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Protecting People and the Environment

Near-term Task Force Recommendation 2.1 Seismic Hazard Evaluation

Southern

June 26, 2014

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References for Meeting

- Licensee Presentation Slides – ML14176B239
- NRC Presentation Slides – ML14177A086
- Public Meeting Agenda – ML14169A437
- Meeting Feedback Form (request from mfb@nrc.gov)
- May 9, 2014, NRC letter regarding Seismic Screening and Prioritization Results for central and eastern US Licensees (ML14111A147)
- May 21, 2014, NRC memo providing preliminary staff ground motion response spectra for central and eastern Licensees (ML14136A126)
- Meeting Summary to be issued within 30-day

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Meeting Introduction

Purpose: support information exchange and begin dialog to have common understanding of the causes of the primary differences between the preliminary NRC and licensee seismic hazard results

Background: NRC and licensee seismic hazard require resolution to support a final seismic screening decision and to support related follow-on submittals

Outcomes:

- Begin NRC and licensee resolution to support regulatory decisions and development of seismic risk evaluations, as appropriate
- Establish resolution path, including timelines and identification of potential information needs

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Look-ahead: Potential Next Steps

- NRC will consider the meeting information
- Potential paths:
  - Licensee submits supplemental information based on public meeting dialog
  - NRC staff issues a request for information
  - Licensee sends a revision or supplement to the seismic hazard report
- NRC completes screening review and issues the final screening determination letter

