

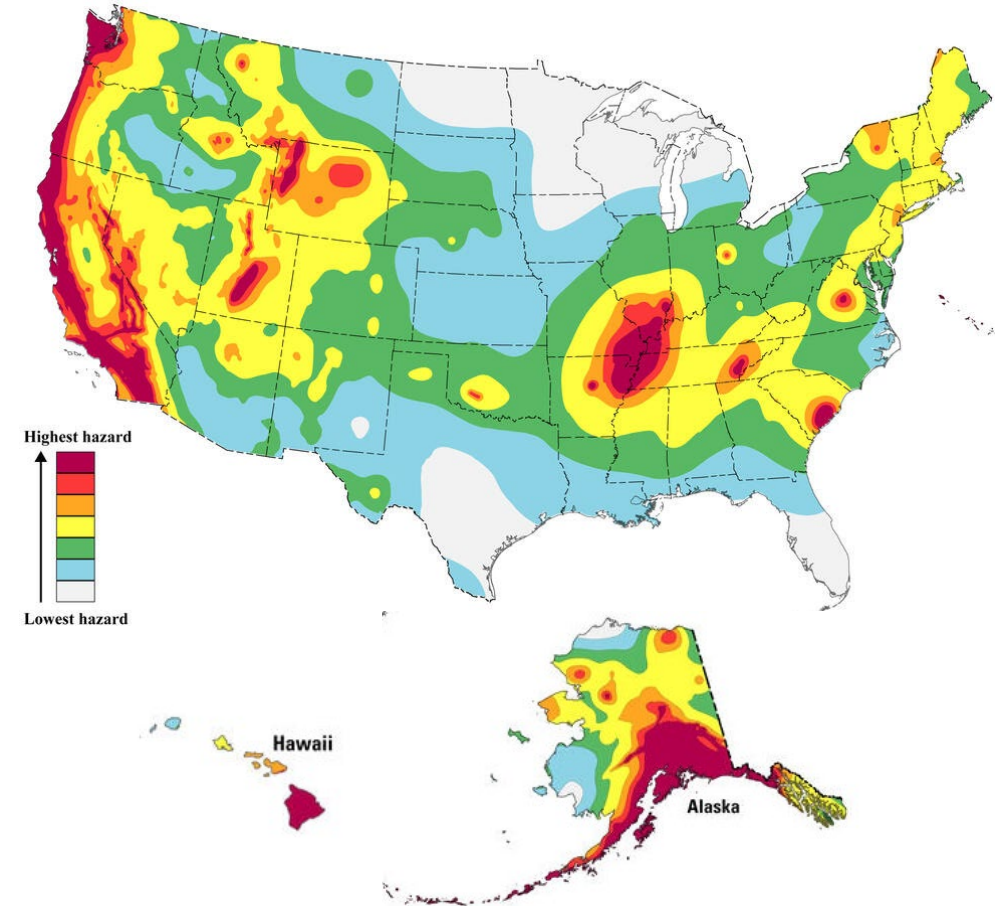
Seismic Hazard Results for U.S. Nuclear Power Plant Sites Based on Site-Specific Studies Compared to USGS NSHM

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2026 DOE/NRC Natural Phenomena Hazards Workshop

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Context and Motivation

- PSHA is critical for siting/design/risk assessment for U.S. nuclear facilities
 - e.g., SSHAC framework (NUREG-2213)
- Non-nuclear sectors use USGS NSHM for PSHA
- Interest in using NSHM for lower-risk facilities in lieu of site-specific PSHAs



Objective of This Study

- To evaluate NSHM vs. site-specific PSHA:
 - **what are the differences between approaches?**
 - **how do those differences impact** hazard characterization?
- Objectives:
 - **Assess** approach differences and their impacts
 - **Compare** NSHM results to site-specific PSHA results to better understand differences
 - **Discuss** RLPB considerations in seismic siting

Intended Purpose

- These comparisons are not intended to critique or cast doubt on either approach.
- The “correct” answer cannot be known, but there are guidelines for ensuring that PSHAs are conducted correctly (NUREG-2213).
- The goal is not to identify “correct” method, but to identify differences and be better informed about potential impact of choosing one of the alternatives.

NSHM vs. site-specific PSHA

NSHM

Nationwide hazard

Periodic (~5 year)
updates

Peer-reviewed
publications

Purpose

Timeline

**Data
Sources**

Site-Specific

Highly detailed study of
hazard and uncertainty
at a single site

Sufficient detail to
remain viable over ~50-
year plant lifespan

All credible data
sources

Key Hazard Studies

NTTF Data NRC KM-0017 (2021)



NUREG/KM-0017

Seismic Hazard Evaluations for U.S. Nuclear Power Plants: Near-Term Task Force Recommendation 2.1 Results

Office of Nuclear Reactor Regulation

USGS Earthquake Hazards Tool (2018 & 2023)



USGS Earthquake Hazard Toolbox

Web applications for querying
and computing hazard from USGS
national seismic hazard models.

