

Contract No:

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

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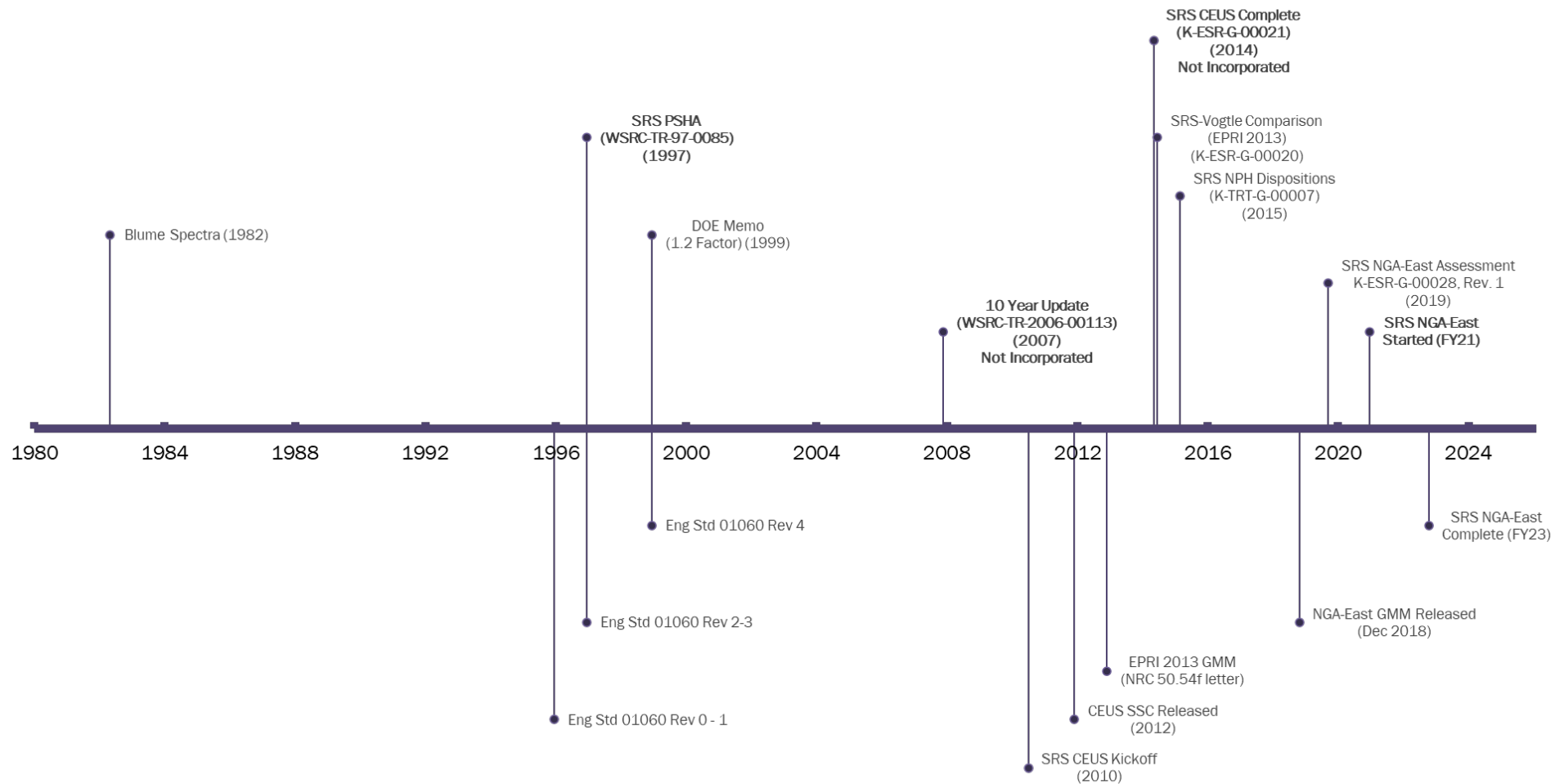
SRS Probabilistic Seismic Hazard (PSHA) Update

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Geotechnical Engineering Lead

SRS PSHA Update: DOE NPH Workshop

October 19, 2022

SRS Seismic Hazard Timeline



Preliminary Assessment of NGA-East Impacts to SRS

- **Preliminary Assessment of NGA-East**
 - K-ESR-G-00028, Rev. 1
- **Savannah Demonstration Site**
 - CEUS Report
 - EPRI 2013 Report
 - NGA-East Report
 - Proxy for Savannah River Site
- **Vogtle 50.54f Analysis**
 - EPRI 2013 GMM



PSHA Input Comparison

National Models/Reports

Report	SSC Model	GMM Model
CEUS 2012	CEUS	EPRI 04/06
EPRI 2013	CEUS	EPRI 2013
NGA-East 2018	CEUS	NGA-East