Hatch Units Nuclear Plant

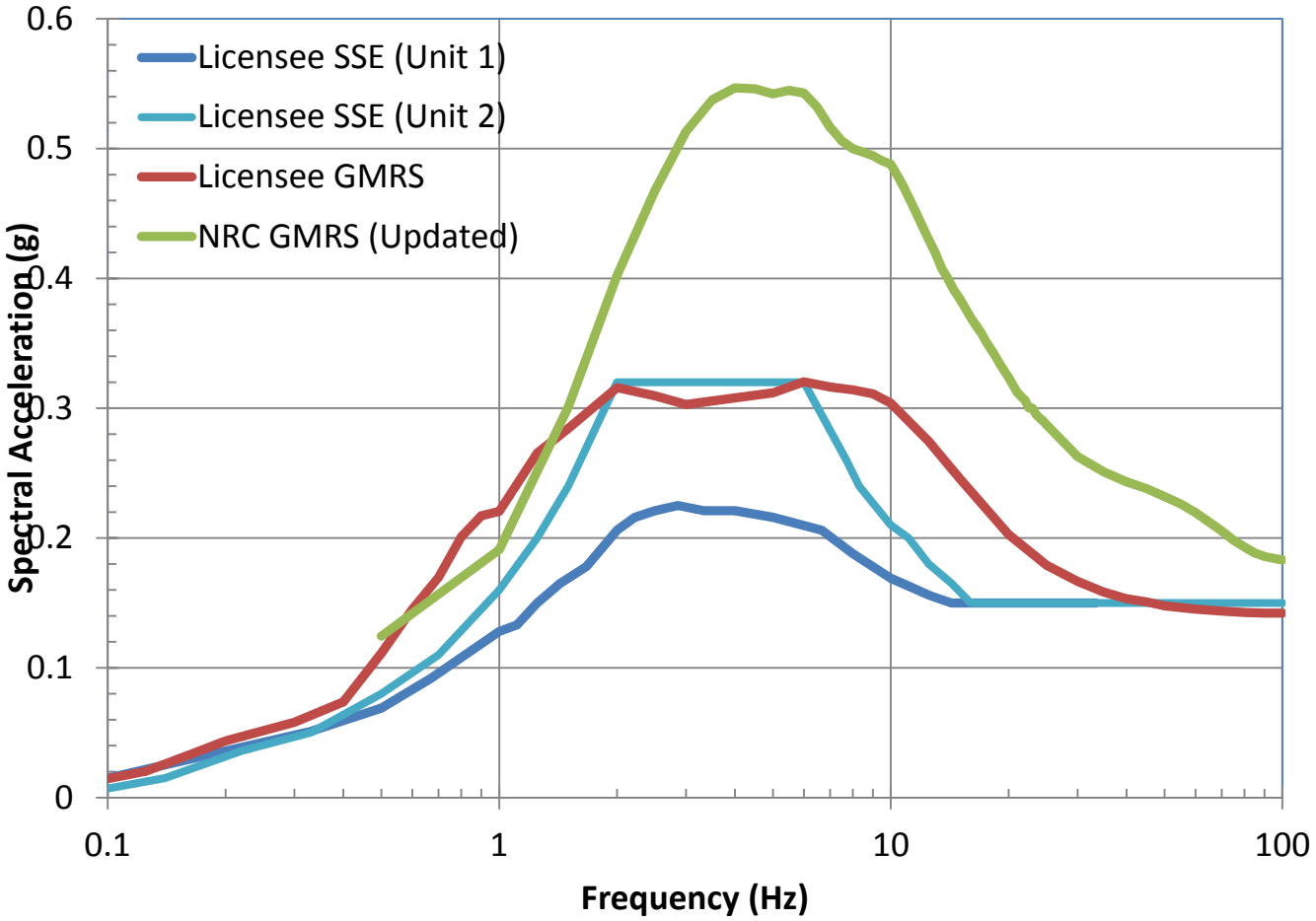
Sarah Tabatabai

Office of Research

June 26, 2014

Screening

- Screens in: Expedited Approach, Seismic Risk, High Frequency, SFP Evaluations
- Prioritization Group: 2



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Stratigraphy

ERA	PERIOD	EPOCH	GEOLOGIC UNIT	APPROX. THICKNESS (FT)	LITHOLOGIC DESCRIPTION
CENOZOIC	QUATERNARY	HOLOCENE	ALLUVIUM	55+	SAND AND GRAVEL; CARBONACEOUS SILTY CLAY.
		PLEISTOCENE – PLIOCENE (?)	BRANDYWINE FM	10+	CROSS-BEDDED SAND AND GRAVEL WITH HEMATITE CONCRETIONS.
	TERTIARY		HAWTHORN FM	300+	PHOSPHATIC, FINE TO COARSE SAND; SANDY, CALCAREOUS CLAY; ARKOSIC, CROSS-BEDDED SAND AND GRAVEL; OCCASIONAL PYRITE.
		MIOCENE	TAMPA FM	160	SANDY TO CLAYEY, PHOSPHATIC, FOSSILIFEROUS LIMESTONE; PARTLY DOLOMITIZED.
		OLIGOCENE	UNDIFFEREN-TIATED	120	MASSIVE, CALCITIZED, FOSSILIFEROUS LIMESTONE.
		EOCENE	OCALA FM (JACKSON GP)	280	MASSIVE, CRYSTALLINE, FOSSILIFEROUS LIMESTONE.
			CLAIBORNE GP: LISBON FM	610	SANDY, PHOSPHATIC, DOLOMITIC LIMESTONE; ABUNDANT GLAUCONITE AND FOSSILS.
			CLAIBORNE GP: TALLA-HATTA FM	160	GLAUCONITIC, CALCAREOUS SAND AND THIN, FOSSILIFEROUS MARL LAYERS.
			WILCOX GP	90	CARBONACEOUS, MICACEOUS, SILTY, FOSSILIFEROUS MARL; OCCASIONAL GLAUCONITIC SAND LAYERS.
		PALEOCENE	CLAYTON FM	315	MASSIVE, CRYSTALLINE LIMESTONE; INTERBEDDED WITH CARBONACEOUS, MICACEOUS, GLAUCONITIC MARLY SAND.
MESOZOIC	CRETACEOUS	GULFIAN	POST-TUSCALOOSA DEPOSITS	955	COQUINOID, PHOSPHATIC SAND; CARBONACEOUS, FOSSILIFEROUS, GLAUCONITIC MARL; OCCASIONAL PYRITE.
			TUSCALOOSA FM	910	FINE-GRAINED TO ARKOSIC, CARBONACEOUS, FOSSILIFEROUS, MICACEOUS SAND AND CLAY.
		COMANCHEAN	UNDIFFEREN-TIATED	115	SANDY, MICACEOUS CLAY; ARKOSIC SAND.
	TRIASSIC (?)		UNDIFFEREN-TIATED		ARKOSIC SANDSTONE; BASALT OR DIABASE.