Hazard

Disaggregation

Hazard Curves (dynamic)

Hazard Curves (static)

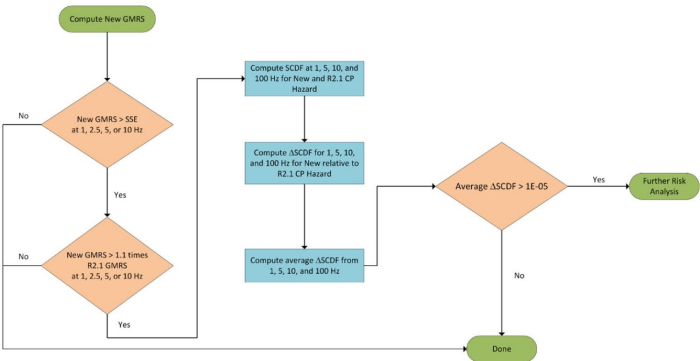
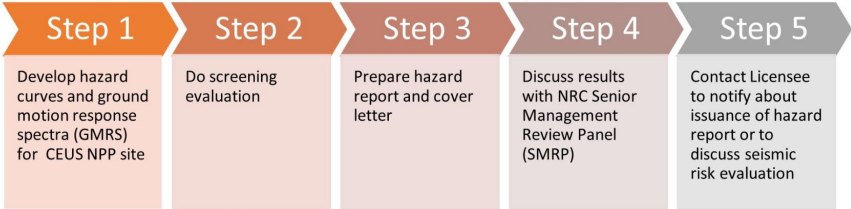
Services

Services

Source Model

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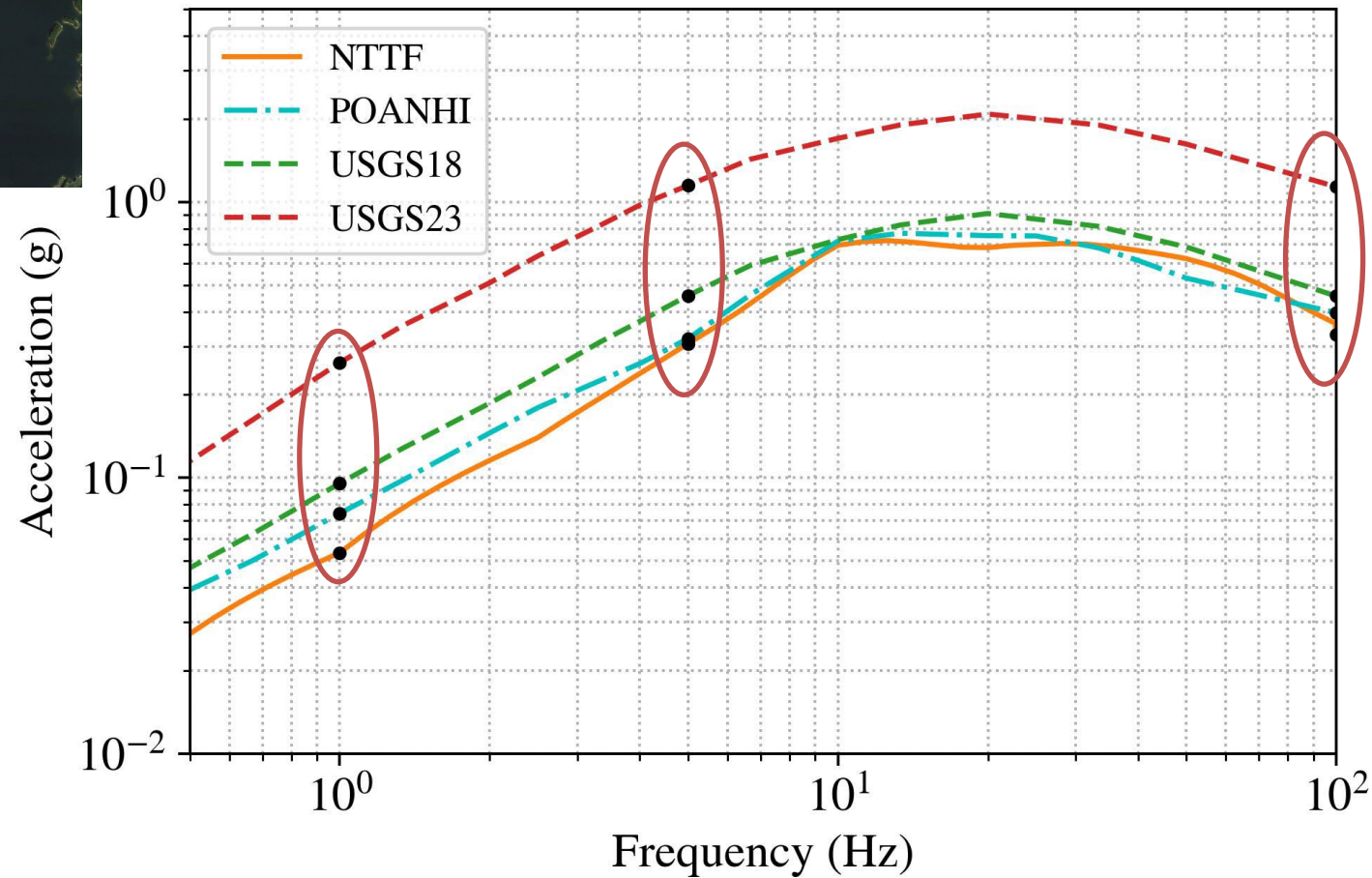
POANHI: Process for Ongoing Assessment of Natural Hazard Information (2023-2025)