SRS PSHA Reports

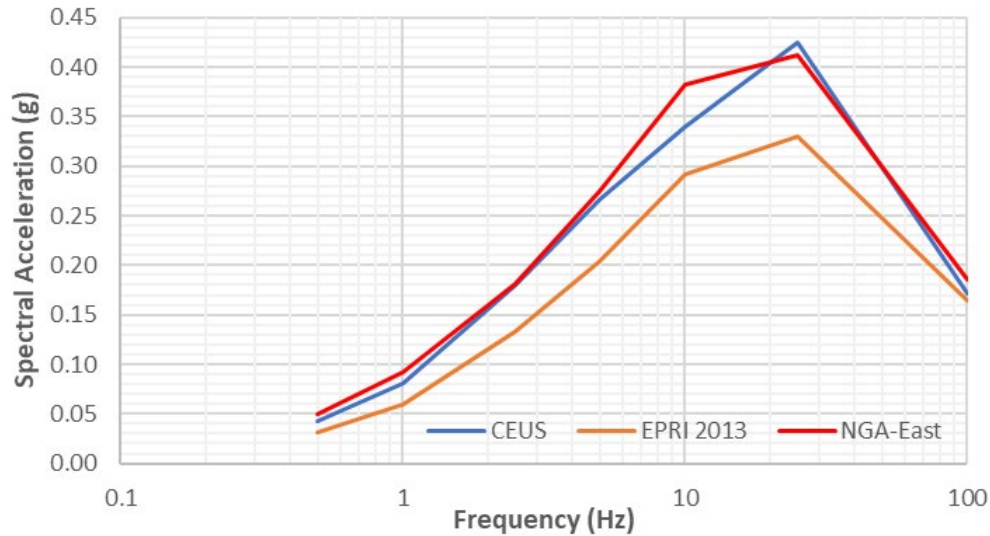
Report	SSC Model	GMM Model
SRS 2007	CEUS	EPRI 04, USGS 02, PEA 04
SRS 2014	CEUS	EPRI 04/06
SRS 2021*	CEUS	NGA-East

Vogtle PSHA Reports

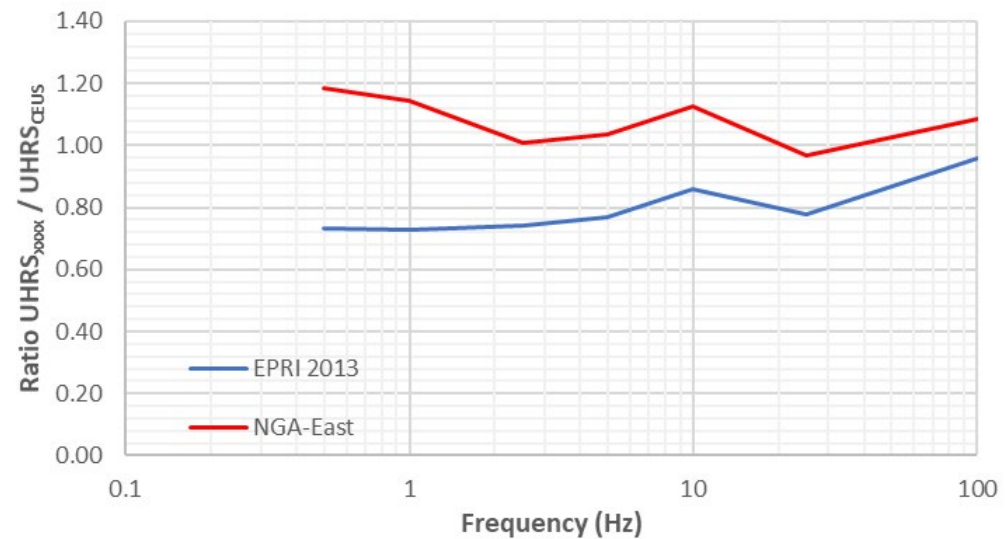
Report	SSC Model	GMM Model
Vogtle	CEUS	EPRI 04/06
	CEUS	EPRI 2013

Savannah Demonstration Test Site UHRS Comparisons

Mean UHRS at 4×10^{-4} AFE for Savannah



UHRS Ratio 4×10^{-4} AFE for Savannah



Project Team

- **Project Owner – DOE/SRNS**
- **Technical Team – Lettis Consultants International, Inc.**
- **PPRP Team**
 - Dr. William Lettis
 - Dr. Richard Lee
 - Dr. Walt Silva
 - Dr. Martin Chapman
- **Technical Advisors**
 - Dr. Carl Constantino
 - Dr. Ken Stokoe
- **Dynamic Soil Properties Peer Review**
 - Dr. Richard Lee
 - Dr. Carl Constantino
 - Dr. Brady Cox
 - Dr. Tom Houston

Key Items for SRS NGA-East PSHA Update

- **Primary inputs**
 - CEUS SSC
 - NGA-East GMM
- **Charleston RLME Workshop**
- **Locations for Rock Hazard Calculation**
 - Previously determined at the center of the site
 - Sensitivity study to determine effect of location
 - Ultimately 4 locations chosen
- **Soil Dynamic Properties**
- **Site Response Analysis - ongoing**

GMPE and SSC Adjustments

• Evaluation of New GMPEs

- Review of GMPEs revised since the release of NGA-East
 - *% change from original model*
 - *% change in hazard, given original GMPE NGA-East weighting*
- Conclusion – no need to update NGA-East