Site Geologic Column (Source: FSAR Figure 2.5-8, Rev. 19)

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Control Point

NRC	Submittal
SSE Control Point El. 129 ft	SSE Control Point El. 129 ft

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Vs Profile Development

NRC

Template velocity profile for Vs=400 m/s (1312 ft/sec) from SPID used for entire profile. Template velocity profile supported by Vs data found in the literature

Submittal

ISFSI data used to develop near surface Vs profile (i.e. to a depth of 229 ft). Deeper portions of the profile (i.e. below a depth of 509 ft) were developed with nearby oil well exploration (Vp) data

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Epistemic Uncertainty in Vs Profiles

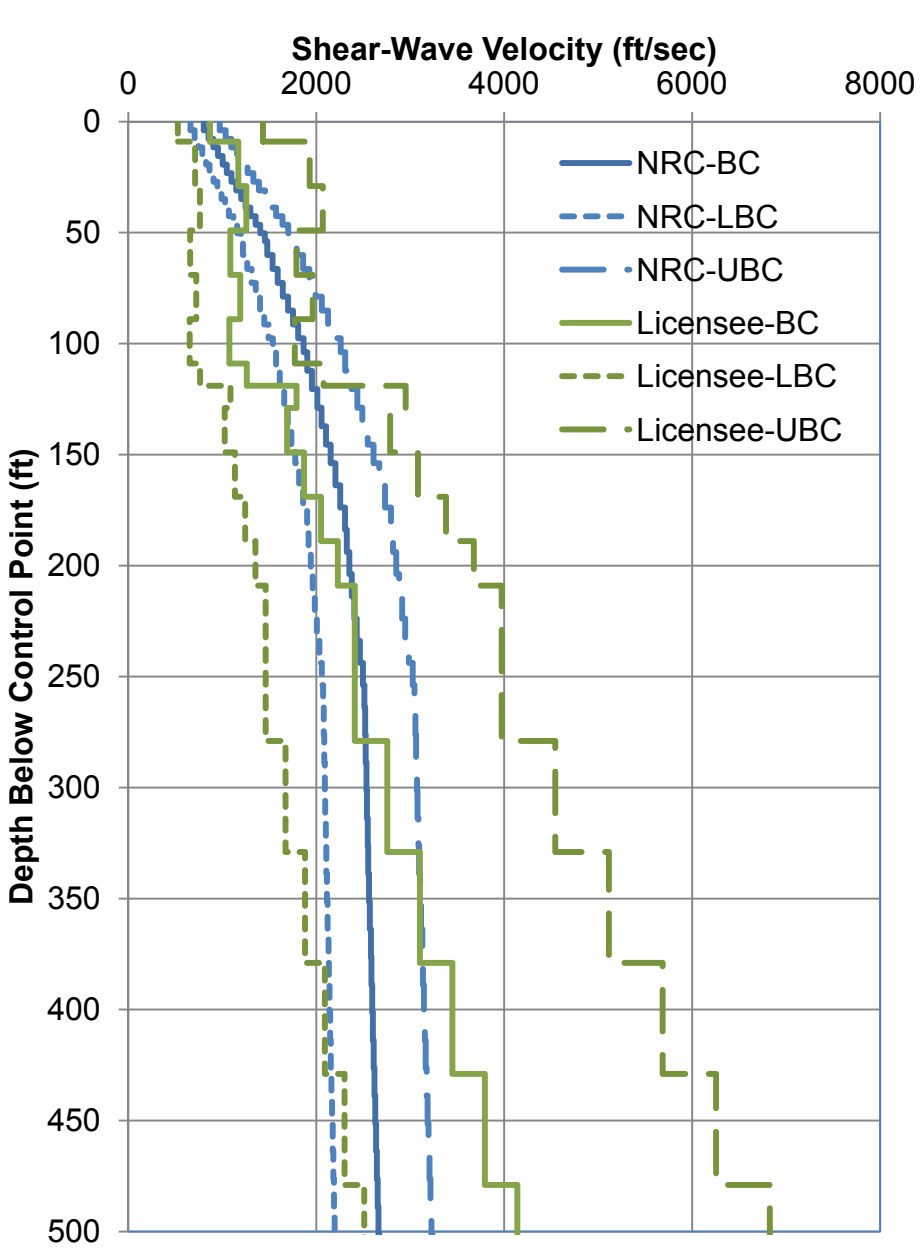
NRC

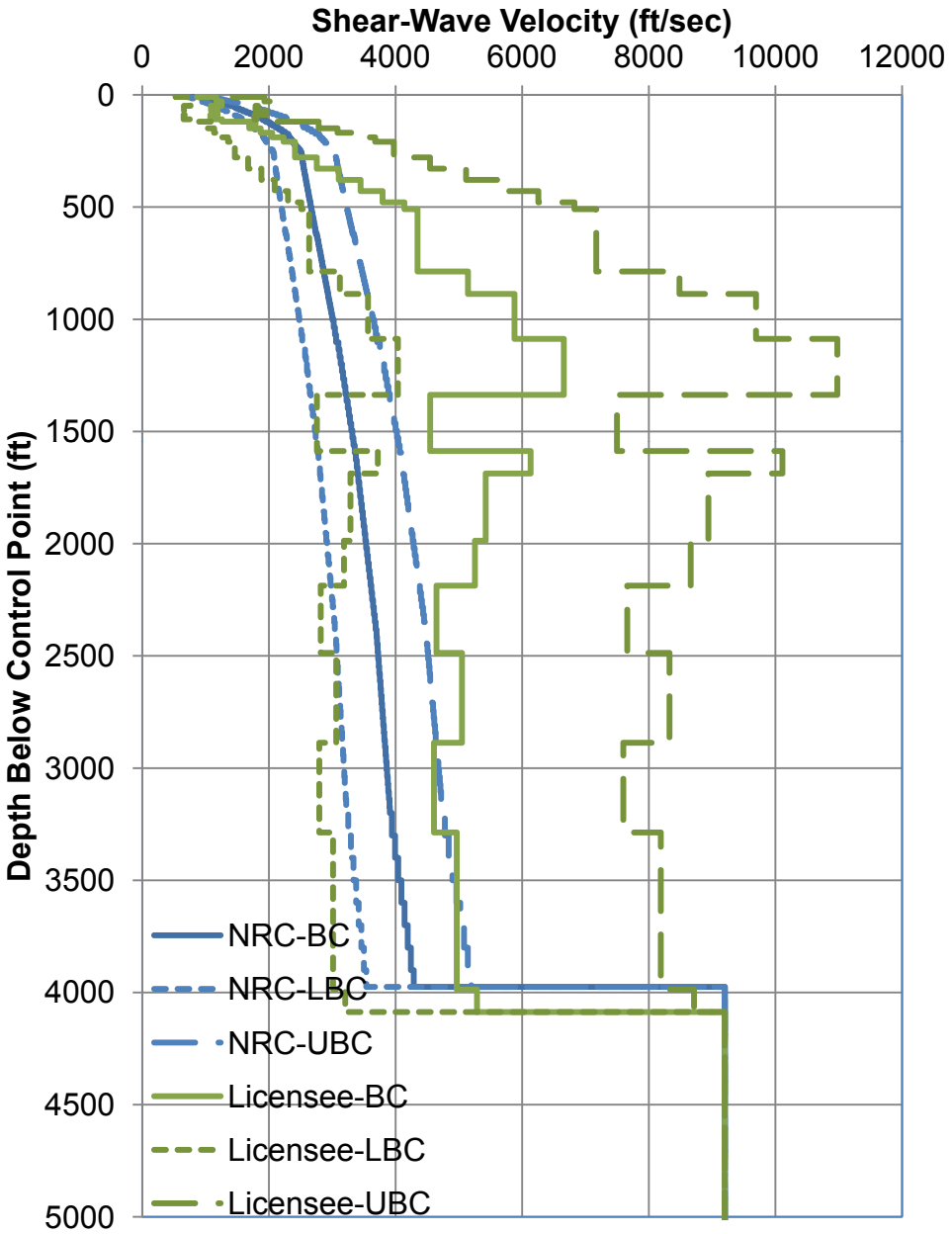
Applied a scale factor of 1.2 to the base case profile for development of the upper and lower case profiles

Submittal

Applied a scale factor of 1.57 to the base case profile for development of the upper and lower case profiles

Vs Profiles


Shear-Wave Velocity (ft/sec)
0
2000
4000
6000
8000
Depth Below Control Point (ft)
0
50
100
150
200
250
300
350
400
450
500
NRC-BC
NRC-LBC
NRC-UBC
Licensee-BC
Licensee-LBC
Licensee-UBC


Shear-Wave Velocity (ft/sec)
0
2000
4000
6000
8000
10000
12000
Depth Below Control Point (ft)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
NRC-BC
NRC-LBC
NRC-UBC
Licensee-BC
Licensee-LBC
Licensee-UBC

Information from other sites:

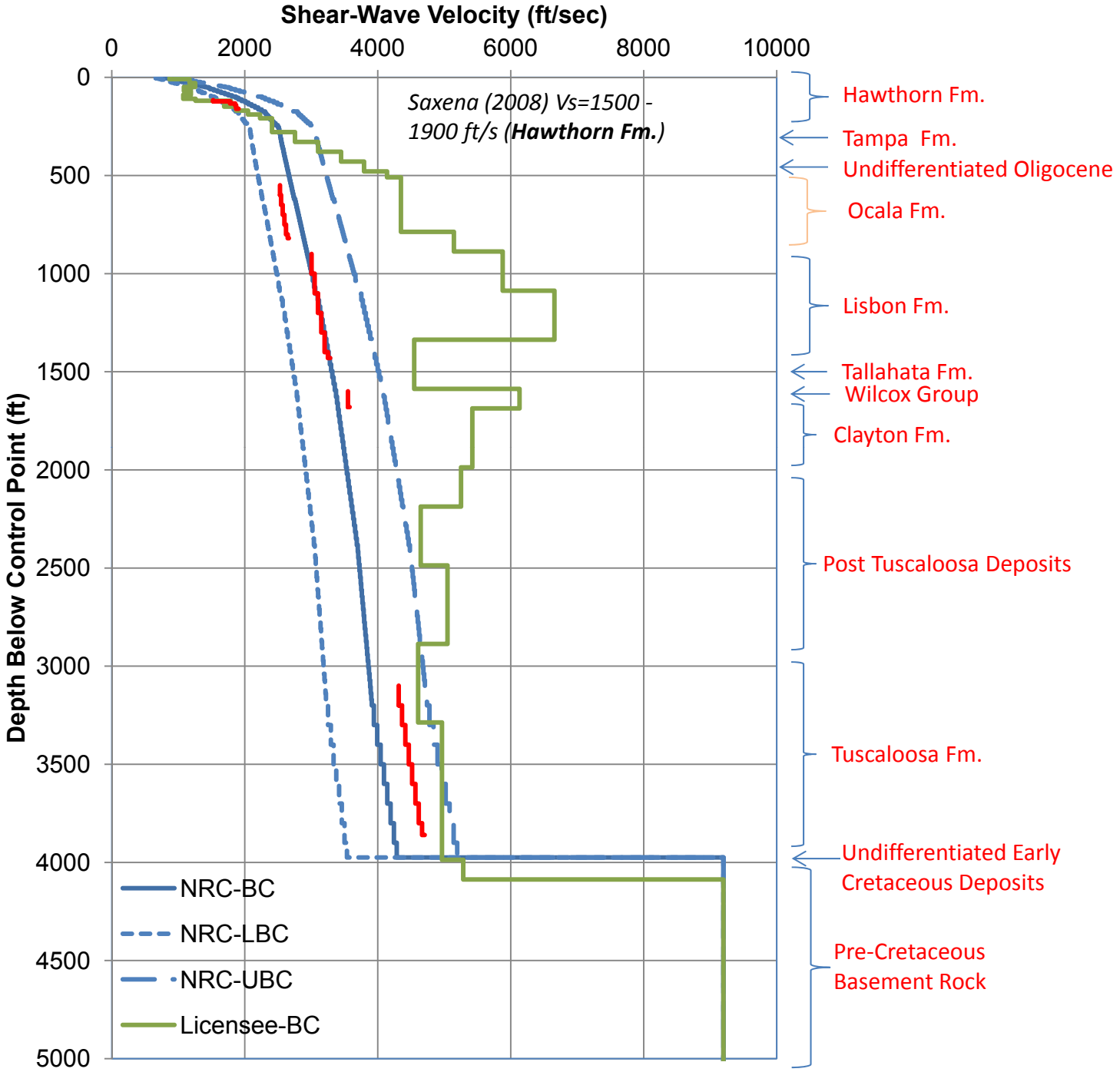
Vs=2450 ±200 ft/s in upper 50-100 ft (FSAR)