Example NPP Result



North Anna AFE= 10^{-4}

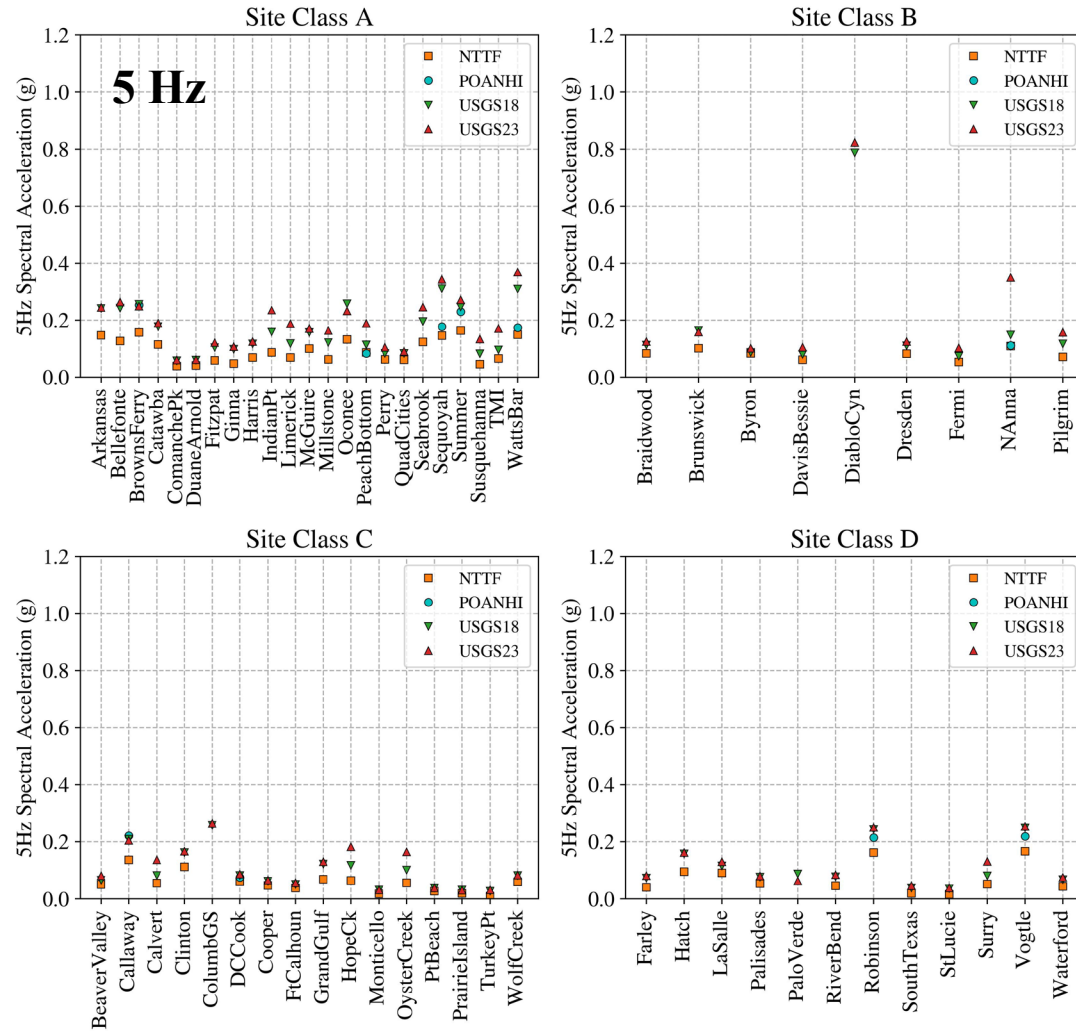


Comparison Framework

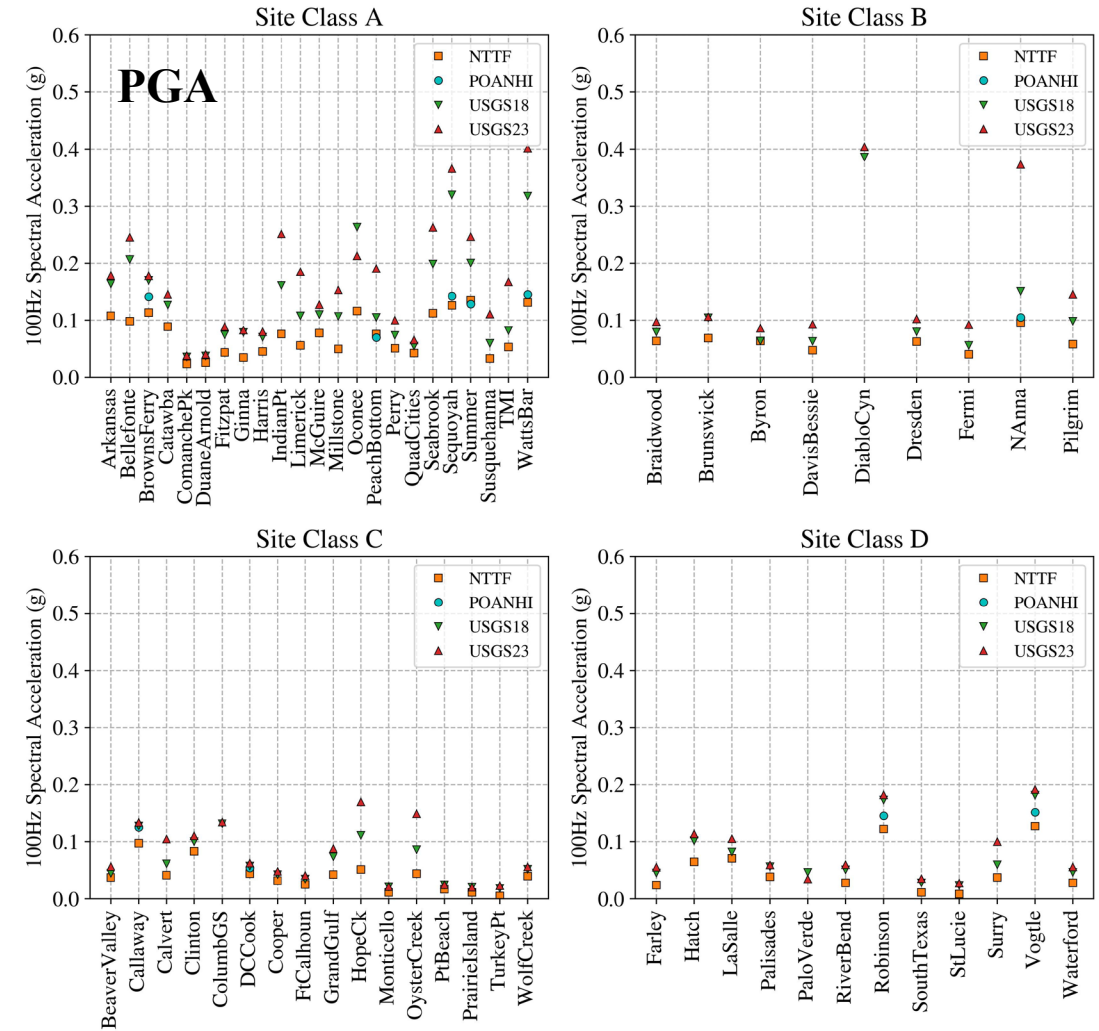
- NPP fleet from NUREG/KM-0017 (and POANHI sites where available)
- Hazard comparisons at reference rock and control point horizons
 - UHRS at AFEs of 10^{-4} , 10^{-3} , and $4 \times 10^{-4} \text{ yr}^{-1}$
 - Spectral acceleration (S_a) for 5- and 100-Hz oscillator frequencies
- Common metrics: spectral acceleration at target AFEs
- Grouped by site class (A-D) to explore systematic differences