SSC

- Corrections to some Seismotectonic zones
- Site-Specific refinements to the Charleston RLME

Source	Source Type	In 320-km Site Region?	Modify from CEUS-SSC?
MESE-N	Mmax zone	Yes	No
MESE-W	Mmax zone	Yes	No
NMESE-N	Mmax zone	Yes	No
NMESE-W	Mmax zone	No	No
Study-R	Mmax zone	Yes	No
AHEX	Seismotectonic zone	No	No
ECC-AM	Seismotectonic zone	Yes	No
ECC-GC	Seismotectonic zone	Yes	No
MidC-A	Seismotectonic zone	No	Use corrected Mmax distribution (EPRI, 2015)
MidC-B	Seismotectonic zone	No	Use corrected Mmax distribution (EPRI, 2015)
MidC-C	Seismotectonic zone	No	Use corrected Mmax distribution (EPRI, 2015)
MidC-D	Seismotectonic zone	No	Use corrected Mmax distribution (EPRI, 2015)
PEZ-N	Seismotectonic zone	Yes	Use corrected Mmax distribution (EPRI, 2015)
PEZ-W	Seismotectonic zone	Yes	Use corrected Mmax distribution (EPRI, 2015)
RR-RCG	Seismotectonic zone	No	No
Charleston	RLME source	Yes	Yes, changes to source geometry, future rupture characteristics, and recurrence model
Commerce	RLME source	No	No
ERM-N	RLME source	No	No
ERM-S	RLME source	No	No
Marianna	RLME source	No	No
NMFS	RLME source	No	No
Wabash	RLME source	No	No

Charleston RLME Seismic Zone Refinements

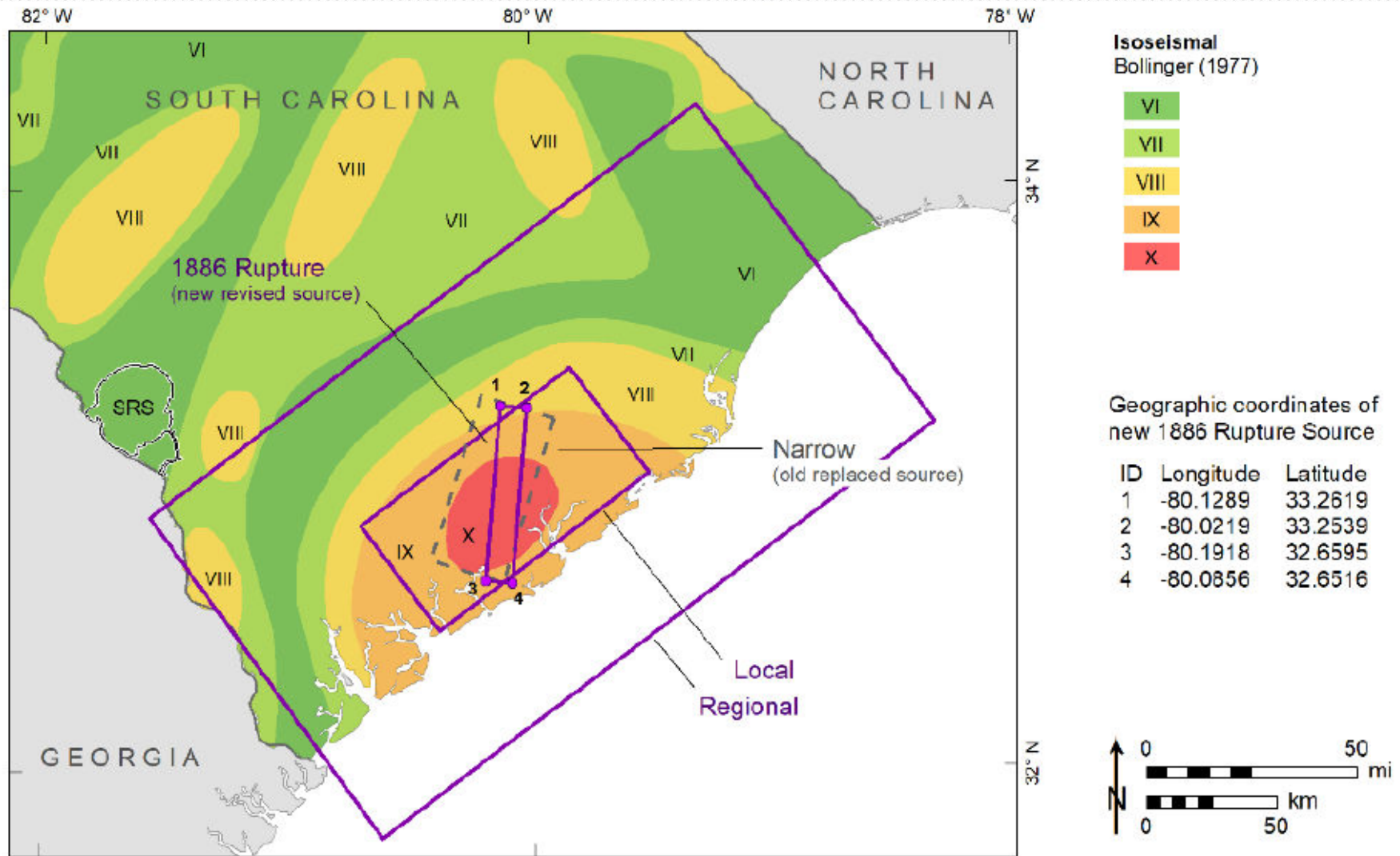
Zone	Boundary Type	Sense of Slip	Rupture Strike	Rupture Dip	Recurrence Model
1886 Rupture [0.3]*	Leaky [1.0]	Reverse [1.0]	S0–15°W uniformly distributed [1.0]	40–50°W uniformly distributed [1.0]	Poisson [0.5] Renewal [0.5]
Local [0.5]	Leaky [1.0]	Reverse [0.5]	N-S [0.6]	30–60° random both directions [1.0]**	Poisson [0.9] Renewal [0.1]
			N45°E [0.2]		
			E-W [0.1]		
			N45°W [0.1]		
		Strike-slip [0.5]	N-S [0.3]	75–90° random both directions [1.0]**	
			N45°E [0.5]		
			E-W [0.1]		
			N45°W [0.1]		
Regional [0.2]	Strict [1.0]	Reverse [0.5]	N-S [0.6]	30–60° random both directions [1.0]**	Poisson [1.0]
			N45°E [0.2]		
			E-W [0.1]		
			N45°W [0.1]		
		Strike-slip [0.5]	N-S [0.3]	75–90° random both directions [1.0]**	
			N45°E [0.5]		
			E-W [0.1]		
			N45°W [0.1]		