*Parker (2008) Vs=2296 ft/s (**Ocala Fm.**)*

*Vogtle COL: Vs=2650 ft/s at 149 ft (**Lisbon Fm.**)*

*Odum et al (2003): Vs=2805 ft/s at 98 ft (**Wilcox Group**)*

*Odum et al (2003): Vs=2840 ft/s at 98 ft (**Tuscaloosa Fm.**)*



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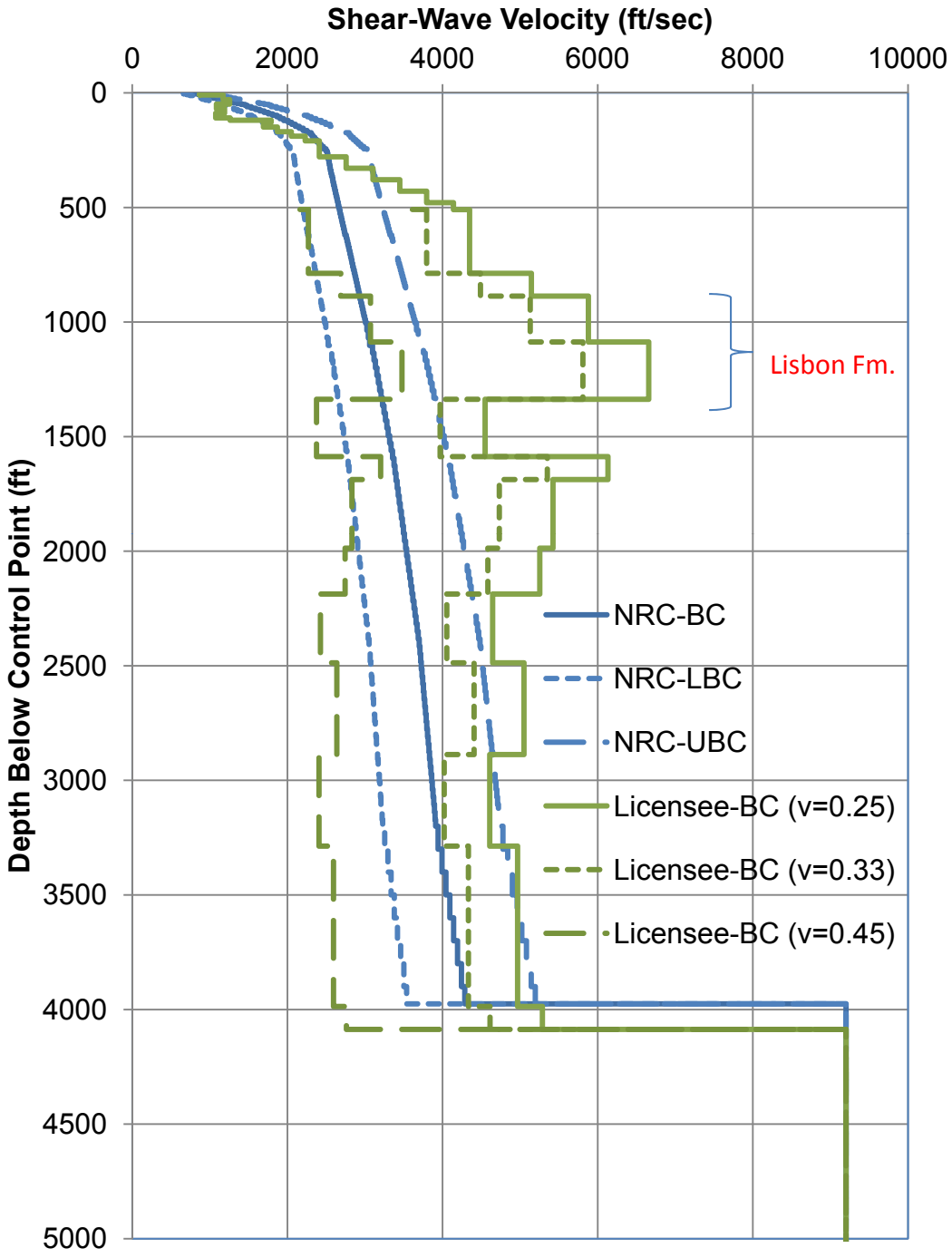
An average Poisson's ratio of 0.43 is reported for the Lisbon Formation at the Farley site



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Aleatory Uncertainty in Vs Profiles

NRC	Submittal
60 Randomizations Using USGS "B" Site Conditions	30 Randomizations Using USGS "B", "C", and "D" Site Conditions for the Upper-Range, Median, and Lower-Range Profiles, Respectively
σ_{ln} = 0.25 Upper 50 ft.	σ_{ln} = 0.25 Upper 90 ft.
σ_{ln} = 0.15 Below 50 ft.	σ_{ln} = 0.15 Below 90 ft.

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Epistemic Uncertainty in Shear Modulus and Damping Curves

NRC

M1
EPRI Soil: 0 – 276 ft
EPRI Rock: 276 – 500 ft
Linear & No Damping: > 500 ft

M2
Peninsular: 0 – 276 ft
Linear & 1% Damping: 276 - 500 ft
Linear & No Damping: > 500 ft

Submittal

M1
Av. of EPRI 50-120 ft & 120-250 ft: 0 – 129 ft
Av. of EPRI 120-250 ft & 250-500 ft: 129 – 279 ft
Idriss & Boulanger Weathered Rock Curves: 279 to 509 ft
Linear & Kappa-Based Damping: > 500 ft

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Kappa and Epistemic Uncertainty

NRC

Kappa was calculated for each base case profile using Q values from Campbell (2009). A σ_{ln}=0.2 was applied to determine the range of kappas for each base case profile.

