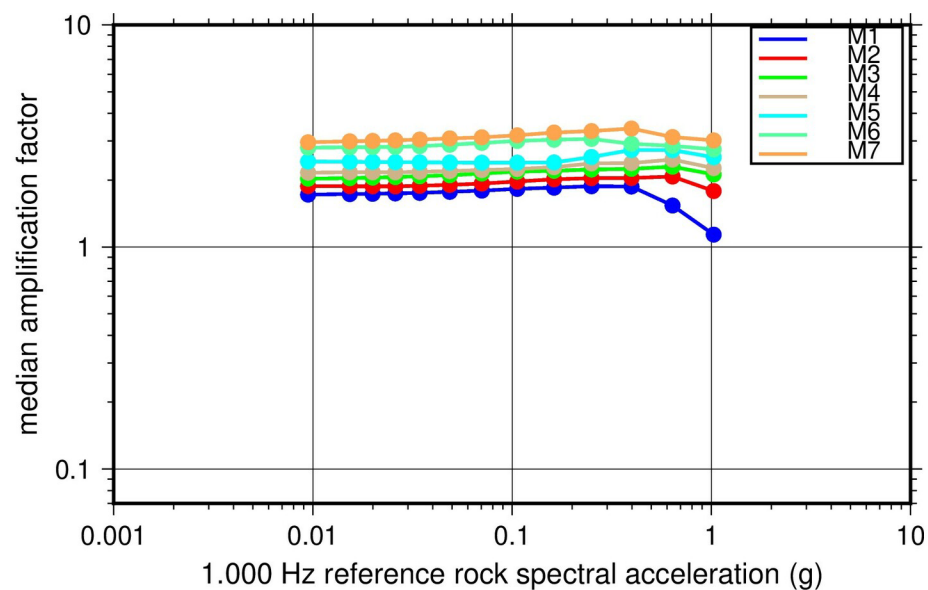
- For each CEUS NPP site develop site response logic tree that incorporates latest methods and models from SSHAC Site Response Project
- Overall lesson learned from SSHAC Site Response Project is to carefully consider multiple alternative models and parameters
 - Widen epistemic uncertainty if warranted for
 - Site response methods
 - Site Vs profiles
 - Treatment of nonlinear response of soil and rock
 - Important site parameters such as site kappa
 - Final Site Adjustment Factors