Notes:

* = See Figure 5-7 for geographic coordinates of the new “1886 Rupture” zone, which replaces the “Narrow” zone.

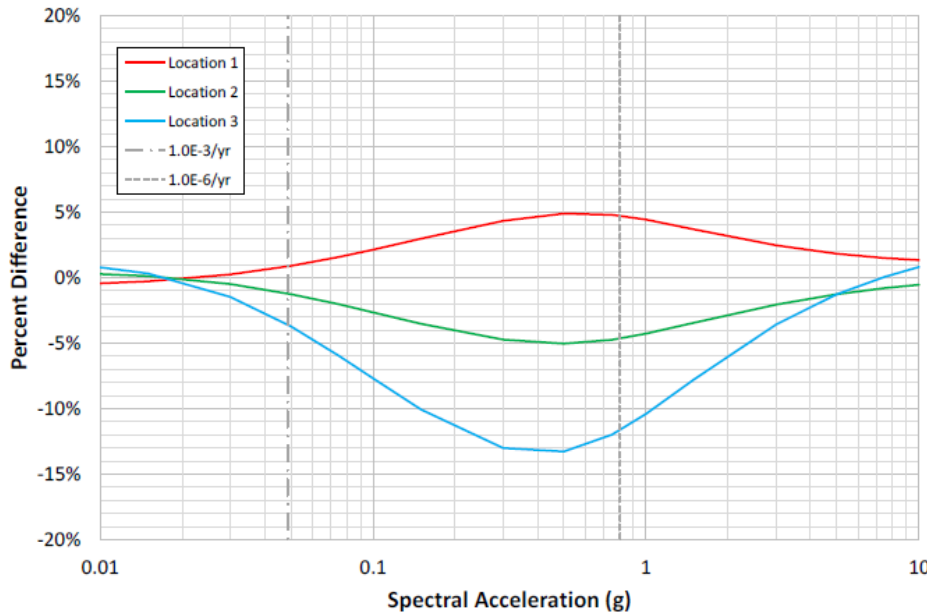
** = Equally likely dip direction.