Base Case Kappas
LBC: 0.057[1]
BC: 0.040
UBC: 0.030

Submittal

Calculated a kappa distribution[2] for each base case Vs profile based on a median kappa of 0.04 sec (i.e. a deep soil site) and a σ_{ln}=0.4

Kappa Distribution
kL: 0.024
kM: 0.040
kU: 0.067

[1]Imposed an upper limit of 0.04 sec based on the SPID Guidance
[2]Clarification needed

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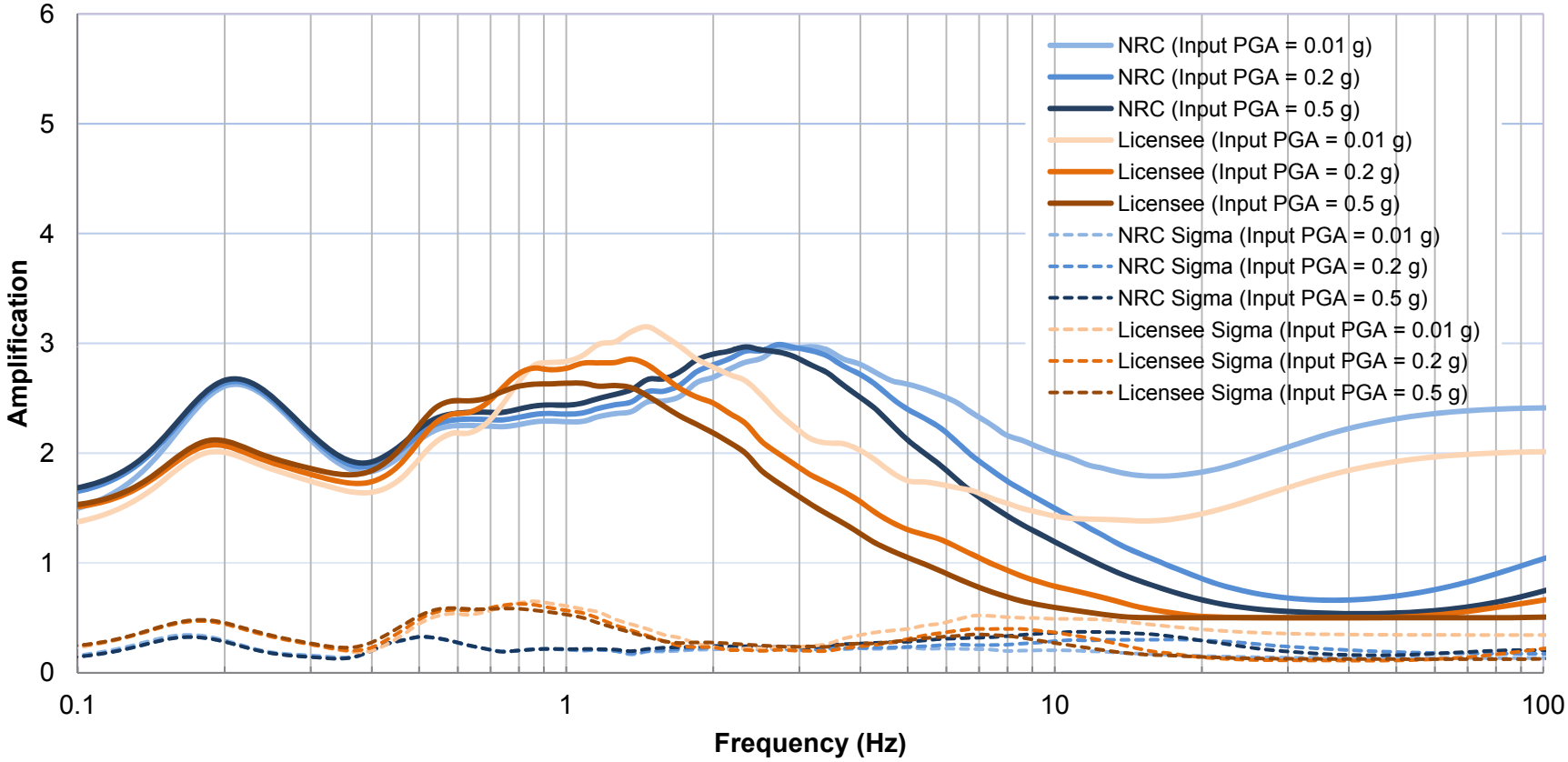
Amplification Functions