Example Site Response Logic Tree

Analysis Method	Kappa Correction Factor	Vs Profile	Site Kappa	MRD Curves
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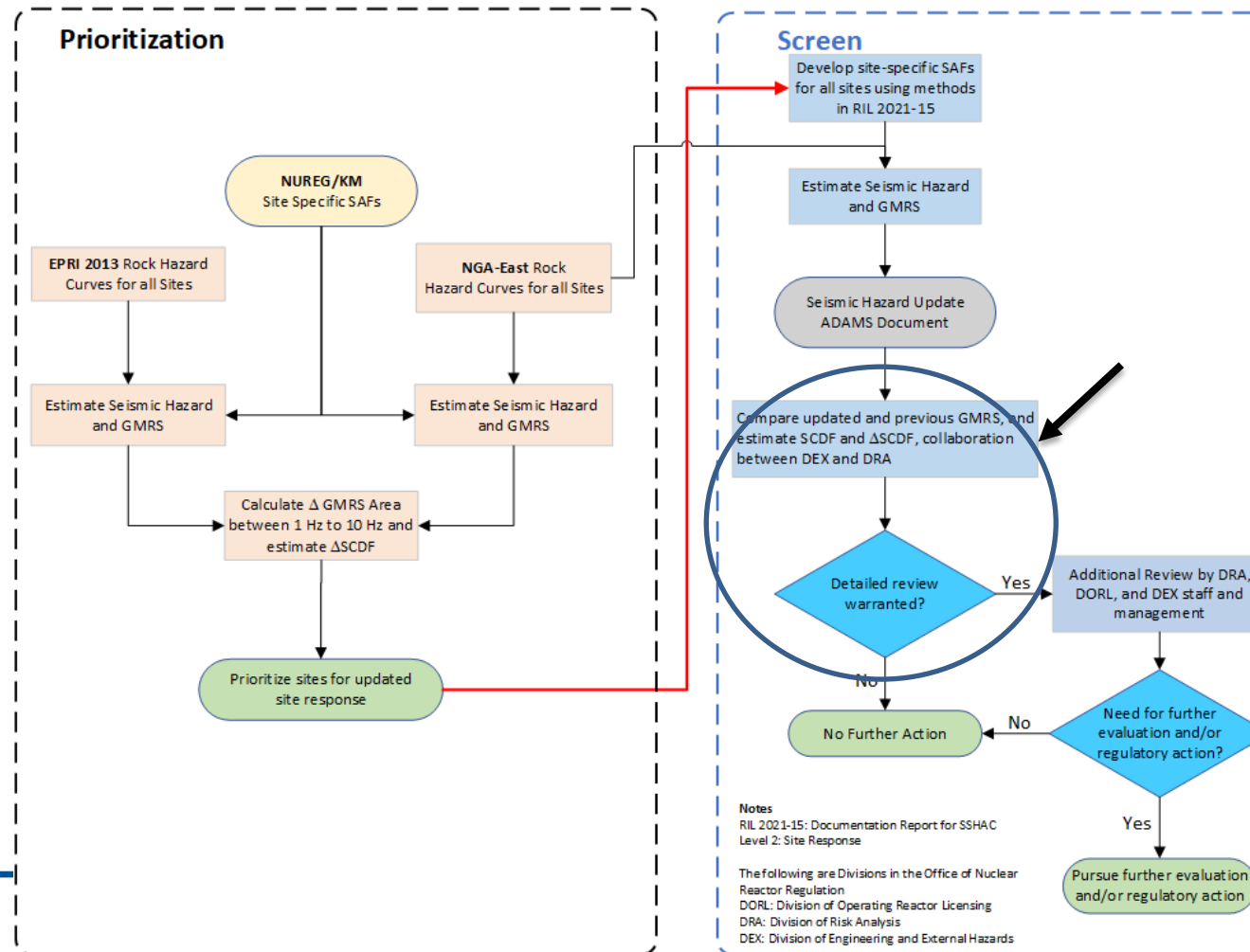
Site Adjustment Factors



Development of Control Point Hazard Curves and GMRS

- Combine reference rock hazard curves with site response results to develop control point hazard curves
 - Use Approach 3 PSHA to convolve rock hazard curves with site adjustment factors
- Develop mean Uniform Hazard Response Spectra and then GMRS
- Prepare seismic hazard update and publish in ADAMS
 - Description of site geology, site response analysis, and PSHA
 - Tables of rock hazard curves, site adjustment factors, control point hazard, and GMRS