Charleston RLME Seismic Zone Refinements

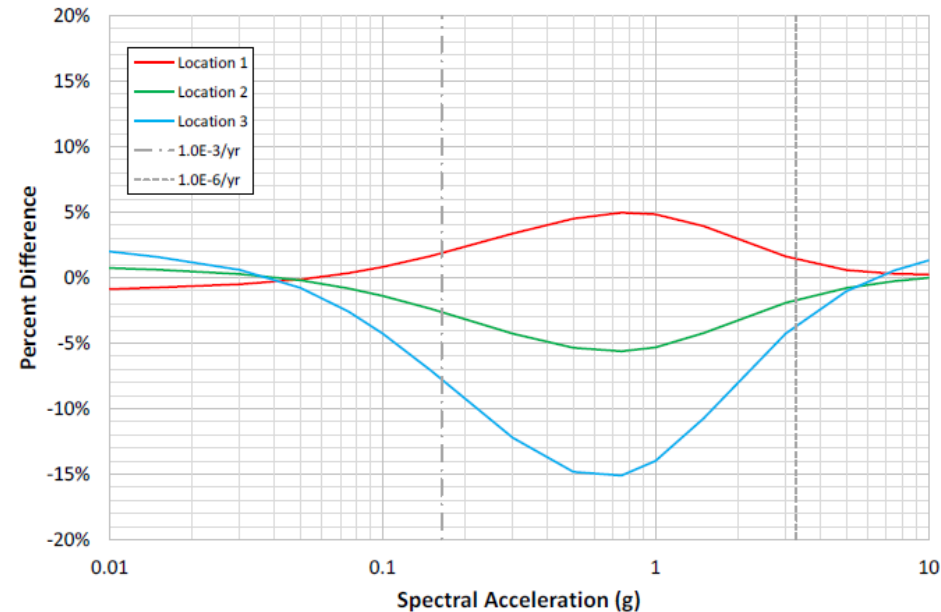


Rock Hazard Location Sensitivity

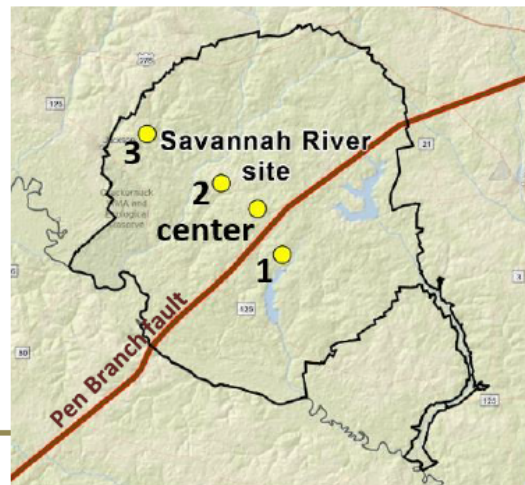
Location Sensitivity, 1 Hz Total Mean Rock Hazard at SRS



Location Sensitivity, 10 Hz Total Mean Rock Hazard at SRS



Total mean hard-rock hazard at SRS at three alternative locations, change from baseline (computed at site center)

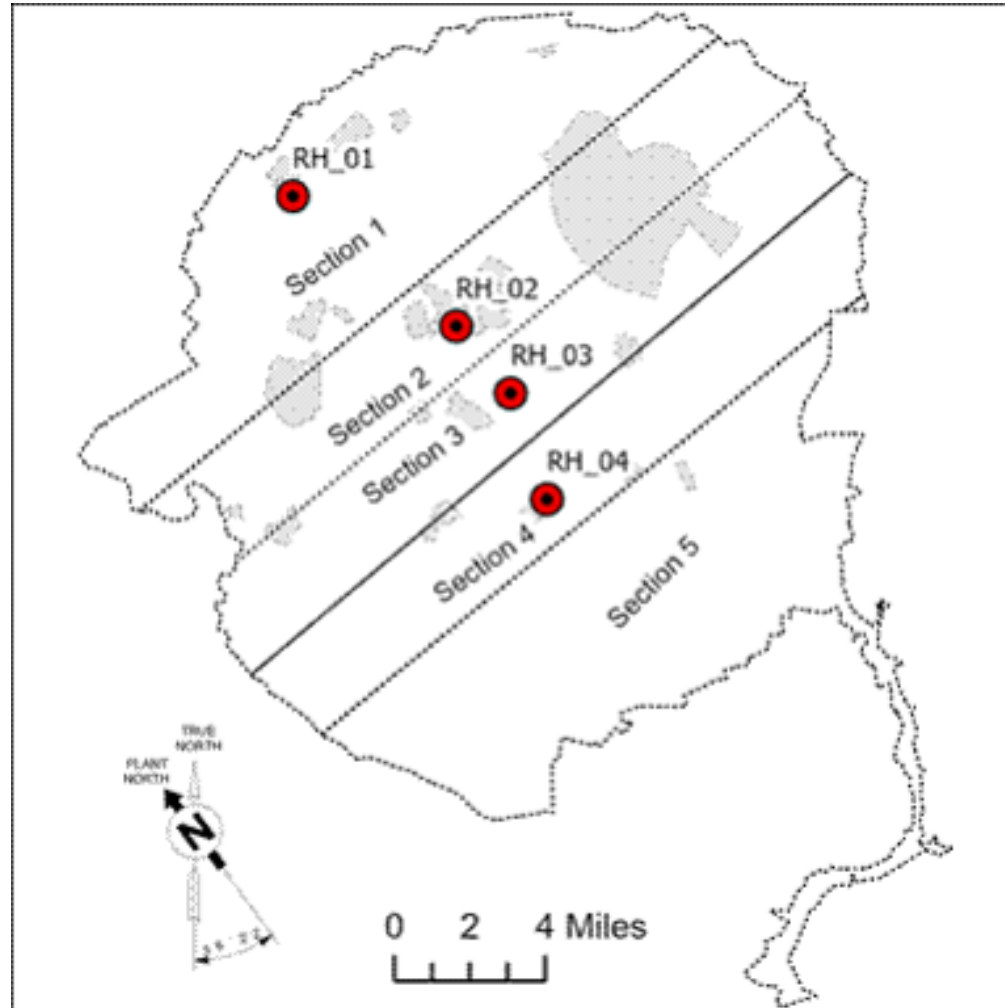


Max change in UHRS ground motions will be $\sim 1/3$ of the change in hazard:

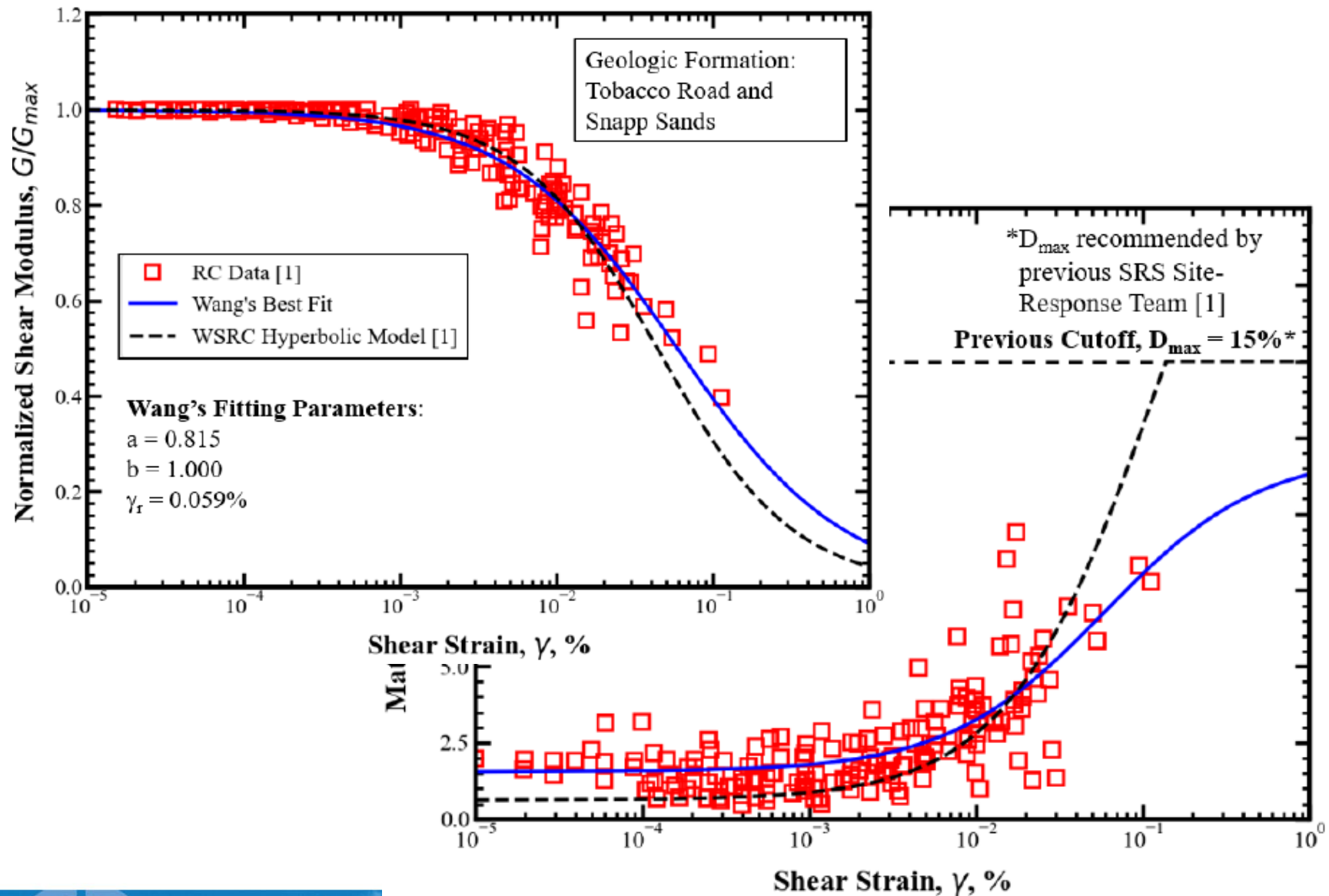
$$20\% / 3 \approx 7\%$$

16