Reference-Rock Comparison Results (AFE=4E-4)

Reference Rock, AFE = 4e-4

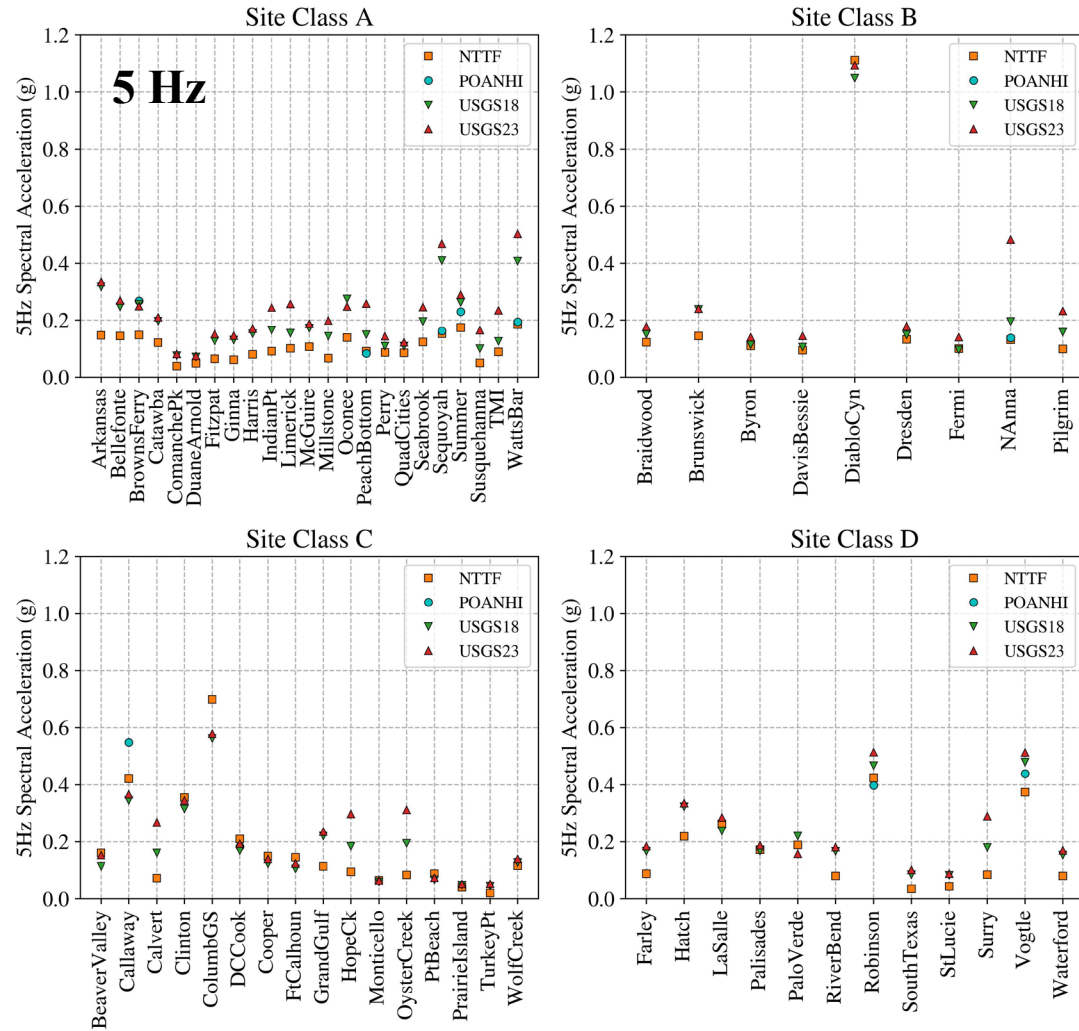


Reference Rock, AFE = 4e-4

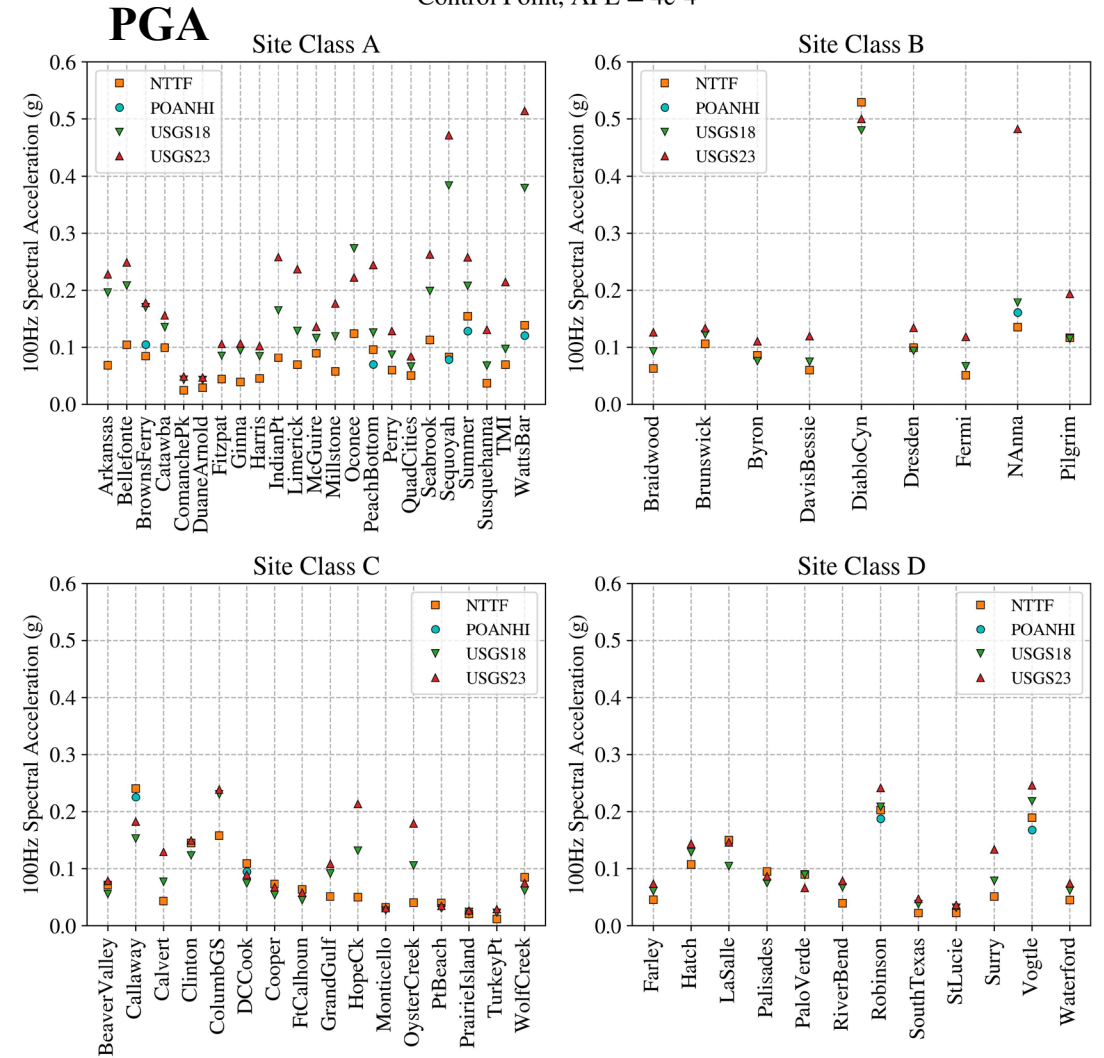


Control-Point Comparison Results (AFE=4E-4)