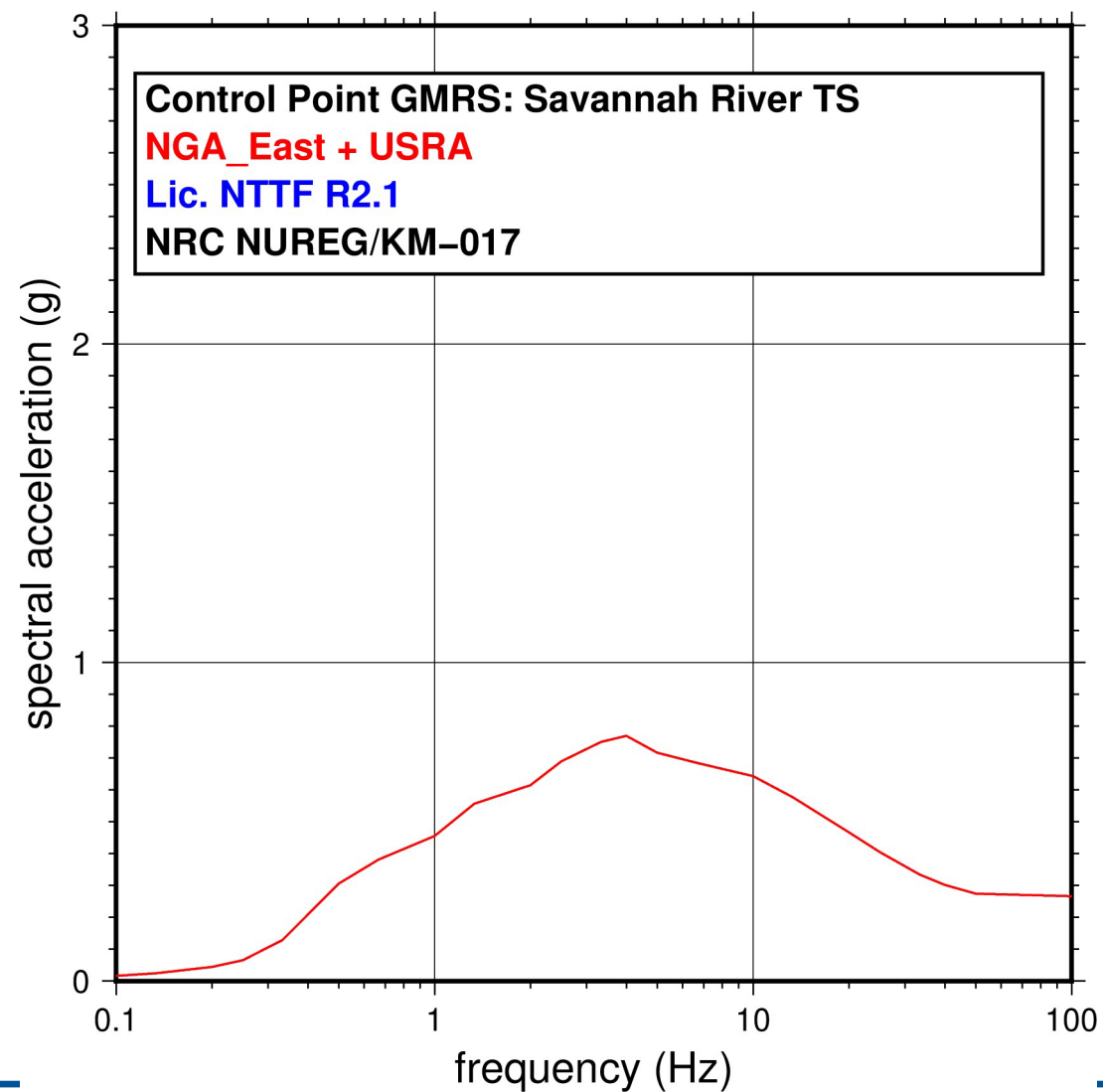
Screening Evaluation



Screening Evaluation

- Changes in hazard with respect to previous GMRS
- Other factors such as plant SSE and overall hazard level between 1 and 10 Hz
- Delta risk with respect to previous plant risk assessments
- Further risk considerations

GMRS Comparisons



Further Considerations in Screening Review

- Licensing basis for approved risk-informed applications
- Insights from SPRAs submitted in response to NRC's post-Fukushima efforts
- Principles of risk-informed decision making (embodies Be riskSMART framework)
- 10 CFR 50.109 and Management Directive 8.4 (Backfitting), as applicable

References

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 - EPRI, 2012. EPRI Report 1025287 “Seismic Evaluation Guidance, Screening , Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic” November 27, 2012, ADAMS Accession No. ML12333A170.
 - EPRI, 2013. EPRI Ground Motion Model Review Final Report, June 3, 2013, ADAMS Accession No. ML13155A553.
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Project Schedule

Task	Initial Milestone	Revised Milestone
NRC development and verification of seismic analyses computer code	Q1FY22	Completed 3/31/22
- Run NRC computer codes for operating plants in CEUS Screen Prioritize hazard updates using NUREG/KM-0017 results	Q2FY22	Ongoing (8/50 sites completed 3 more running) Q4FY22
Public Meeting - stakeholder interaction	Q2FY22	5/17/22
- Run advanced site response analyses for screened all sites Screen updated site seismic hazard GMRS relative to previous results - Develop seismic hazard update report for each site	Q3FY22	Ongoing Q1FY23
Public Meeting - stakeholder interaction	Q3FY22	Q4FY22
Assessment of screened sites for risk significance	Q4FY22	Q1FY23
Public Meeting - stakeholder interaction	Q4FY22	Q1FY23

Sharing comments and information

- Staff will create a resource email to accept comments and information
- Staff will consider public comments and new information submitted through this email
- POANHI annual report will summarize comments received on POANHI projects

Questions