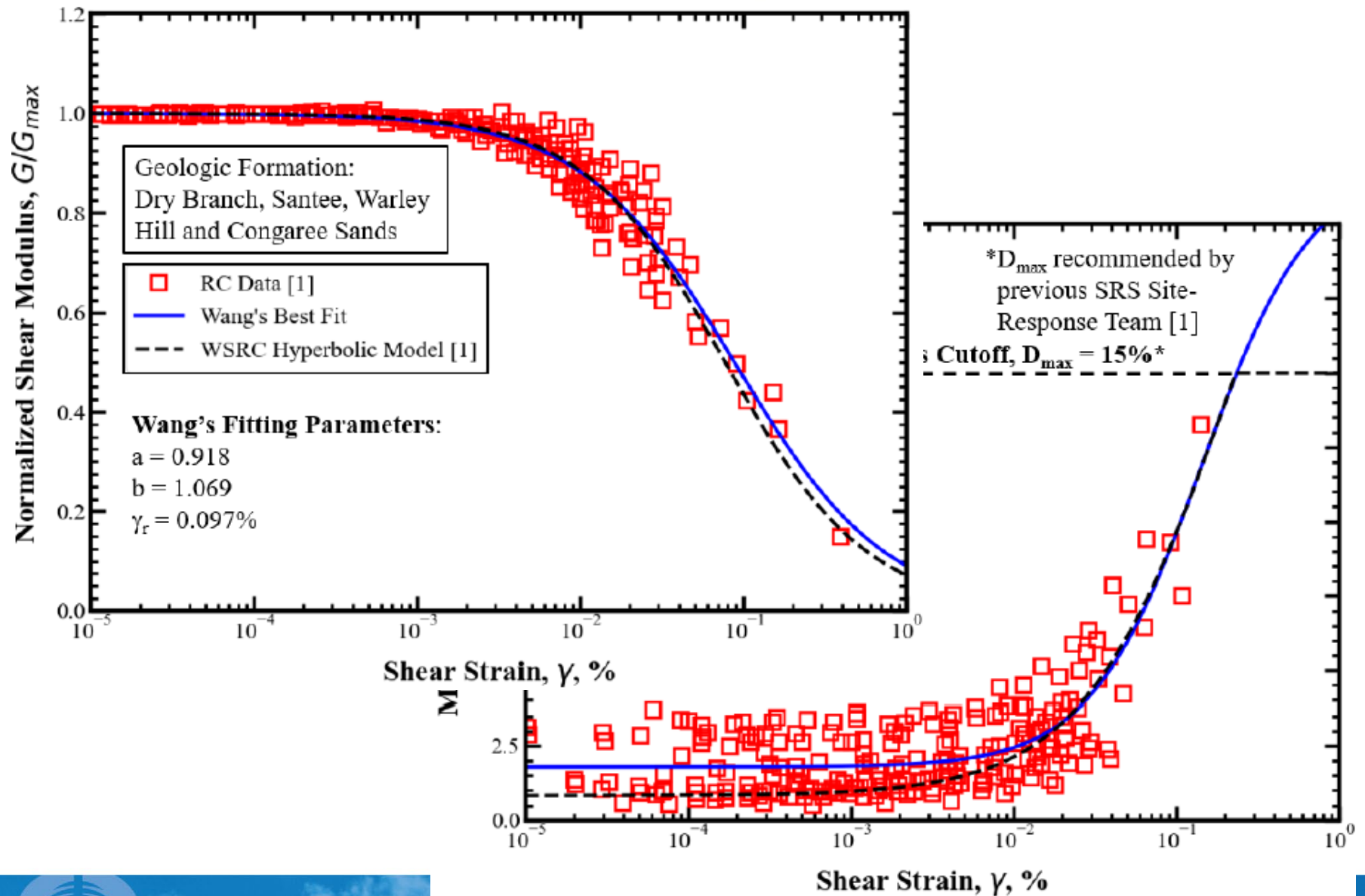
Savannah River Site Soil Profile Sections