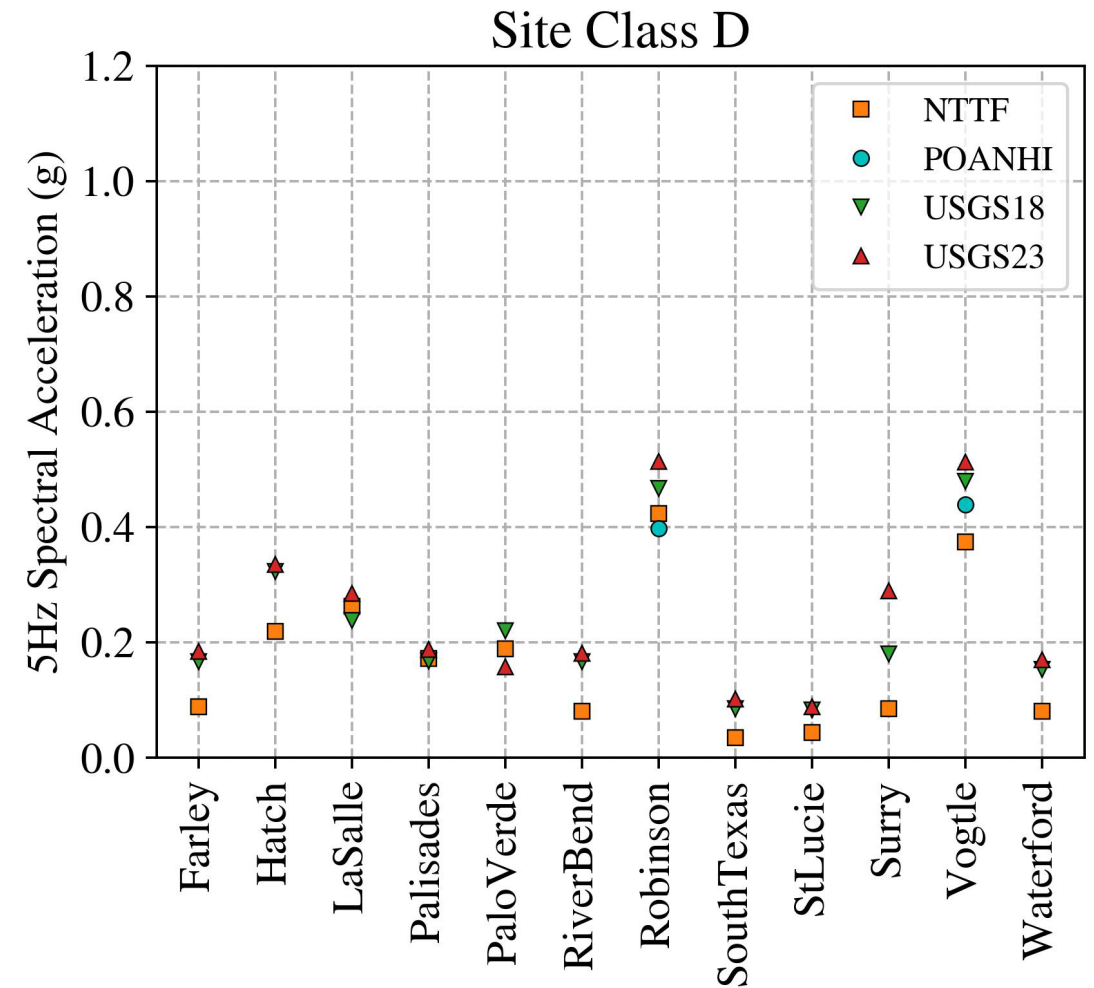
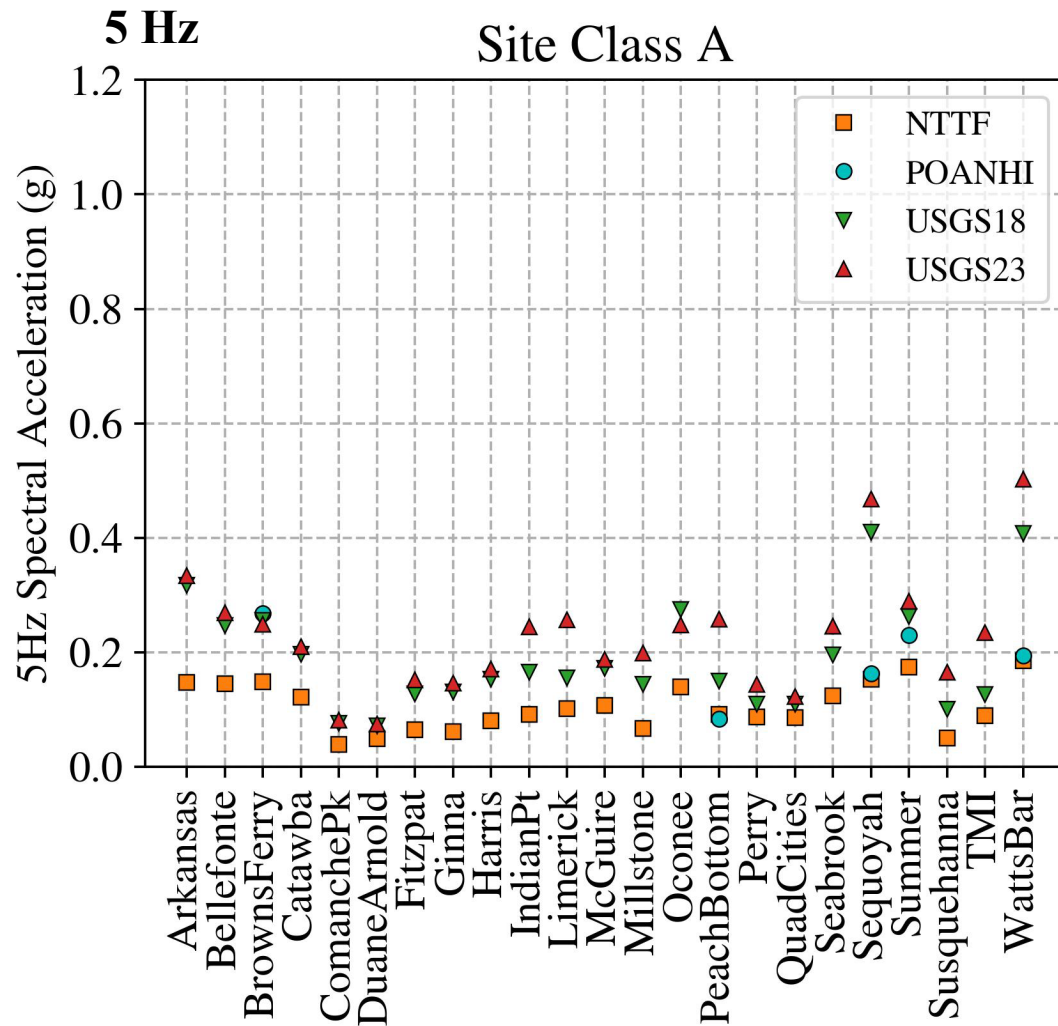
Control Point, AFE = 4e-4