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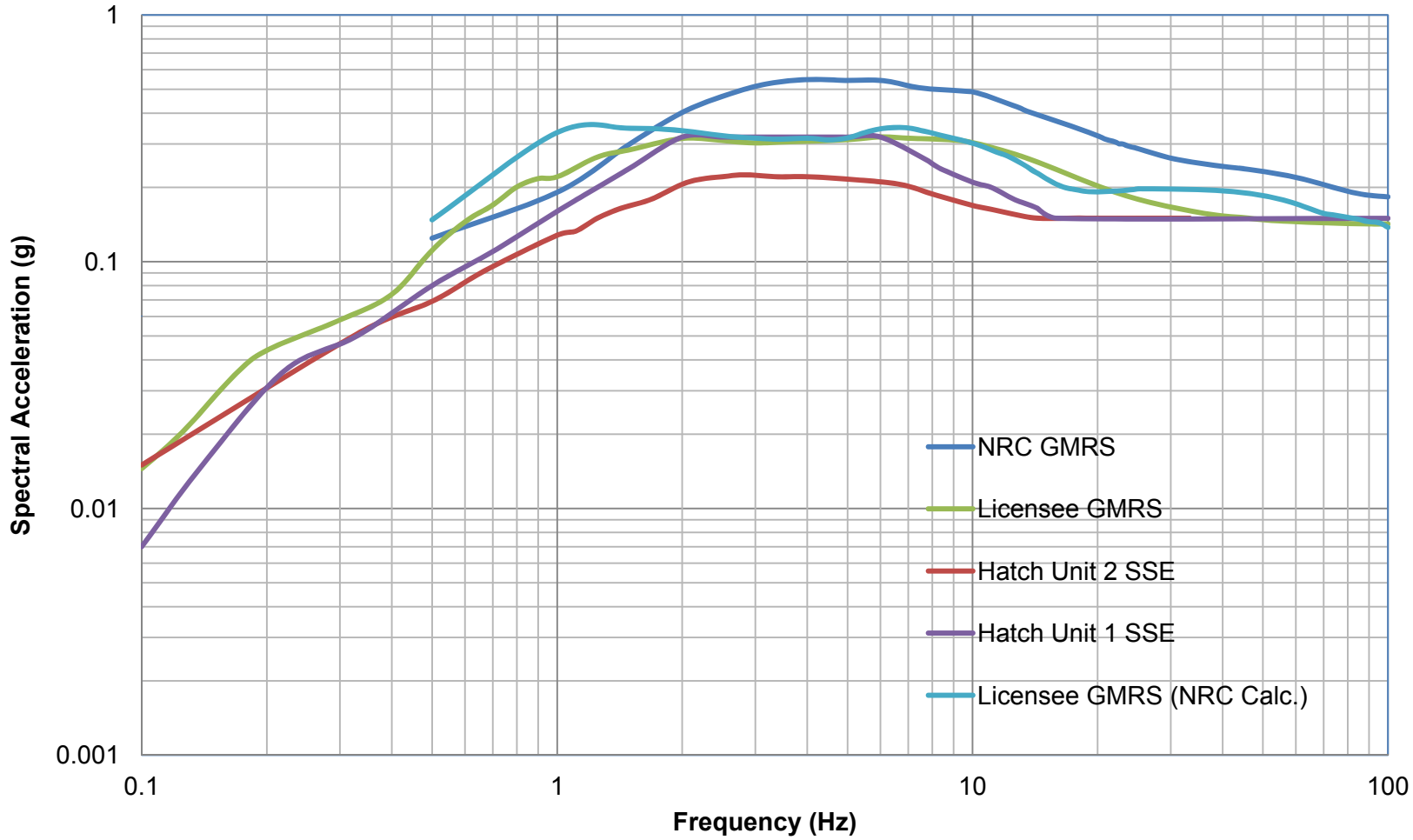
GMRS Comparison



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Primary Differences

- Kappa
  - Southern considered Hatch to be a deep soil site and used a median kappa of 0.04 sec, while the NRC placed an upper limit of 0.04 sec on kappa
  - Classification as a deep soil site inconsistent with Vs base cases
- Large differences in shear-wave velocities below a depth of approximately 500 ft due to an assumed Poisson's ratio