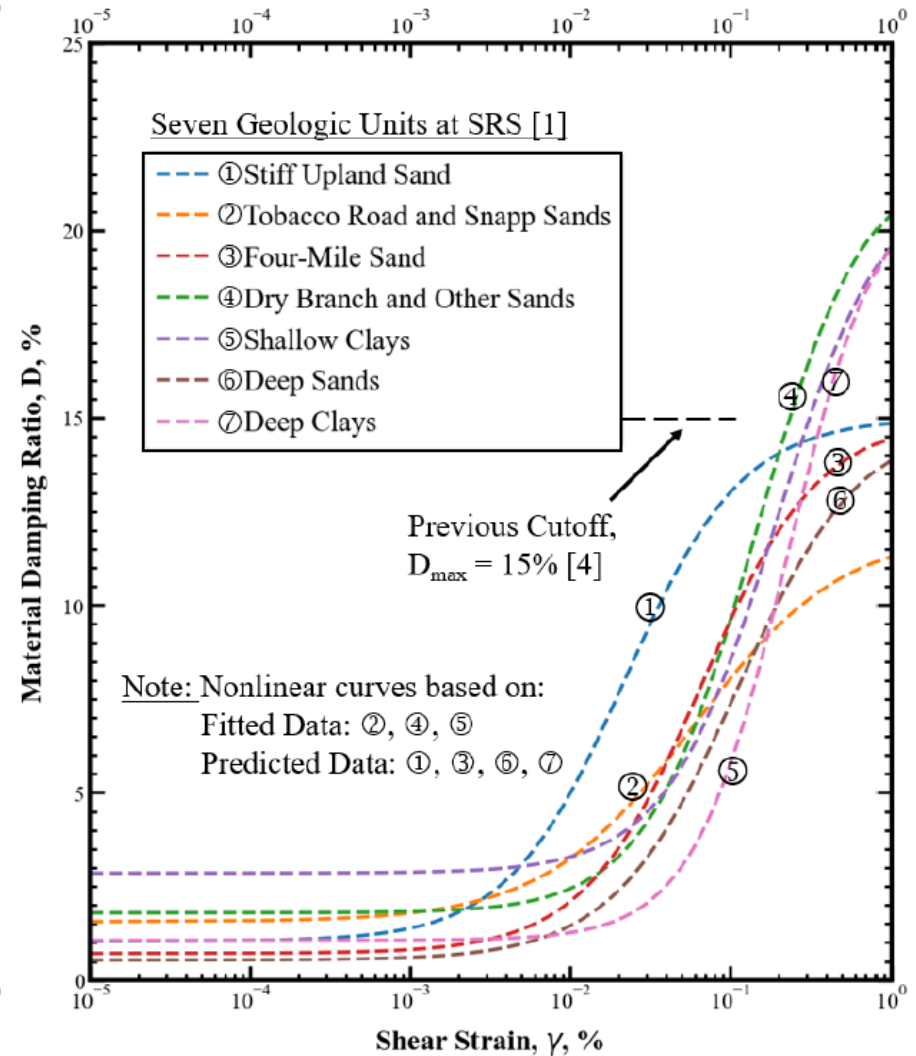
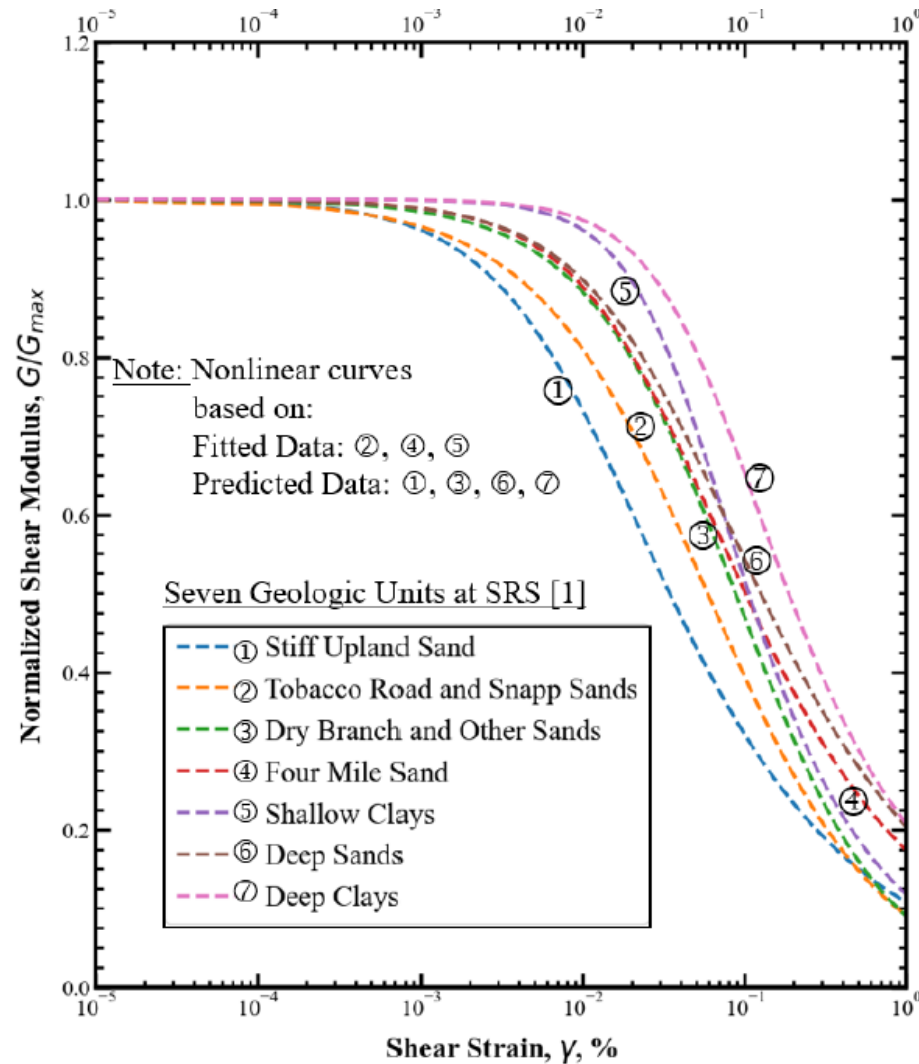
Revised SRS Soil Dynamic Property Curves



Revised SRS Soil Dynamic Property Curves



Revised SRS Soil Dynamic Property Curves



Revised SRS Soil Dynamic Property Curves

- **Revised curves are applicable for use**
 - Beyond 1% strain, the curves are extrapolated (Stokoe)
- **Consideration of Shear Strength Beyond ~0.5% Shear Strain**
 - Old curves (WSRC 1996) may under-estimate shear strength at high strains
 - New curves (Stokoe and Xu, 2022) may over-estimate shear strength
 - Both sets are be used to account for epistemic uncertainty at high strains



Site Response – On Going

- **SDC-3 through SDC-5**
- **Surface Spectra Developed at 6 Representative Locations**
- **FIRS developed at representative depths**
 - 10 ft, 25 ft, and 50 ft



• **Thank You**