Control Point, AFE = 4e-4

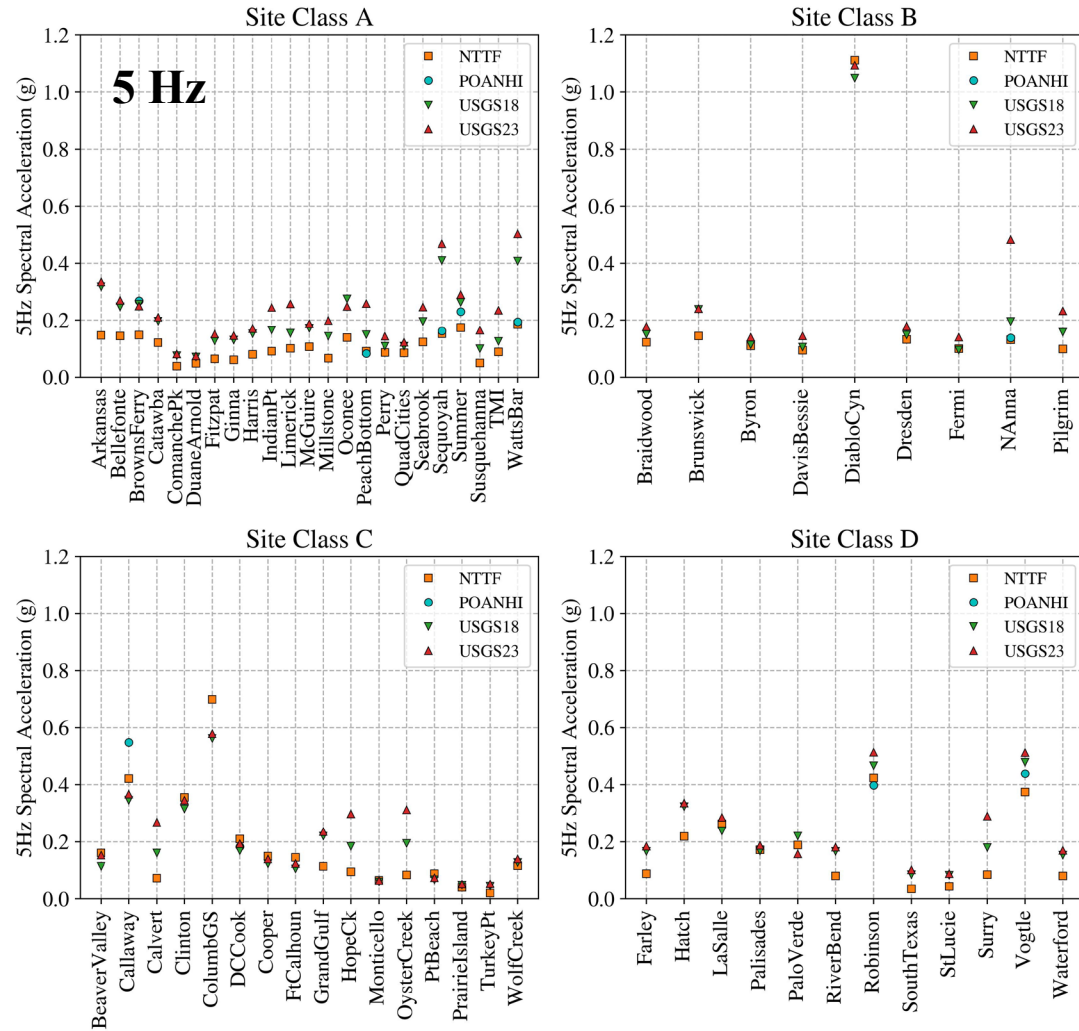


Control-Point Comparison Results (AFE=4E-4)

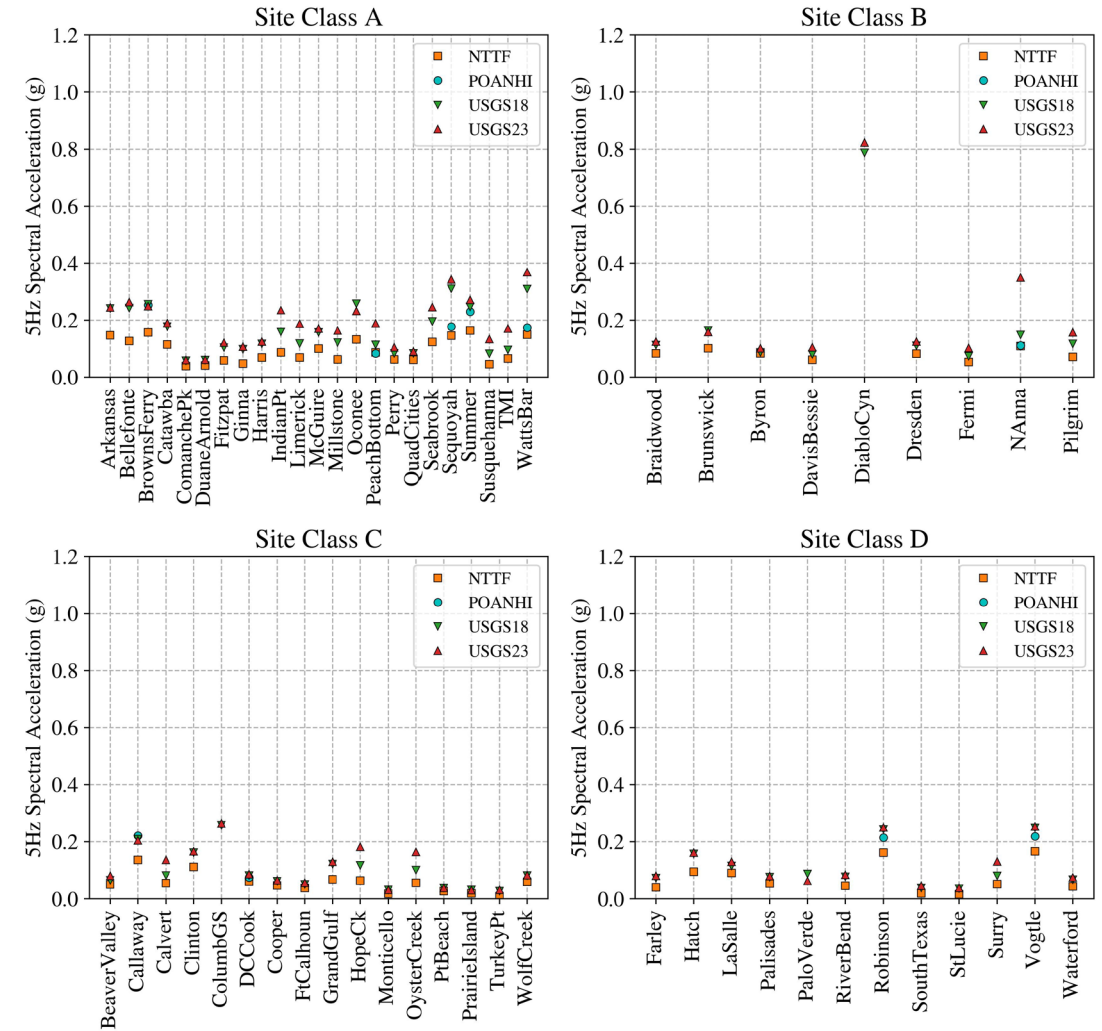


Reference Rock vs Control Point (AFE=4E-4)

Control Point, AFE = 4e-4



Reference Rock, AFE = 4e-4



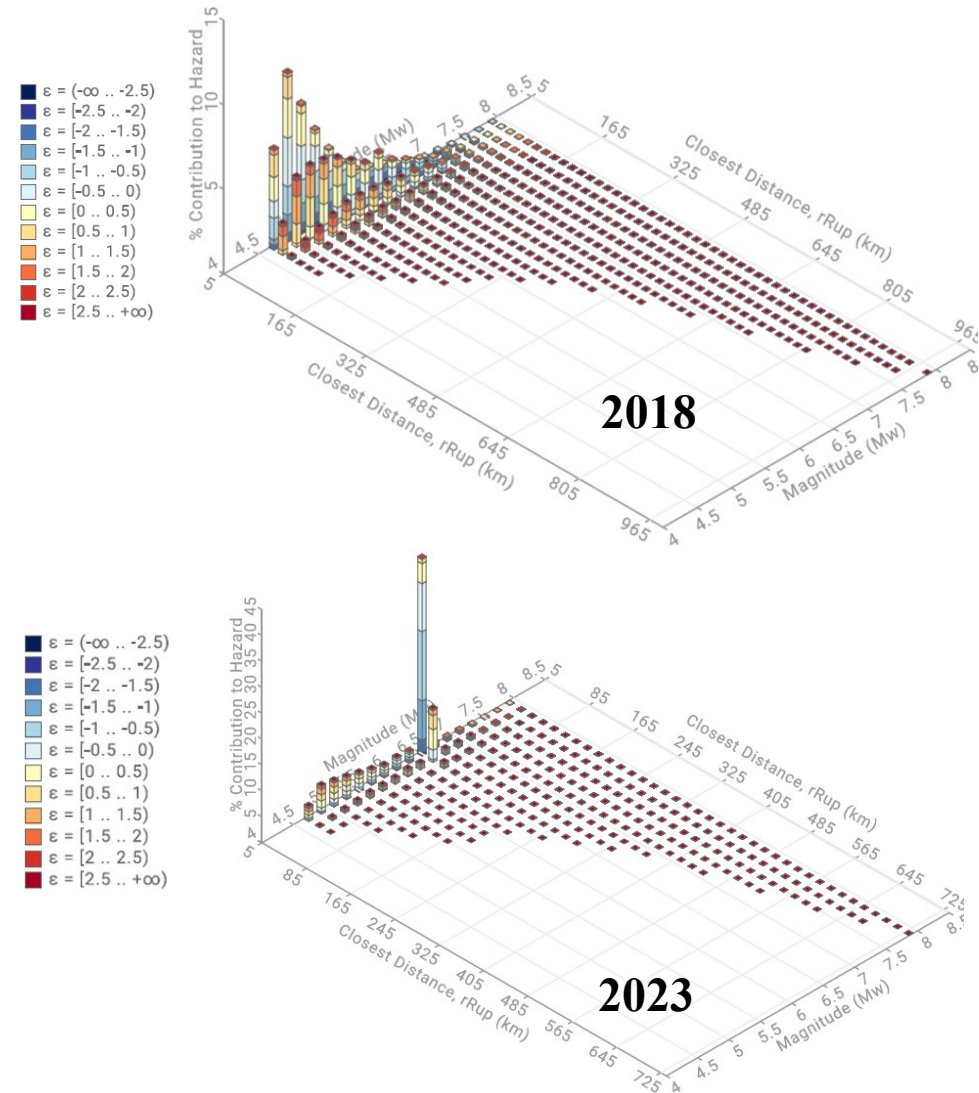
Fleet-Level Comparison Overview

- NTTF hazard generally lower; POANHl slightly higher but similar
- USGS18 and USGS23 typically higher spectral acceleration (but with exceptions)
- Many plants show small differences with limited practical impact
- Some sites show larger differences, warranting closer review

Summary of Site-Level Differences

- No clear single driver of differences
 - Source model changes likely responsible for difference for some, e.g., North Anna
 - No correlation with PGA
 - Site response model drives some changes
- Likely relates to differing model inputs and purposes

Example: NSHM North Anna Disaggregation



Summary

- No systematic source of difference - driven by source models, GMMs, and site-response models
- Many differences compatible with documented PSHA uncertainty
- Despite uncertainty, if hazards or consequences are sufficiently low, an RIPB framework may allow streamlined hazard characterization
- NSHM update cycle will need to be considered when evaluating regulatory stability